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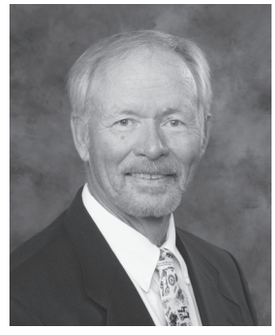

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Animal instincts: To succeed with humans, listen, learn and lead

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Abstract

Newly-graduated veterinary practitioners are equipped with an impressive science education when they step into their first jobs. They're enthused about their new careers and eager to ply their skills. The post-graduate Real World is full of challenges; however, and not all of them were addressed in the veterinary curriculum. Consider the stresses of moving into a new community. Or trying to sort out the peculiarities, people and politics in the practice. There may be clients who are openly skeptical of the new graduate because they are inexperienced and/or unfamiliar to them. The shift to the working world can be daunting. The success-limiting species for veterinary practitioners walks on 2 legs, not 4. The power and practice of applying fundamental 'people skills' like listening, learning and leading will build credibility, relationships and serve as a foundation for success in practice.

Key words: listening, empathy, connection, learning, questions, leadership

Introduction

I was visiting Craig's farm not as a veterinarian, but as a photographer. It's an impressive place – a very tidy enterprise milking 450 Jersey cows nestled in the hills of South Central Wisconsin. This was the first and only conversation I've ever had with the man. I wanted permission to take some photos of his cows and property but I got much more. There were many interesting threads to our chat that day, but the one that's pertinent to this paper had to do with who does his veterinary work. He uses a multi-person practice about 25 miles from his farm. He spoke very highly of a lady vet who's very good with the ultrasound for pregnancy diagnosis. "She's one of the best in the state," he said. Hmmm. Interesting. I wonder how he came to that conclusion. He went on to share, "I don't have much use for new vets, though. They come out here and don't have any experience. They're book-smart but not farm-smart."

Again, hmmm. How does he make that assessment?

Though our extensive veterinary training has focused on four-legged animals, our success as veterinarians is equally weighted on our ability to work with two-leggers. Our happiness, satisfaction, incomes, and outcomes are determined by our skills in communicating, cooperating, and collaborating with people.

People like Craig.

As a recent graduate, what does it take to win a guy like that over? How and when do we transition from being a new vet to being good enough to be on the team? It's a big challenge for new vets – earning confidence and trust - not just from clients like Craig, but from our colleagues in practice and support staff as well.

Is it hard skills, like ultrasonography and surgery that earn their regard or is it soft skills like connecting and emotional intelligence that swing them? Dr. Betsy Charles, DVM MA, Executive Director of the Veterinary Leadership Institute, corrects me when I refer to relating skills as 'soft skills.' She calls them *essential* skills. True. They *are* essential.

Humans are a complicated, emotional animal. We are biased. We're often irrational. We are so different from each other. However, as diverse as we are in our backgrounds, values and priorities, we are very similar in how we are wired. If we understand basic social needs and awaken our essential relating skills to meet them, we can quickly distinguish ourselves as desirable, interesting, and valuable to other people. This may be the faster track to winning friends and influencing people than impressing others with our technical talents[1].

I have titled this paper "Animal Instincts: To succeed with humans, listen, learn and lead". I chose animal instincts because our emotional brain is very influential in our decision-making. Though we have great capacity for processing logic, the more primitive, limbic part of our brain has a very large say in our judgements and actions. Knowing that, we can engage with others by listening, learning, and leading in ways that connect with them at an authentic and deeper level and build relationships that are not based solely on the perception of technical expertise.

Brain chemistry = Animal instincts

I'm sorry to ask you to revisit some basic neurobiology, but a quick review of 3 neurotransmitters and a hormone are in order. Why? Because so many of human behaviors are driven by the actions of 4 chemicals whose first initials make up the acronym DOSE[2]. How we engage with people can activate these chemicals in the brain so as to create a deeper, more memorable connection. *Note: this is not about behavior manipulation*. The actions of these chemicals happen in everyone's brain every day. If we know a bit about how these endogenous 'happy chemicals' work, then perhaps we can utilize this information to make positive impressions on the people we interact with.

D is for Dopamine. This neurotransmitter is associated with motivation and reward. As we anticipate and achieve a goal we get a wee spurt of dopamine as a reward and a marker that this is the right path to achievement. We like it. Dopamine trains us that if we do X we can get a hit of feelgood and that means that if we repeat that action we are again rewarded. At the low end, Parkinson's Disease results from the *absence* of production of dopamine. On the other end, most addictive behaviors and drugs trigger the release of dopamine. They yield a sense of reward without doing the work. What actions can we undertake or engage with others to trigger the release of dopamine? For ourselves, learning or mastering something new can generate an "I got it!" response. Feels good? Blame dopamine. What can we do with others so that they, too, can experience a squirt of achievement nectar? If we're interacting with clients, an open conversation about their goals may lead to putting a plan together to work towards those goals. If big goals are broken down to steps, then recognition and achievement of subgoals results in many shots of feelgood along the way. If we engage in that process as coaches or consultants, we, too, get our own little squirt of satisfaction as we collaborate in others' successes.

O is for Oxytocin. Yes, the same molecule that we use for milk letdown and uterine contraction. Oxytocin is associated with how people bond and trust each other. There's the love and intimacy side of those activities, but with colleagues and customers if we are accountable, empathetic, and demonstrate integrity we will have oxytocin to thank for helping us to build a solid relationship and trust. Relationships take time and this molecule helps seal the deal.

S is for Serotonin. Serotonin is often referred to as a mood neurotransmitter. Most antidepressant medications are Selective Serotonin Reuptake Inhibitors (SSRIs), whose action is to retard the uptake of serotonin, elevating its concentration and our mood. Endogenous serotonin is released when one feels important and confident. A personal strategy for bolstering our serotonin levels is to remind ourselves of our good work and our importance (of course, we're taught from an early age that bragging is not good; I suggest it's a great strategy if we're talking to ourselves.). Others experience a squirt of serotonin when we recognize their improvement or achievement. Serotonin is down-regulated when we 'compare-and-despair,' which can lead to a sense of inadequacy, depression, and imposter syndrome.

E is for Endorphins. Often referred to as endogenous opioids, endorphins are neurotransmitters that, when triggered, mask physical pain. The 'runner's high,' a state of mind that accompanies extended physical exercise, is often attributed to endorphins. From that, exercise is a positive feelgood trigger. As is laughter. Laughter makes us feel good. Now we know why. It's no wonder that funny people are popular people. If we can laugh with others we are engaging more than just their sense of humor.

Neurobiology is fascinating and complex. My intention here is to highlight that some very basic human interactions are stimulating chemicals in the brains of those around us that can have positive, lasting effects. A few years ago the AABP conference theme was 'Be Indispensible.' In my keynote speech, I riffed on the dopamine theme and suggested that as practitioners we should strive to 'Be Rewarding.' Considering the general effects of DOSE, if we want to be perceived as good people, we should reach out to others' animal instincts.

Listen

Psychologist William James once said, "The deepest principle in human nature is the craving to be appreciated."

At our core, we all want to feel important. Validated. Recognized.

Knowing that, how can we demonstrate appreciation to another?

I'll suggest it's simple (but not easy): listen well.

If you take nothing else away from this session/paper, please note this: the greatest impact you can have on another will come not from something you say but how well you listen. People who are good listeners are uncommon. Develop and practice good listening skills and you will have more impact with people than you can imagine.

You've already got a head start. Even though your 4 years in veterinary school have been spent learning about animals, you've also had to grow your observational skills. You are a Trained Observer. True story. You can't put that on your driver's license, but you can know that your impressive diagnostic skills can be used to good effect with humans, too.

Back up a step or 2 in this conversation. Carnegie et al, say that people want to be acknowledged and appreciated. Like all of us, they wish to be interest*ing* to other people. You and I are wired that way too, you know. How do we attract that elusive attention? As a card-carrying introvert (consistently so on Myers-Briggs personality assessments), I've had to develop a cunning strategy for becoming more interesting without expending more energy with people. My secret? If I (you/we) wish to be more interesting to others, I should be more interest*ed* in others. If they, like me, crave appreciation and I am clever enough to give it to them in conversation by simply being interested in what they say, I, in turn, am a most unusual and interesting fellow. All I had to do was ask good questions.

It's. That. Simple.

Fundamentally, most people love to talk about themselves. If we invite them to do so and are genuinely interested in what they have to say, then we are handing them a precious gift: our attention. That will trigger a cascade of neurotransmitters for them and put us in a grand spot for learning new information and building new relationships.

The conversation can be intentional at the listener's discretion. I love this line from Jeffrey Mayer's book *Time Management for Dummies*: "People who talk a lot can dominate a conversation but people who ask good questions control it[4]."

We can learn a lot from good interviewers. They put their interviewees at ease – there is trust that comes from respectful curiosity. They ask open-ended questions that generate interesting and expansive answers. Open-ended questions cannot be answered by yes or no and often begin with what or how (eg, What is the biggest challenge you face? What are your goals? How are you dealing with the shortage of corn this year?). **As a trained observer, listen carefully for clues in the conversation that could lead to the story behind the story** (Note: there is *always* more to the story). THAT may be the direction you need to go. That you're listening well enough to pick up on it and courageous enough to ask for more detail honors the speaker that you're engaged and interested in their story. Takeaway point: clues in the conversation are often the trail to the treasure.

A non-threatening way to ask for expansion on a clue is to use the mirroring technique that Chris Voss advocates in his good book *Never Split the Difference.*[7] Mirroring is repeating 2 or 3 words in the sentence that you want more information on. For example, the producer may say, "We dewormed those calves a month ago and one half of the group is scouring." You mirror by simply asking: "one half?" Then go quiet so she can answer. This process can be repeated as often as necessary to drill for more detail.

In his book *The Coaching Habit*, Michael Bungay Stanier suggests using the AWE question as another way of expanding clues[6]. AWE is shorthand for "And What Else?" and again, it is a means of seeking the story behind the story. If there seems to be more to the thread that needs pulled out, simply ask "and what else?" Conversational clues mark the trail to the treasure…

I once heard a colleague say that vets get very good at making decisions with insufficient information. We're talking about listening well and collecting more information. We can never have too much information. The double benefit of data collection is that it adds to our diagnostic picture and at the same time gives validation to the person who we are talking with.

A few additional thoughts for you, my young veterinary friends. One, we are programmed to FIX things. Resist the temptation. Listen, don't advise, unless it's requested. Follow the clues. Don't interrupt. Distinguish your young inexperienced self as an outstanding and engaged listener who mightn't yet have a handle on farm management but you've certainly shown interest in the farmer and his/her problem. It takes time to listen. It takes an active interest in doing it well, but it will pay off.

Here's a bonus tip: every human craves being listened to. EVERY one. There may be hired help or staff in the farming enterprise who may have other valuable information. Reach out to them, too. Imagine being asked out to talk about rising somatic cell counts. The owner/manager is the decision-maker and you're getting good conversation from him/her. Who's actually at the interface 2 and 3 times/day? You may want to get down in the pit and have a chat with the milkers, too. More information is more valuable! Those people are rewarded with your attention, too.

One introvert strategy that I use when I encounter strangers is to know that they've got a story inside of them that I want to hear. I just need to crack 'em open and let it spill out. Take an interest in everyone you talk with – your colleagues, your staff, your friends. Ask good questions and wait for the answers. We can rehearse these techniques in every conversation. Lives will be changed because of it – ours and theirs. Give the gift of good listening. It costs you nothing!

Learn

The by-product of good listening is we learn from others. Ours is a complex and rich profession. The pressures of veterinary school and board exams are now behind you but the educational aspect of your work has really just begun. Craig, the Jersey farmer in Richland County, Wisconsin, said that young vets don't know much. That's a pretty broad statement.

There is a teaching opportunity for him if we ask good questions. Seek out positive people who are willing to educate us. Ask great questions, Trained Observers. Dig in on subjects outside of your expertise and expand your view of their world. Build a network of people who are knowledgeable and are impressed by your humility in coming to them for information.

I chose that word humility for a reason.

My days as a clinician are long behind me. Today I work for the University of Wisconsin Extension in a role that is mostly unrelated to veterinary medicine. One aspect of my role there has been to be part of a substance abuse recovery program. I went through a five-day recovery coaching training a few years ago. I had an 'aha!' moment in the program when the facilitator talked about the Spectrum of Attitudes[5]. This has direct application for us as we endeavor to connect with and learn from other people.

The Spectrum of Attitudes is about the attitude that we bring when we encounter another person. The Spectrum references 3 categories of regard for other people: Object, Recipient or Resource.

When we treat people as Objects, one group of people "know what's best" for the other group and they determine the circumstances that the second group will exist. At an extreme, this is an incarcerated population.

When we treat people as Recipients we have given them an upgrade. Group 1 still knows what's best for Group 2, but the latter is given the opportunity to participate in decision making. There is still a profound power differential.

The last category is when the Other is seen as a Resource. Group 1 respects that Group 2 is the expert of their own experience and can make autonomous decisions. "This is the way to do it" gives way to "How can I help?"

The only category that works is the Resource attitude. Empathize with how the first 2 groups must feel. I suggest

that humility means learning about what makes your clients, colleagues and teammates tick. Listen to them, learn from them, and endeavor to work with them as valued resources.

I worked with vets in New Zealand several years ago and one of them asked me "What's the difference between God and a veterinarian?" I waited for the punch line: "God doesn't think he's a vet."

Humility means we can always learn more.

There are 2 things I wished I had done better when I was in large animal practice in Idaho.

In my first practice job there were 2 practices in a town of 3500. The competing practice also had a new vet who graduated the same year as I had. He took a lot of business from our books. He had no more experience than I had, but he employed a very effective tool that transferred clients from our database to his. Simply, he followed up on his cases. This was the pre-cell phone era so he was often taking the time to do this work from home in the evenings. What a powerful tool! He was demonstrating that he cared (soft… er, *essential* skill), and he was monitoring his cases. He had the attitude that the client was a resource, he listened, and was able to learn about the progress of the case, he accelerated his acquisition of experience and if anything appeared untoward, he was able to fix the case before it turned into a train wreck. His yearning for learning expanded into a powerful relationship, and practice-building technique. Today's technology allows us to make these sorts of contacts very efficiently. Follow-up is a remarkable tool (would you fall off your chair if your doctor called to see how you're doing? See?!)

The other thing I wished I had done was to discipline myself to document my experiences in practice. In a leadership program that I facilitate we call these After-Action Reviews (AAR). Our daily interactions with colorful characters, challenging cases, emotional highs and lows can serve many purposes as we progress into our careers. Yes, to keep some form of journal is another time pirate but there are riches and rewards in the process of active reflection. Much like the SOAP (Subjective Objective Assessment Plan) notes you kept on cases in vet school, an AAR forces us to review, reflect, re-set and repeat. It's a laborious process but the learning yield is extraordinary. As an aside, I wish I had a catalog of the crazy experiences that practice gifted me with – as a public speaker that would be like *treasure!!*

Odds and ends about the importance of learning:

- "Everyone we meet has something to teach us. Even if it's 'don't do that!'"
- Mentors can be an accelerant to our progress and keep us between the guardrails as we go forward. Some mentors have a shelf life.
- The outer boundary of the comfort zone is the beginning of the learning zone.
- I worked with a vet who was a better public speaker than I was. We were very competitive and I sought a way to improve my skills. I joined Toastmasters, an organization devoted to improving speaking and leadership skills. Single most important thing I have done in my professional life. Seek out training in communications and leadership. Remember, humans, not cattle, will determine your destiny in the veterinary profession.
- The AABP Listserv is a great place to learn about cool stuff related to large animal practice (and lots of interesting info that's not).

Good listening leads to good learning. Good learning is growth. Growth is good.

Lead

You can hold your diploma up to a strong light and you won't see the word 'Leader' anywhere near the DVM, VMD or BVSc. It's there, though. It comes along with that big brain of yours, those critical thinking skills, the ability to make decisions with insufficient information, and now with the enhanced set of *essential skills* that are Listening and Learning. You're a leader. Did you say nay or Hooray!

In 2014 I watched a good friend of mine go through a company-sponsored yearlong leadership course. He changed. His attitude, the things he paid attention to, his conversations… all were altered by the experience. Positively. I wanted some of that… but not for that price tag. I signed up for a county leadership program instead. At the end of the 9 months I, too, was seeing myself and my world through a different lens. One big takeaway for me was the concept that you don't need a title to be a leader. That took my main excuse away. I could lead and it didn't have to say it on my diploma or on a business card. I could encourage and listen and share visions and volunteer and speak up and… I could now see myself as a leader. And a contributor.

That can be you, too. Actually, that *should* be you, too.

I highly recommend that you find some leadership training and take it. Early in this paper I referenced Dr. Betsy Charles. From what I hear, the Veterinary Leadership Institute is an amazing experience. You can learn more here: https://veterinaryleadershipinstitute.org/programs/vle/ The benefit of any leadership program is that it invites introspection. The more self-aware we are, the better leaders we are. I discovered some blind spots during my program and I also identified some unknown sparkly bits. I cross-pollinated with like-minded, positive people and learned about the power of authenticity and vulnerability.

Now I co-facilitate the program with a very talented lady who teaches me a lot about effective facilitation and growth. Together we're a dynamic team and it's a real joy to watch our participants moult their old limiting shell and expand into a new awareness with new possibilities.

Some of my most powerful learnings about leadership are:

- Leadership isn't about knowing all of the answers, it's about having the courage to have a go. Put your hand in the air. The people you meet and the lessons

you learn are very different than they are when you sit back.

- Failure is an 'F' word, but it's a great teacher.
- A sincere Thank You is a powerful tool (review: humans *crave* appreciation). In a study conducted by leadership experts Kouzes and Posner[3], people identified the most powerful non-financial reward that they received at work as… a simple thank you.
- One of my veterinary leadership mentors, Dr. Andy Clark, DVM, MBA, once said that leadership comes down to a simple question: "What kind of wake do you leave with people?" Sometimes we don't know. Sometimes we do. If it's not good, leadership may require that we turn our attitude into a renovation project.

One last story and I'll wrap this up.

I worked in veterinary pharmaceutical research and development in New Zealand for 10 years. It was a great experience, but it was a long way from my home state of Wisconsin. In 1998 my father was diagnosed with lung cancer. There were multiple metastases. His prognosis was grim. The poor fellow went from diagnosis to deceased in 15 weeks. I had a generous boss who let me make that long trip twice during my father's descent. One day the call came from Wisconsin. "You'd better come – it's not long before he's gone." Sigh. I sat down with my boss and explained the situation. He said, "You know you've got to go. Do you need money for an airfare?" I didn't need the money. He'd given me the gift of empathy, which is one of the most critical pieces of emotional equipment for a leader. He got it that this was hard and that I was a long way from home. He offered to help wherever he could. He was a great boss. He was a great leader. On that day he taught me what leadership was all about.

To summarize, I wanted to share some of my insights on connecting with people in ways that stimulate their neurotransmitters, that benefit them, benefit us and build a healthy, respectful professional relationship. Listening – truly listening – to another can be enlightening to us and a gift to them. It's also a tool for us to learn about that person, their business and how we can best serve them with our skills and our network of support. Combine those 2 with our intellectual and decision-making skills and we have the template in place for leadership and making a difference in our practices, in the livestock business and our communities.

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Healthy people, healthy practice: Tools to enhance health and wellbeing

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Abstract

Veterinary professionals are highly committed and dedicated individuals who work hard to care for their patients, clients, colleagues, and communities. For those who devote their lives to the service of others, the physical, emotional, and spiritual demands can lead to exhaustion. Day-to-day work expectations and pressures can at times feel overwhelming and isolating, and have detrimental effects on personal and professional wellbeing. The natural response may be to work harder, to give more, until there is nothing left to give. The good news is that as caring individuals, you have the capacity to focus that care on yourself. With development of healthy practices, you can continue to effectively provide comprehensive and compassionate care for others, while taking care of yourself. This paper will address and define some of the main challenges to health and wellbeing and identify strategies and tools individuals can implement to address them.

Key words: compassion fatigue, burnout, wellbeing

Introduction

In a 2015 Centers for Disease Control (CDC) survey of veterinarians of 11,627 respondents, 1,077 (9%) of respondents were experiencing current serious psychological distress. Since leaving veterinary school, 3,655 (31%) respondents experienced depressive episodes, 1,952 (17%) experienced suicidal ideation, and 157 (1%) attempted suicide. Some 2,228 (19%) respondents were receiving treatment for a mental health condition. Only 3,250 of 10,220 (32%) respondents somewhat or strongly agreed that people are sympathetic toward persons with mental illness. The most reported practice-related stressor was demands of practice.[4] Results of a 2018 Merck study found of the 3,540 responses, 66% of respondents, including 79% of associate veterinarians in practice, reported experiencing feelings of depression, compassion fatigue or burnout, or anxiety or panic attacks within the past year. Overall, 5.3% of veterinarians experienced serious psychological distress within the past 30 days and 25% of respondents had thought about suicide at some time in their lives. Only 41% of veterinarians who responded to the survey indicated that they would recommend the profession to a friend or family member. Major reasons for not recommending the profession were related to compensation, high student debt, and the personal toll practicing veterinary medicine takes on an individual.[5]

In May of 2019, the World Health Organization added burn-out to the 11th Revision of the International Classification of Diseases (ICD-11) as an occupational phenomenon and defined it as "a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed." It is characterized by 3 dimensions: "1) feelings of energy depletion or exhaustion; 2) increased mental distance from one's job, or feelings of negativism or cynicism related to one's job; and 3) reduced professional efficacy. Burn-out refers specifically to phenomena in the occupational context and should not be applied to describe experiences in other areas of life."[6]

Common Challenges

Factors challenging the health and wellbeing of veterinary professionals are complex and interwoven. Compassion fatigue is a state experienced when one is feeling the impact of burnout, defined above, and secondary trauma. Secondary trauma is when exposure to others pain and suffering creates a sense that the trauma has happened to you. The combination of these factors leads to a reduced capacity for engagement as a consequence of exhaustion from being with suffering.[2] Moral distress refers to feelings provoked by the real or perceived violation of one's moral or ethical beliefs and can include issues of fairness, respect, commitment to care. Decision fatigue is "a psychological phenomenon surrounding a person's ability or capacity to make decisions." When one experiences decision fatigue, the ability to make decisions can get worse as the brain will be more fatigued. This fatigue applies to all decisions, not simply the large or more difficult ones.[3]

Most strategies and tools for intervention exist at the individual and working group level. It is important to note that burn-out, as a phenomenon directly related to the workplace, must be acknowledged and dealt with by organizations and institutions as they have a primary role in creating the situational factors inherent in it.

Strategies Supporting Wellbeing

Veterinary professionals, caring, compassionate and dedicated to service, can experience any or all the challenges listed above at some point in their working life. Identifying and naming one's challenges can help in finding ways to deal with or overcome them. Using a whole person model including the physical, mental, emotional, and spiritual ele-

ments helps focus on areas that are working well and areas of concern.

Once specific challenges have been identified and named, common strategies for individuals include development of coping skills, cognitive restructuring, setting boundaries, conflict and time management. Assess the potential to change work patterns, work less, taking more breaks, job sharing, and avoiding overtime work. In addition, building a strong community of support both at work and outside have been found to support wellbeing. Finally, utilizing relaxation techniques, promoting good health, eating, fitness, and sleep provide a strong foundation of health, wellbeing, and self-care which can be helpful when faced with the challenges of work.

Engagement has been identified as the positive counterpart to the challenges described above. Engagement with the meaning and purpose of your work, connection to the calling which brought you to veterinary medicine, involvement with colleagues, clients and patients, giving back to the community and a sense of efficacy and connection to the deeper value in the work you do sets a foundation of protection when facing professional challenges. Fostering compassion satisfaction and self-compassion helps one focus on the positive aspects of working as a helper caring for others and oneself. Compassion makes us feel good and compassionate action activates pleasure circuits in the brain. In a 2015 article on sources of satisfaction in veterinary professionals, Martin Cake and colleagues found 7 elements contributed to a life of meaning: helping and healing animals, grateful clients, interesting and varied challenging job, lifelong learning, educating others, and financial rewards.[1]

Conclusion

To practice effective and beneficial veterinary medicine, one must learn specific clinical skills and techniques and have the education, knowledge, and experience to implement them. The process of practice includes assessment, diagnosing, treatment planning and implementation, evaluation, and possibly modification or additions to what was done. It is the same for our professional and personal health and wellbeing. Developing awareness of what we are experiencing, naming it, assessing the various elements involved, creating strategies and techniques to address and overcome challenges, and taking action. These steps, followed by evaluation and adjustments as necessary, can support us in being whole, healthy human beings with the expertise, clinical skills, knowledge, and ability to be competent and caring veterinary practitioners while maintaining our personal and professional health and wellbeing.

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Coping with the stress of practice

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Abstract

Veterinary practice is stressful and always will be. Stress is a natural animal adaptation that allows us to face challenges and survive. The thinking human brain gives us the unique opportunity to convert a physiologic mechanism meant to protect us into a chronic condition that causes us bodily harm. How then do we create coping strategies to stop our propensity for chronic, maladaptive stress? While there is excellent data that proper diet, exercise and sleep habits help, bovine veterinarians may be limited in their ability to employ these tools. Practicing techniques like meditation, gratitude, self-compassion, and story-checking, all of which can be done in the truck between calls, can wake us up to our habits of thought and change the volume and channel on the chatter in our brains. Waking up to our thoughts is the first step to changing how we relate to stress as it arises in the moment and being more resilient in our ability to cope with it.

Key words: stress, meditation, self-compassion

Introduction

As veterinarians, we are trained to evaluate presentations of disease, synthesize the data we collect with physical examinations and diagnostic tests, prepare a differential diagnosis list and treatment strategy and monitor for outcome. Four years of veterinary education, countless hours in practice and our propensity for Type A personalities, teaches us the following mantra: "See the problem and fix it". We are good at this, except when it comes to our mental health and wellbeing. Bovine veterinarians in particular, I would argue, suffer from a "tough guy" mentality. Our identity in some respects revolves around our ability to work a physically difficult job, in trying weather, and at all hours of the day. We tell ourselves, "This job is hard, it's supposed to be hard, our clients work hard and so should we." The mythology of the tough guy says that the signs of chronic stress and burn out – including sleep abnormalities, diet indiscretion, and irritability – are a normal part of the job and the treatment is to "suck it up". For some, this strategy could be successful. For me, it led to a humiliating moment in the emergency room when, what I thought was a stroke, turned out to be a full-blown panic attack.

The Second Arrow

Stress is a normal animal adaptation that protects us from threats to our safety. When the gazelle on the plains senses the presence of the lion, her sympathetic nervous system activates to move her body effectively to safety. We, as veterinarians, know the exact physiologic mechanisms by which this occurs. However, once that gazelle is safe again, her sympathetic response shuts down and she returns to her peaceful existence grazing on the plain. She does not stand around worrying about the next lion attack, wondering if she has protected her offspring well enough, or doubting whether she will be fast enough to get away the next time.[5] Those responses to stress are uniquely human, for better or worse. Our brains often respond to stress by catastrophizing the next stressful event, doubting our abilities to respond, and using our inner cattle prods to condemn our response and "motivate" us to be better next time.

Buddhists call this phenomenon the "second arrow"[3]. In this parable, when we suffer misfortune, 2 arrows are shot our way. The first is the actual event, which is undoubtedly painful and very often out of our control. The second arrow we shoot at ourselves by creating a story around the event, berating ourselves with our response to it and reliving it repeatedly. Psychologists describe this as the negativity bias of the brain. We dwell on the bad so that we will remember it and never, ever do it again.

Let's use an example to depict this concept. Imagine you arrive at a calving in your first few months of practice. It's 3 am and you've never been to this facility before. The client tried to get the calf out for 3 hours before finally calling you. When you arrive, the cow is down in lateral recumbency and all you see is a very swollen head of a dead calf protruding from a very swollen vulva. As you attempt to manipulate the head back into the uterus, it becomes clear that you cannot fix this dystocia in the manner in which you were taught: "repel and reposition". You start to panic because the client is watching you like a hawk and you don't know what to do. As you get lost in negative thought, your prefrontal cortex (the part of your brain that could come up with a solution to the problem) is hijacked by your amygdala (the part of your brain that is supremely unhelpful in this situation). You call your boss who arrives 45 minutes later, incredibly grumpy, works for 30 minutes and extracts the calf. As you drive away, your inner cattle prod begins berating you for your lack of expertise, you tell yourself a story about how your boss and the client think you are an idiot and you start to wonder if you will ever succeed in this industry. Sound familiar?

The first arrow is the difficult dystocia. You did not cause this cow to attempt to deliver a calf head-first. It is not your fault the client worked at it for so long before calling you. You are not at fault for your inexperience. All these factors are a normal component of the stressful job of veterinary

medicine. The second arrow is all the stories you will tell yourself about the event. Left unchecked, these stories will lead to decreased self-worth, increased imposter syndrome, difficulty taking constructive criticism, and ultimately poor job performance. How do you stop the second arrow?

Coping with Stress

In my opinion, meditation is a super power. It has a bad rap as a touchy-feely thing one does on a pillow surrounded by incense and weird music. In reality, it is the ability to see the thought-stream that runs on continuous loop through our minds. The act of meditation is simply sitting still, trying to focus on one thing and inevitably failing over and over as your mind wanders. The moment you notice you have gotten lost in thought, the moment when you fail at focusing, is the entire point of meditation. Like going to the gym, each moment you notice you have gotten lost in thought is a bicep curl for your brain.[3] As you practice meditation, you get better at this "noticing" skill. This simple ninja move is the foundation for subsequent techniques to ease whatever stressful moment you face in practice.

Once you can wake up from your thoughts, you can begin to change your relationship to them. Three strategies are particularly good at this; gratitude, self-compassion, and checking your story. The daily practice of gratitude – simply noticing 3 specific, unique good things from each day - has been shown to improve levels of optimism, satisfaction in relationships, and job performance.[1] Psychology suggests gratitude practice subverts our negativity bias and instead gets us focused on the good.

Self-compassion is a powerful tool that physiologically downregulates the threat response and the sympathetic nervous system. The act of self-compassion has been widely shown to activate our mammalian care system, releasing oxytocin and endorphins, thereby lowering our stress levels.[4] Psychologist Kristin Neff describes a simple 3 step move that can be employed when you notice yourself struggling. First, simply acknowledge that whatever you are experiencing is difficult. Second, remind yourself that this moment is difficult for many people, that you are not alone in your feelings. Lastly, send yourself some kindness and warmth, just as you would for a friend who was struggling with something similar, in other words, put down the hotshot. AABP aims to help with the shared experience component of self-compassion practice through the mentorship program and the Humans of AABP Facebook page. By sharing our rough times, we can remember that times can be hard for even the "toughest" of us.

Lastly, it is important to acknowledge the fallibility in the stories we tell ourselves. They will almost always be biased and at their worst, simply untrue. When you notice you are lost in a story, ask yourself, "is it demonstrably true?" or better yet, ask the others involved if it is true.[2] Exposing the inaccuracy of our stories makes us believe them less and in turn, frees us from our self-critical minds.

Revisit our Example

Let's return to the calving example to try out these strategies. The first step is to notice the thoughts that have carried you away while you are working the problem – their negativity is not helpful. Secondly, send yourself some compassion in that moment. That calving was hard, it would be hard for lots of people – heck, it was hard for the client! Lastly, when the dust has cleared, talk to your supervisor. Brene Brown suggests beginning with the preamble "The story I'm telling myself is…".[2] In this case, you could try "The story I'm telling myself is that I am a burden on you and will never improve at bad calvings." I would hazard to guess your boss will have a completely different story to share about that moment and the conversation will improve your connection and relationship to one another. From this space, you will be better able to learn from the moment, rather than beat yourself up about it, which will improve your performance for next time.

Conclusion

Veterinary practice will always be inherently stressful and our sympathetic nervous systems will be perpetually activated by moments in our careers. However, the practices of mediation, gratitude, self-compassion, and story-checking can supercharge our ability to turn down the sympathetic response when it is no longer needed. Mastering these skills is not soft or feminine. In fact, they make us even tougher, more resilient and more capable to perform our jobs. They help us stop shooting the second arrow and go back to peacefully grazing on the plains.

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Practical immunology and beef and dairy vx protocols: Starting from ground zero–what, when, and how

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Abstract

Vaccination is an important component for the prevention and control of disease in cattle. However, too often vaccines are viewed as a catch-all solution for management and nutrition errors; the "best" vaccine can never overcome these deficiencies. Proper vaccination in the young and developing heifer is the key to long-term development of that animal as a reproductive unit in the herd. Modified-live vaccines (MLV) have been used because of the good antibody response, longer duration of immunity, fewer doses needed per animal, and lower cost. However, non-adjuvanted MLV vaccines fail to booster well vaccinated animals, as active vaccine-induced immunity neutralizes vaccine virus preventing the MLV from replicating and preventing a booster immune response. Improved adjuvants have increased the scope and duration of both MLV and inactivated virus immunity. The periparturient period (the last 3 weeks prior to calving and the first 3 weeks following calving) are poor times to initiate an immune response—hormonal, dietary and metabolic factors limit immune responsiveness. Postpartum is also a difficult time to vaccinate as lactation energy demands supercedes immunity. Each vaccine program needs to be designed based on animal flow, actual "disease" threats, and labor on the farm.

Key words: immunology, vaccinology, mucosal immunity

Introduction–In the Beginning there was the Immune Response

The immune system consists of 3 lines of defense systems: mucosa epithelium, innate immunity, and adaptive or acquired immunity (Figure 1) that work together to give cattle protection from disease. The mucosa epithelium of the respiratory and gastrointestinal (GI) system is the largest immune organ of the body and provides the barrier, "the kill zone" that eliminates 99.9% of all infections (Figure 2).[19] The kill zone integrates all of the components of the immune system: 1) barrier components (mucous and mucins, tight junctions), 2) innate immunity (macrophages, defensins, neutrophils, interferon, cytokines, and 3) adaptive immunity (secretory IgA and IgG, and T and B lymphocytes). This system is very susceptible to dehydration and changes in microbial populations. In addition, the mucosa epithelium along with the lamina propria is the immune "fire wall" (Figure 3),[2] the immune regulatory system that provides "homeostasis" mechanisms that balance the immune system to provide a stable healthy internal environment to minimize inflammation (Figures 4A & B).[2] Once the mucosa epithelium is breached, the innate system is the first to be activated and responds almost immediately (Figure 5). The adaptive response follows up 10 to 14 days later in naïve animals. The immune system is regulated to prevent an over-response (too much of a good thing). The cumulative effect of this anti-inflammatory response is to regulate the immune system, maintain homeostasis and to direct the immune response away from the memory response to the short-term antibody immune response. At the same time, over expression of pro-inflammatory cytokines from infectious agents, feed intake issues (acidosis, ketosis), and stress can result in immune dysfunction and an over reactive immune system that can result in immunopathology and disease.[29]

What? Types of vaccines and pathogens/immunogens

MLV and Inactivated–Together is even better

Modified-live virus (MLV) vaccines have been used because of the good antibody response, longer duration of immunity, fewer doses needed per animal, and lower cost. To a lesser extent modified-live bacterial vaccines have also been used (*Brucella abortus, Mannheimia hemolytica, Pasteurella multicida, Salmonella dublin*). These ML vaccines are administered intramuscularly, intranasally or subcutaneously. As the basis for establishing a good immune response, they are the best. Although the return to virulence in MLV vaccines has been minimal, mutations will occur and there is some risk of new strains arising. Non-adjuvanted MLV vaccines also fail to booster well-vaccinated animals. Active vaccine immunity neutralizes vaccine virus, preventing the MLV from replicating and preventing a booster immune response.[10,25] Unlike maternal interference, this active immune interference **never goes away** in well vaccinated animals. The animal's immune system can't differentiate between a natural infection or vaccine virus. Another issue with MLV IBR (BHV-1) vaccines is that they result in latency and their continued use throughout the life of the animal will insure that BHV-1 will be present in the herd even though the rates of shed are between 0.13 and 2.6% of the animals shed.[7]

Inactivated vaccines contain chemically or physically treated bacteria, toxins and/or viruses. There is no danger of replication in the vaccinated animal of the pathogen or adventitious agents that maybe present in a MLV. Improved

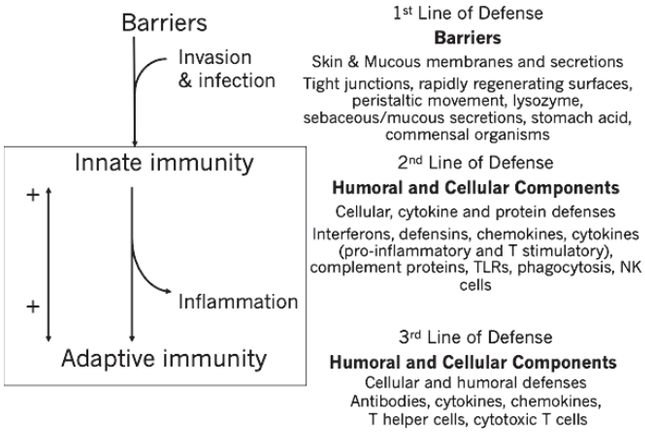

Figure 1. Immune responses.

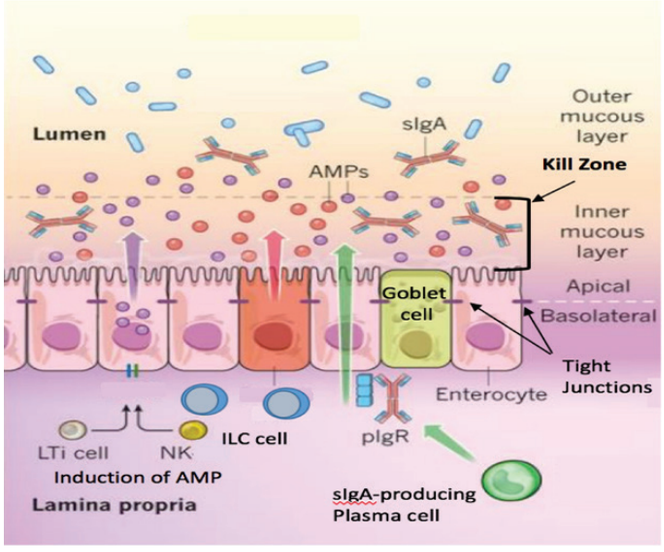

Figure 2. Mucosal epithelial cells (ME) are integrated into a continuous, single cell layer that is divided into apical and basolateral regions by tight junctions. ME sense the microbiota and their metabolites to induce the production of antimicrobial peptides (AMPs). Goblet cells produce mucin and mucous, that is organized into a dense, more highly cross-linked inner proteoglycan gel that forms an adherent inner mucous layer, and a less densely cross-linked outer mucous layer. The outer layer is highly colonized by constituents of the microbiota. The inner mucous layer is largely impervious to bacterial colonization or penetration due to its high concentration of bactericidal AMPs, as well as commensals specific secretory IgA (sIgA), which is moved from their basolateral surface, where it is bound by the receptor, to the inner mucous layer. Responding to the microbiotal components, innate lymphoid cells (ILC), lymphoid tissue inducer cells (LTi) and natural killer cells (NK), produce cytokines, which stimulate AMP production and maintain the epithelial barrier. Adapted from Maynard CL, Elson CO, Hatton RD, Weaver CT. Reciprocal interactions of the intestinal microbiota and immune system. *Nature* 2012;489:231-241. doi:10.1038/nature11551

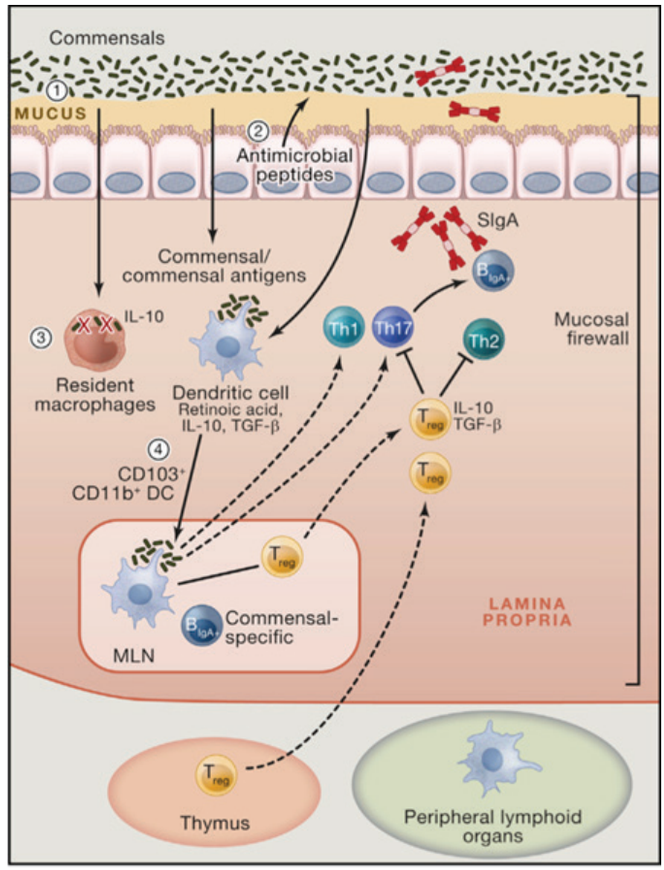

Figure 3. The mucus represents the primary barrier limiting contact between the microbiota and host tissue preventing microbial translocation. (2) Epithelial cells produce antimicrobial peptides that also play a significant role in limiting exposure to the commensal microbiota. (3) Translocating commensals are rapidly eliminated by tissue-resident macrophages. (4) Commensals or commensal antigens can also be captured by DCs that traffic to the mesenteric lymph node from the lamina propria but do not penetrate further. Presentation of commensal antigens by these DCs leads to the differentiation of commensal-specific regulatory cells (Treg), Th17 cells, and IgA-producing B cells. Commensal-specific lymphocytes traffic to the lamina propria and Peyer's patches. In the Peyer's patches, Treg can further promote class switching and IgA generation against commensals. The combination of the epithelial barrier, mucus layer, IgA, and DCs and T cells comprises the ''mucosal firewall,'' which limits the passage and exposure of commensals to the gut. Belkaid Y, Hand TW. Role of the microbiota in immunity and inflammation. *Cell* 2014;157:121-141. doi:10.1016/j.cell.2014.03.011

adjuvants have increased the scope and duration of inactivated virus immunity. They have several disadvantages including cost, and more doses required per animal. Inactivated vaccines generate cell-mediated responses.[27,30] Interestingly, there is ample evidence that inactivated vaccines can effectively boost MLV vaccines.[12,16,25,31,32] Inactivated vaccines have also been shown to decrease BHV-1 latency shed rates.[16]

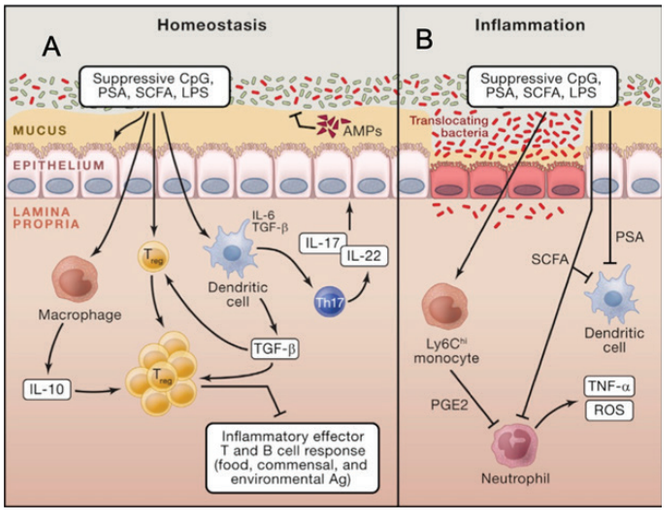

Figure 4. A) Commensals promote the induction of regulatory T cells via direct sensing of microbial products or metabolites by T cells or dendritic cells. Further commensals promote the induction of Th17 cells that can regulate the function and homeostasis of epithelial cells. In the context of inflammation, similar mechanisms may account for the regulatory role of the microbiota. (Right) Commensal-derived metabolites can also have a local and systemic effect on inflammatory cells. For example, SCFA can inhibit neutrophil activation. Upon entrance in the tissue, inflammatory monocytes can also respond to microbial-derived ligands by producing mediators such as PGE2 that limit neutrophil activation and tissue damage. Belkaid Y, Hand TW. Role of the microbiota in immunity and inflammation. *Cell* 2014;157:121-141. doi:10.1016/j.cell.2014.03.011

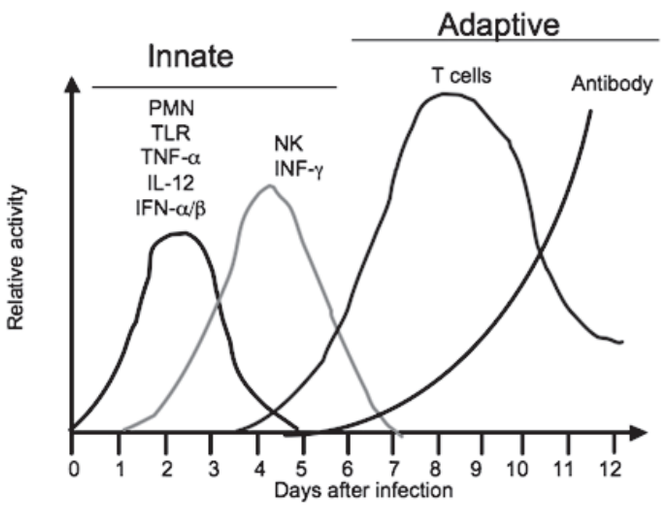

Figure 5. PMN-neutrophils, TLR-toll-like receptor, TNF-α-tumor necrosis factor alpha-proinflammatory, IL-12- interleukin 12-proinflammatory, IFN-α/β- interferon alpha/beta, NK-natural killer cell, IFN-γ-interferon gamma- proinflammatory

What to vaccinate for? What pathogens make sense?

Cattle vaccine programs are probably the most effective against viral pathogens (bovine herpesvirus 1 [BHV-1; IBR] bovine respiratory syncytial virus [BRSV] and bovine viral diarrhea virus [BVDV]). This is because many of the cattle bacterial pathogens (*Histophilus somni, Mannheimia hemolytica, Pasteurella multicida, Moraxella* spp, *Mycoplasma bovis, Salmonella typhimurium, Clostridium perfringens*) are normal inhabitants of the bovine microbiome and they are endemic in most herds.[18,20] Stressors discussed below play a major role in allowing these "normal" bugs to become pathogenic. When looking at a herd, it is essential to have a strong diagnostic program in place to get an accurate pathogen diagnosis. With next-generation sequencing, diagnostic PCR and good old-fashioned pathology and microbiology isolation, there has never been a better time to determine which pathogens are occurring and when. Being strategic in vaccination requires targeting those pathogens on that farm or ranch. Another term that we have learned from COVID19 is Replication Rate, called R naught (R_0).[7,11] Replication rate is the number of susceptible animals that 1 infected animal can infect (Figure 6). Probably one of the most infectious viruses is BRSV (Table 1). BRSV has been estimated to have a R_0 ~36. BRSV-susceptible animals (neonates) are highly susceptible to BRSV infection because of the high R_0. In a herd with BRSV disease history, BRSV vaccination would be at the top of the list. Once an animal is infected with BRSV and endemic, the immunity is not perfect, but R_0 is 1.1 so BRSV is barely circulating in the herd (Table 1). For IBR and BVDV transient infections, the rate is around ~3–meaning 1 infected animal shedding virus could potentially infect 3 susceptible animals (Table 1). By the time we get 70 to 80% of the animals either infected or protected from vaccination, the occurrence of infections to those viruses will be low and herd immunity has been achieved (Table 1). The BVDV PI

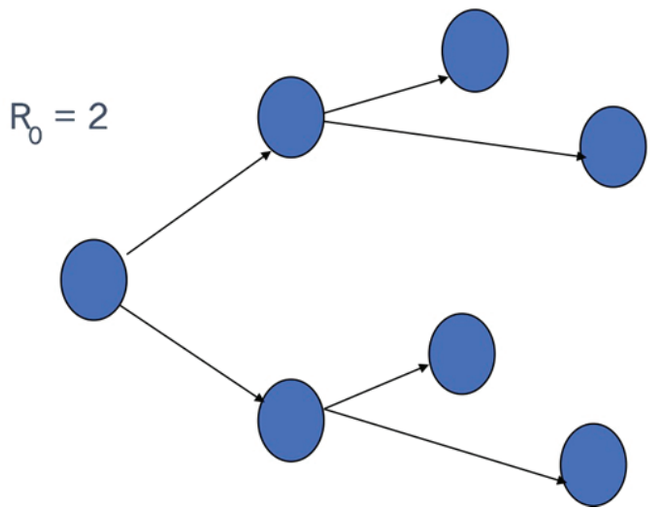

Figure 6. Basic reproduction number.

Table 1. Herd immunity thresholds for selected bovine vaccine-preventable diseases.

Disease	R_o	Herd immunity needed to prevent
BVDV PI	∞^	>95%
BRSV-naive	36.5*	>95%
BHV-1-naive	3.2#^^	75-86%
BVDV-Transient	0.25^-3.4##	70-80%
BRSV-endemic	1.14*	50-60%
BHV-1-latency	0.5^^	0%
COVID19	2-3	60-66%

*de Jong MCM, et al. *Am J Vet Res* 1996;57, 628-633.
#Bosch JC, et al. *Vaccine* 1998;16, 265-271.
##Moerman A, et al. *Vet Rec* 1993;132, 622-626.
^Sarrazin S, et al. *Vet J* 202, 244-249.

animal is the one case that totally destroys the concept of herd immunity. Since the BVDV PI animal continually sheds virus, any susceptible animal is at risk of infection. This makes the R_0 for a herd with BVDV PI of ∞ "infinity", indicating that a herd with a PI animal can never vaccinate their way out of the threat of BVDV. Endemic viral infections frequently include rotavirus and bovine coronavirus along with *C. perfringens*, representing a threat to the newborn susceptible animals. Environmental pathogens like *Bacillus anthracis* (anthrax), *Leptospira* spp, *E. coli,* and *Campylobacter* require considerations based on herd history and locality. Finally, *Brucella abortus* represents a "regulatory" vaccine.

When do we Vaccinate—Age and Stressors

Age

Neonatal Calves

The newborn calf is immunologically naïve at birth. It has had no chance to enhance adaptive immunity by "experience" because of the protective environment in the uterus. It is further handicapped by maternal factors and the hormonal influences of parturition, and by its lack of antibodies in circulation and in the tissues. The ingestion of colostrum is essential for providing the neonate with immunological protection during at least the first 2 to 4 weeks of life. While all the essential immune components are present in the neonate at birth, many of the components are not functional until the calf is at least 3 weeks of age, and may continue to develop until puberty.[6] This ongoing maturity of the immune system in the developing neonate, coupled with maternal antibody interference, makes vaccination strategy more complex. The mucosa epithelium provides immune function very early, making intranasal and oral vaccines effective in calves less than a week of age. Parenterally administered MLV vaccine responses begin at 7 to 10 days following birth, although BVDV MLV vaccines should be avoided particularly in dairy calves before at least 2 months of age as the major BVDV vaccine strains inhibit innate immune bacterial killing for 10 to 14 days following vaccination.[24] Bacterial parenteral vaccines typically don't have much response in animals less than 3 weeks of age, with the exception of *Clostridial perfringens* toxoids that have an immune response when administered at 3 days of age.[9]

Calves (<3 months)

Respiratory Diseases

- MLV intranasal vaccines (depends on maternal antibody levels-MANY MLV IM or SC are NOT EFFECTIVE BEFORE 30-45 days-ONLY adjuvanted MLV IM or SC)
- Branding time-beef- MLV IM or SC- adjuvanted; inactivated viral vaccines??- Well adjuvanted, not affected by maternal antibody?

Enteric Diseases

- Rota-coronavirus MLV-1 dose- within the first week of life- not recommended due to maternal interference and later onset of protection.
- *Clostridial perfringens* toxoid in the first 3 to 5 days after birth

Weaning-Puberty (Arrival)

Vaccination programs are a routine practice in beef and dairy operations to protect cattle against bovine respiratory diseases (BRD). Current vaccine protocols recommend that calves be vaccinated prior to weaning or commingling, to provide protection against BRD. Unfortunately, many calves are not vaccinated prior to weaning or commingling into backgrounding lots, feedlots or pasture operations. These animals are at increased risk of viral infection and are predisposed to secondary bacterial pneumonia. However, the highly-stressed calf presents a unique problem in that the vaccines may sometimes actually predispose the calves to more severe disease while on other occasions providing protection.

The time from vaccination to onset of protection can play an important role in subsequent management of newly arrived cattle against BRD viral agents, i.e., bovine herpesvirus 1 (BHV-1; IBR) bovine respiratory syncytial virus (BRSV), and bovine viral diarrhea virus (BVDV). Commercially available MLV vaccines administered to non-vaccinated, low-stress calves at weaning or at arrival to feed yards will provide increased weight gains and protection to animals as early as 48 hr prior to an IBR exposure, at 5 to 7 days prior to a BVDV, and 8 days prior to BRSV exposure.[4,8] This protection is due to the innate immune response, which is activated within hours after exposure to modified-live vaccines or infectious virus.

Frequency of vaccination

No more than 1 to 2 doses of MLV or 2 to 3 doses of inactivated vaccines should be administered in young calves less than 4 months of age to develop good herd immunity against respiratory diseases.

Interval between doses of vaccine

In all animals following vaccination, there is expansion in the populations of responding T- and B-cells. However, to have a complete and mature immune response, this T- and B-cell expansion must not only stop, but an active process of cell death (apoptosis) must also occur. This "waning process" allows "culling" T- or B-cells that may be poor responders or even cause autoimmunity to be removed by apoptosis. This whole process from vaccination to achieving mature immune response homeostasis takes at least 3 weeks (Figure 7). This fully developed mature primary response can then be boosted to get a true anamnestic secondary response. In many cases, cattle vaccine primary and booster doses are administered at 2-week intervals. In young calves, this is done to provide an opportunity to make sure that the calves develop a primary response in the face of maternal immunity. The adjuvants that are used with most commercial vaccines provide superior immune development over older generation adjuvants like alum. Therefore, in most instances if primary vaccination occurs after 3 weeks of age, booster vaccination beyond 3 weeks and even longer will be efficacious (Figure 7). The dogma that revaccination must occur within 2 weeks of the primary vaccination is not true, and the anamnestic response will be better if we wait longer.

Calves (>3 months)

Respiratory

- 2 to 3 weeks prior to weaning
  - MLV-1 dose
  - Inactivated-2 doses
  - Bacterial respiratory disease?
- At weaning
  - MLV-Immune dysfunction- delay–a few days to a month

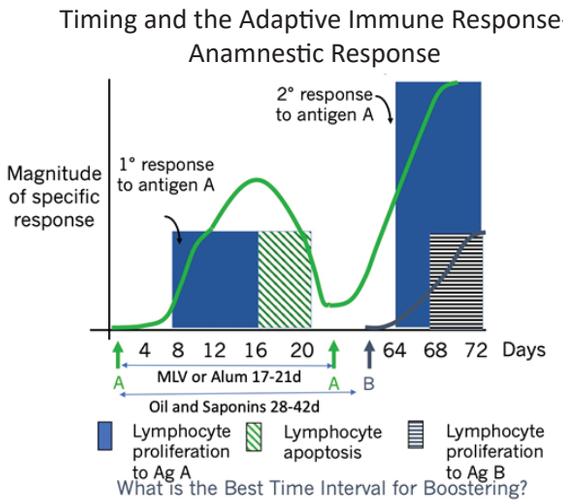

Figure 7. Vaccine A primary dose is administered and the booster dose is given ~21 days later.

- Inactivated-2 doses
- Bacterial respiratory disease?
- 2 to 3 weeks post weaning
  - MLV-1 dose
  - Inactivated-2 doses
  - Bacterial respiratory disease?

Heifer Development

Respiratory and Reproductive Diseases

Heifers (prebreeding) heifers need to receive at least 1 dose of MLV prior to addition to the breeding herd (1 dose should contain BVDV Singer Strain)

- MLV-2 doses-BVDV and BHV-1
  - >6 months and 2 months before breeding
- Inactivated viral-2 doses
  - 5 weeks and 2 weeks before breeding
- Leptospirosis-2 doses
  - 5 weeks and 2 weeks before breeding
- Brucellosis-1 dose

Prepartum Heifer & Cows–Colostrogenesis

The prepartum animal is an excellent animal to immunize- it is a "two-fer": respiratory and reproductive protection for the dam and colostral protection for respiratory and enteric disease for the calf. Beef cows, in contrast to dairy cows, will have better immune responses both in the prepartum and postpartum periods. Dairy cows are continuously managed to increase milk production. Some alterations in the host defense mechanisms that occur during the preparturient period are associated with changes in hormone profiles and the metabolic and physiological stress of parturition. The alteration of the immune system and the innate host resistance mechanism in dairy cows usually begins 3 weeks before parturition, and it is maximized 3 weeks after calving, when milk yield peaks and the energy balance begins to improve These changes can contribute to the high incidence of disease and the low immune response to vaccination experienced by the periparturient cow. Evidence of the changes in the immune system and the non-specific host defense mechanism occur in the periparturient dairy cow.[14,15]

Colostrogenesis

Colostrum synthesis in the mammary gland of the pregnant female is dependent on 2 factors: the presence of serum antibodies and a transport mechanism to move the antibody, primarily immunoglobulin G1 (IgG1), into the mammary gland.[1] Although the pregnant cow must be immunosuppressed to maintain the allogenic fetus (otherwise the bovine fetus would be rejected), this immunosuppression appears to occur most strongly in the uterus and the placenta. This fetal protective immunosuppression does not appear to cause a high level of generalized systemic immunosuppression that affects the cow's antibody response to vaccines or environmental antigens. However, some effect on the cell-mediated adaptive responses is observed in the pregnant animal. The

movement of antibody from the circulation to the mammary gland is hormonally regulated and begins 3 to 4 weeks prior to calving and has its highest transport in the last 1 to 2 weeks of pregnancy. This coincides with increases in estrogen, decreases in progesterone, and increase in the neonatal receptor (FcRn) in the mammary gland.[1] This small window of colostrogenesis makes timing of vaccine administration to the dry cow important. Non-adjuvanted vaccines would need to be given within 4 weeks of calving to get maximum circulating levels during colostrogenesis. Adjuvanted vaccines could be given earlier in the dry cow period, as they sustain higher antibody levels for longer periods of times. This ability to concentrate antibody ends rapidly after parturition. Colostrum from cows with premature calves will have lower levels of antibodies, so premature calves should be fed colostrum from cows that delivered full-term calves.

Respiratory and Reproductive Diseases -Cow and Respiratory Diseases-Calf

- MLV-1 dose
  - Vaccinating pregnant cows-lower efficacy demonstrated for preventing PI in subsequent pregnancy-problems with IBR abortion in poorly vaccinated animals
- Inactivated-1 dose-pregcheck time
  - Protection shown 1 year after vaccination

Enteric Diseases for Calf-Rotavirus, Coronavirus, *C. perfringens, K99 E. coli*

- MLV-2 doses- heifer- cows 1 dose
  - 5 weeks and 2 weeks before calving
- Inactivated-2 doses heifer- cows 1 dose
  - 10 to 12 weeks and 4-weeks before calving

Mastitis Dairy Heifer and Cow

First dose of J5 *E. coli* at 7 to 8 months of gestation in heifers and dry off in cows

Second dose of J5 *E. coli* 2 weeks following first dose

Third dose of J5 *E. coli* 2 to 3 weeks post calving

Postpartum heifer and cow

For the beef cow, the postpartum period is a good time for reproductive vaccination to attain the best protection for BVDV PI for the subsequent pregnancy. For the lactating dairy cow, this is a troublesome time. The common practice of vaccinating during the fresh period (15 to 45 days-in-milk) is an immunological challenge for the cows due to the negative energy balance associated with the high energy demands and the low dry matter intakes typically observed postpartum. The requirement of the immune system for energy becomes a secondary requirement compared to lactation. Since subclinical ketosis is present in nearly 30% of fresh dairy cows, suggesting vaccination during this period is probably not the best approach and vaccinating during the dry period might be a better alternative. In our research, we found that milk production, mastitis, and reproductive health were improved in dairy cows vaccinated in the prepartum period as compared to cows vaccinated in the postpartum period.

Reproductive Diseases-Cow

- MLV and Leptospirosis-1 dose
  - Vaccinate 45 to 60 days prior to breeding in beef cows to improve conception rate. In dairy cows vaccinate after 45 days-in-milk.
- Inactivated- Leptospirosis/(Campylobacter?-non-AI)- 1 dose
  - Do not use inactivated vaccine in the dairy cow-milk drop following vaccination. No effect of administering inactivated vaccines prior to breeding on conception rate.

Mastitis Dairy Heifer and Cow

- Third dose of J5 *E. coli* 2 to 3 weeks post-calving

Stressors and Vaccination

There is ample evidence that both physical and psychological distress can cause dysfunction of the immune function in animals, leading to an increased incidence of infectious disease.[20,25] Excess heat or cold, crowding, mixing, dehydration, weaning, calving, limit-feeding, shipping, noise, and restraint are stressors that are often associated with intensive animal production and have been shown to influence immune function in cattle (Figure 8).[13] Also, social status, genetics, age and the duration of stress (chronic vs acute) have been shown to be important in the animal's response to stress.[26] There is clear evidence that waiting to vaccinate at least 2 days and preferably as long as 2 weeks after the stress will result in better immunity and less sickness in that adjustment period after the stress.[22,23]

How do we vaccinate–Route and Good Nutritional Plane

Mucosal delivery vs parenteral delivery

Mucosal delivery of vaccine either orally or intranasally is a strategy that has been used for 3 reasons: 1) mucosal responses occur earlier in the neonatal calf than parenteral, 2) the presence of systemic maternal antibody has little effect on generating antigenic mass necessary for developing an immune response that occurs following immunizing with a mucosal vaccine (in the face of maternal antibody-IFOMA), and 3) mucosal vaccination results in the generation of secretory IgA that is produced locally and protects mucosal surfaces where most pathogens are colonized and/or infect the host (Figure 9). For all vaccines, mucosal or parenteral, the critical immune reactions occur in the draining lymph node (Figure 9 and Figure 10). With the right adjuvanted parenteral MLV vaccine, a protective mucosal IgA response can occur IFOMA.[17] The paradigm that only mucosal vaccines result in the immune response IFOMA and induce mucosal IgA is not true. However, the key ingredient for a parenteral MLV vaccine to induce mucosal immunity is the adjuvant.

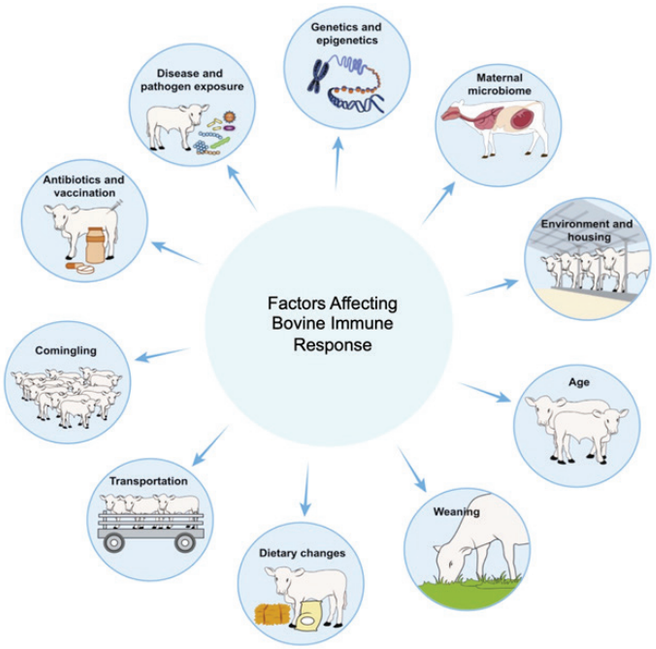

Figure 8. Immune responses are highly dynamic and are shaped by various host and environmental factors, including host genetics, mode of delivery, diet and the microbiota of the mother, environmental housing, weaning, feeding type, transportation, comingling, antibiotic treatment, vaccination, and pathogen exposure. Adapted from Zeineldin M, Lowe J, Aldridge B. Contribution of the mucosal microbiota to bovine respiratory health. *Trends Microbiol* 2019;27:753-770. doi:10.1016/j.tim.2019.04.005

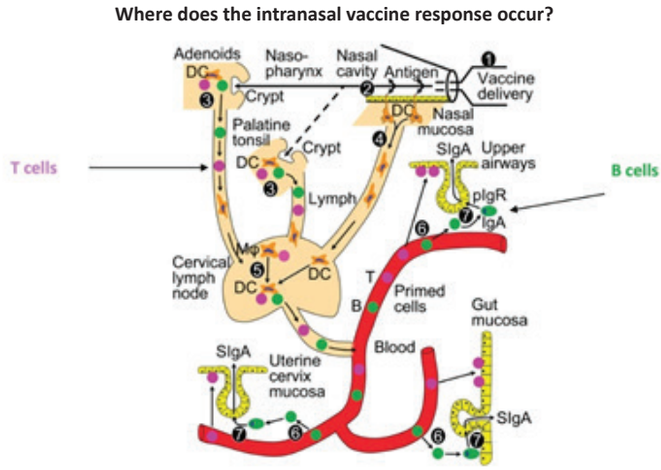

Figure 9. 1) Delivery of nasal vaccine; 2) Uptake of vaccine antigen through nasal mucosa; 3) Immune-induction in nasal associated lymphoid tissue (NALT) including tonsils; 4) Antigen targeting and migration of mucosal dendritic cells (DCs) to regional lymph node; 5) Immune induction and amplification in regional (cervical) lymph nodes by antigen-loaded DCs and macrophages (MΦ); 6) Compartmentalized homing and exit of NALT-induced T and B cells to secretory effector sites in airways, gut, and uterine cervix; and 7) Local production and polymeric Ig receptor (pIgR)-mediated external transport of dimeric IgA to generate secretory IgA (SigA). Brandtzaeg P. Potential of nasopharynx-associated lymphoid tissue for vaccine responses in the airways. *Am J Respir Crit Care Med* 2011;183:1595-1604.

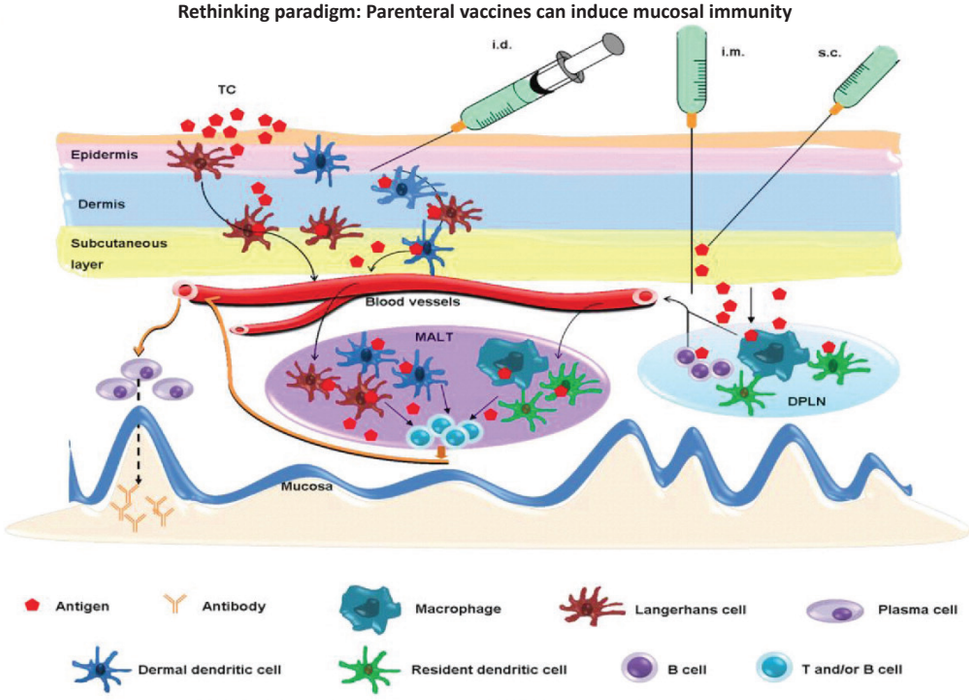

Figure 10. Properly adjuvanted parenteral vaccines can induce mucosal IgA responses via the draining lymph node. Su F, Patel GB, Hu S, et al. Induction of mucosal immunity through systemic immunization: Phantom or reality? *Hum Vaccin Immunother* 2016;12:1070-1079.

Most adjuvants can not overcome IFOMA and/or produce a mucosal IgA response (Figure 10). The more sophisticated oil-saponin adjuvants have this ability.[17]

Needleless Injections

Needle-free injection devices (NFID) result in a high-pressure stream that penetrates the epidermis, dermis with some subcutaneous penetration.[5] NFID-administered vaccines can use half to a tenth of the dose required for intramuscular vaccines because of the higher antigen dispersion and contact with the antigen-presenting cells found in skin. The use of NFID decreases the number of needle-stick injuries. Needle-free devices also have disadvantages, including start-up cost of the equipment, exhaustible gas-storage infrastructure (for those systems using a compressed or CO2 gas system), technical and operational expertise (training of the operators and maintenance of the units), and inability to completely replace needle-syringe devices. The cost of the equipment varies depending on the type of needle-free injector, and there are additional associated costs with maintenance and infrastructure, especially with compressed gas devices. Needle-free application requires a consistent application method. Needle-free devices are calibrated to deliver the vaccine when the needle-free device is perpendicular (90°) to the skin. Vaccinations made at more acute or oblique angles will affect the distribution of the vaccine in the tissue. In addition, because of the moving parts and gas system, regular maintenance is required. Finally, there is no "one-size-fits-all" needle-free device for all applications that require injections. Humidity, cattle breed, hide condition (haircoat, mud, snow, etc.), and age of the animal all effect the elasticity and thickness of the hide, greatly changing the force required for correct delivery. Different ages, breeds of cattle, treatment dose, and viscosity of injection substance require different injection volume, injection pressure, and even different NFIDs. Adoption of needle-free devices in the US cattle industry has been slow, although there has been better adoption in the swine industry driven by foreign markets that require the use of NFID. Reasons for this low industry implementation rate involve cost of the unit and associated maintenance and infrastructure costs, higher complexity than needle-syringe device, availability of devices (a smaller handheld injector that is used in Europe is not available in the US), uncertainty if the animal was vaccinated (i.e., no physical sensation that the animal was vaccinated and/or a "wet" appearance at the injection site) and requirement for training.

Hydration and Nutrition

One of the most critical issues in poor responses to vaccines are when animals have low water and feed intakes as a result of lack of supply, transportation, etc. The immune system requires hydration and energy for the barrier to be effective and for the immune system to actively respond and develop an effective immune response quickly, including duration of immunity and memory from vaccination. The immune system is a major consumer of energy and in times of negative energy, like seen in the newly weaned calf and the fresh dairy cow, can be difficult times for the immune system to respond.[29] The immune response requires energy, protein, vitamins, and trace minerals. Both malnutrition and overfeeding may result in impairment of immune function and increased susceptibility to disease due to a deficiency or excess of proteins or calories, or a relative imbalance in vitamin or trace mineral content. Animals under intensive production conditions typically have a completely controlled diet. Therefore, it is very important that the diet, especially the vitamin and trace mineral content, be optimally formulated. Key vitamins and minerals for optimal immune function include vitamins A, C, E, and the B complex vitamins, copper (Cu), zinc (Zn), magnesium (Mg), manganese (Mn), iron (Fe), and selenium (Se). Of these zinc, copper and selenium are the "immune microminerals". The balance of these constituents is especially important since excess or deficiency in one component may influence the availability or requirement for another. Zinc is involved in protein synthesis and antibody formation, cell differentiation, and enzyme formation and function. Zinc also plays a major role in skin and mucosa integrity, the first line of defense of the immune system. It is also essential for innate immune responses.[3] Copper and manganese are directly involved with cell-mediated immunity and protein matrix formation during the healing process. Copper has been linked with the ability of isolated neutrophils to kill yeast and bacterial infections. Selenium is an essential antioxidant.[28] Manganese plays a role in facilitating the "germ-killing" function of macrophages.[29]

Conclusions

Management of the cow's and calf's immune system is not a simple process. Stressors and nutrition often compromise immunity. It is important that vaccinations be given at optimal times and that vaccination is not overused. Vaccination can never overcome poor management.

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Dinner plan killers: Blocked goats, pig C-sections, and pregnancy toxemia

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Abstract

Urinary obstructed small ruminants, pigs in dystocia, and pregnancy toxemia all represent challenging, truly emergent clinical scenarios in mixed and large animal practice. Each of these scenarios, however, lend themselves to protocol development. Putting these cases on autopilot can remove a lot of the associated stress and ensure consistent patient care with consideration for client expectations and finances built right in.

Initial evaluation of animals with suspected urolithiasis should include examination of the preputial hairs for grit or formed stones and exteriorization of the penis for examination and amputation of the vermiform appendage. When vermiform appendage amputation fails to relieve the obstruction, catheterization and surgical intervention, including perineal urethrostomy, tube cystotomy, minimally invasive tube cystotomy, and others should be considered.

Swine presented for dystocia are often compromised and require a Cesarean section. Having a standard protocol in place for perioperative drugs, including anesthetic drugs, antimicrobials, and anti-inflammatories, reduces the veterinarian's stress in preparing to go to surgery. Unlike other species, the surgical approach in swine is paramammary and the uterus is much more highly vascularized. Care must be taken to minimize abdominal contamination where dead piglets are involved.

Ewes and does presented ill in late gestation should always be evaluated for pregnancy toxemia. Many, if not most of these animals, additionally have pneumonia and a GI parasite burden. Does and ewes that are still standing and eating can often be managed in the field, while those that are recumbent will only recover if placed on IV fluids and dextrose CRI. Producers must be educated on pregnancy toxemia risk factors, such as obesity, parasitism, and improper feeding.

Key words: urolithiasis, sheep, goats, swine, Cesarean section, pregnancy toxemia

Blocked Goats

Obstructive urolithiasis is considered to be the most economically significant urinary tract disease of food animals, affecting primarily intact and castrated male ruminants, swine, and camelids. Male small ruminants are particularly predisposed, while females are rarely clinically affected.

Pathogenesis

Uroliths are solid crystalline formations in the urine which are composed of organic matrix and organic and inorganic crystalloids. Matrix, made up of sugars, proteins, and cells, results from urine super-saturation. Factors affecting urine super-saturation include the rate of renal excretion of crystalloids, negative water balance, urine pH, and the presence or absence of crystallization inhibitors. Metaplasia of uroepithelium, as a result of vitamin A deficiency, may contribute cells and protein for nuclear formation. Suture, tissue debris, blood clots or bacteria may also serve as nuclear components initiating urolith formation. Infection, however, is considered to be a minor factor in urolith formation in ruminants. The formation of a nucleus is followed by deposition of inorganic minerals, including magnesium, calcium and phosphate, onto the matrix.

The anatomy of the distal urinary tract of male ruminants differs significantly from that of males of other species, and contributes to the development of obstruction and increases treatment difficulty. The penis is sigmoid in arrangement, with 2 major bends occurring between the urinary bladder and the distal glans penis. The distal flexure is a common site of urethral obstruction by uroliths. The glans penis of the small ruminant also has a vermiform appendage, or urethral process, which is an extension of the urethra 2 to 4 cm beyond the distal end of the penis. It has a narrowed diameter compared to the more proximal portions of the urethra and also serves as a common location for obstruction. The urethral diverticulum, an outpouching of the urethra at the level of the ischial arch, complicates treatment of affected animals. When a urinary catheter is passed into the urethra in a retrograde manner from the glans in order to access the urinary bladder, this diverticulum readily accepts the catheter, rather than allowing the catheter to proceed into the urinary bladder.

Urolithiasis is a multifactorial disease with such inputs as diet, urine pH, and body water balance. Struvite (magnesium ammonium phosphate) and apatite (calcium phosphate) may be commonly seen in animals fed high-grain diets, while animals consuming legumes are predisposed to calcium carbonate uroliths. Silicate stones may be observed in animals grazing silicaceous plants and soils in the western United States and Canada. Calcium oxalate stones may be associated with oxalate-containing plants.

A significant factor in availability of urolith components and their binding ability is urine pH. Struvite, apatite, and

calcium carbonate uroliths are known to precipitate in alkaline urine. Struvite crystallization occurs only at a pH range of 7.2 to 8.4, while apatite stones develop at a urine pH of 6.5 to 7.5. Calcium carbonate stones also tend to form in alkaline urine, while pH may have little or no effect on silicate or calcium oxalate uroliths.

Total body water balance plays an important role in calculogenesis by its effects on urine volume and concentration. This may be seen in winter and during times of other systemic illness, when animals consume decreased volumes of water. A negative body water balance contributes to supersaturation, precipitation, and formation of residue of organic and inorganic crystalloids in urine.

Uroliths may obstruct urine flow anywhere from the renal pelvis to the distal urethra, although the most common sites of obstruction are at the distal sigmoid flexure or the vermiform appendage in sheep and goats. Obstruction at these sites may result in either rupture of the urethra or of the urinary bladder.

Treatment

Management of affected individuals consists of establishing a patent route of urine excretion, providing analgesia, correcting fluid deficits and correcting electrolyte derangements, decreasing inflammation and preventing infection.

The presence of the urethral diverticulum prevents passage of a urinary catheter retrograde from the urethral orifice to the urinary bladder. Retrograde catheterization or retropulsion of uroliths is not recommended to avoid further trauma or puncture of the urethra at the level of the diverticulum. Attempts at retropulsion of uroliths may result in over-distention of the urinary bladder as the stone is diverted into the diverticulum, allowing fluid to pass into the bladder, followed by the urolith falling back into the urethra and preventing the bladder from emptying. Occasionally, removal of the vermiform appendage in small ruminants establishes a patent urethra; however, inflammation in the proximal urethra from passage of the uroliths may still prevent normal urination. Uroliths tend to occur in multitudes in the urinary bladder, and 80% of animals initially relieved by amputation of the vermiform appendage will reobstruct with subsequent stone passage. Relief of urinary obstruction most often requires surgical intervention.

Sedatives may be useful to facilitate treatment. Historically, acepromazine (0.05 to 0.1 mg/kg, IV or IM) has been utilized in the medical management of urolithiasis. Unproven arguments for utilization of acepromazine have been to relax urethral tone through α-antagonistic effects on smooth muscle and relaxation of the retractor penis muscle. Benefits of acepromazine may also include suppressing the anxiety associated with the inability to urinate. Caution should be taken when using phenothiazine tranquilizers in patients which may already be hypotensive and hypothermic. Diazepam (0.1 mg/kg, slow IV) may also be used for urethral relaxation and as an anxietolytic. Xylazine (0.05 to 0.1 mg/kg, IV or IM) or other α-2 agonists may be used in attempt to restrain the patient for examination of the penis and have excellent analgesic properties in ruminants. Caution should be exercised when utilizing xylazine prior to relief of the obstruction, as it promotes diuresis, as well as enhancing hypotension. Lumbosacral epidurals using 2% lidocaine (1 mL/7 kg) may be utilized in the place of sedation to relieve discomfort and aid in exteriorization of the penis.

Fluid therapy should be instituted as indicated by the clinical findings and economics of the case. After relief of the obstruction, diuresis is important to replace dehydration, reduce azotemia, and flush the urinary tract. 0.9% NaCl is a good choice for intravenous fluid therapy, although additional electrolyte and acid-base abnormalities should be considered.

Non-steroidal anti-inflammatory drugs should be administered to decrease inflammation and aid in the prevention of urethral stricture formation, but should be used with caution until adequate renal perfusion is attained. Broad-spectrum antibiotic therapy should be instituted to prevent or treat infection resulting from devitalized or inflamed urinary tissues or cavitational accumulation of urine. Beta-lactams (penicillins and cephalosporins) may be chosen, as they have good spectrum of activity and are excreted in the urine.

Many surgical options are available, usually selected based upon economic constraints and purposes of the animal. Animals with ruptured urethras should be considered lost for breeding purposes due to adhesion formation. Salvage procedures include perineal urethrostomy and penile amputation, both of which typically suffer from stricture formation weeks to months after surgery. Tube cystotomy is the most successful method of urine diversion, where a foley catheter is placed in the urinary bladder, passes through the abdominal wall and drains externally. This diversion allows for urethral healing and stone dissolution through flushing or diet change, and tubes are left in place until urine flow is achieved through the urethra. Other options include urinary bladder marsupialization, urethrotomy, and laser lithotripsy. Each of these methods is described in most food animal surgery texts.

Once the obstruction is relieved, treatments to acidify the urine should be initiated in an effort to solubilize additional stones and sediment. Ammonium chloride at a dosage of 90 mg/lb (200 mg/kg) may be orally administered initially and adjusted to attain a urine pH of 6.0 to 6.5. Care should be taken in dosing so that systemic over-acidification does not occur.

Prevention

Due to the poor prognosis and expense associated with clinical cases of obstructive urolithiasis as well as the herd or flock implications of the disease, considerable focus should be placed on prevention. The important role of metabolic by-products and minerals in the pathophysiology causes diet to be the primary focus of disease prevention. Risk factors addressed in preventative strategies include high dietary

phosphorus relative to calcium, high magnesium, low fiber content of rations, low urine output, and an alkaline urine pH. Additional factors including selective grazing and castration timing may be addressed.

An elevated level of phosphorus in the diet, with a calcium:phosphorus ratio less than 2:1 increases the excretion of phosphorus in the urine and provides an ion to bind to organic matrix. Increasing the level of calcium in the diet markedly decreases the incidence of urolithiasis, probably due to competition with phosphorus for intestinal absorption and matrix binding. Phosphorus should not comprise greater than 0.6% of the total ration and it is recommended that a 2.5:1 or 2:1 calcium:phosphorus ratio be achieved, by the use of calcium salts, if necessary. Calcium oversupplementation should be avoided as increased calcium excretion in the urine may contribute to calcium-containing uroliths. High phosphorus levels are present in grains, particularly sorghum, wheat, corn, milo, and oats.

A reduction in phosphorus excretion into the urine is also desirable. Ruminants excrete phosphorus primarily by saliva, where it is then swallowed and removed from the body in the feces. Excessive dietary levels of phosphorus may saturate this salivary pathway, causing the excess to be excreted in the urine. Urine phosphorus excretion is greater in animals fed pelleted rations as compared to meal-type rations, due to a decrease in saliva production, and therefore a pathway for excess phosphorus excretion. Increases in the roughage component of diets are important from this standpoint, as they increase the amount of saliva that must be produced for proper mastication.

Particularly in the case of struvite stones, but also with apatite stones, an increase in magnesium excretion into the urine is contributory to crystallization. It is recommended that magnesium not exceed 0.6% of the total ration of ruminants. Magnesium is more available and absorbed more efficiently from concentrate rations than from roughage diets.

Increasing water intake and urine volume is an important preventive measure for urolithiasis. Sources recommend the provision of adequate palatable water at desirable temperatures according to the ambient environment. Ruminants demonstrate a reduction in water intake for grain feeding over roughage feeding. Additionally, the feeding of intermittent meals may cause shunting of body water into the rumen due to increased osmotic pull from generated volatile fatty acids, resulting in a decrease in urine output. This has led to the recommendation that ruminants be fed *ad libitum* to maintain urine output.

Increasing forage vs grain in the diet of animals at risk for urolithiasis has many benefits. Grain results in increased magnesium, phosphorus and peptides in the urine. Forage encourages saliva production for phosphorus excretion, potentially reduces magnesium uptake, reduces overall grain consumption and increases water intake. Legumes and their hay should be avoided, as they have high levels of calcium and are associated with calcium carbonate urolithiasis.

The role of urine pH in urolithiasis is well documented and various sources recommend urine pH goals of 5.5 to 6.5, based on the solubilities of the common stone compositions. Due to an ability to alter acid-base balance and body water balance, salts have been widely used and recommended for the prevention of urolithiasis. Anionic salts containing primarily chlorides have been popular and used extensively, as they reduce urine pH, increase urine output, and, ultimately prevent urolithiasis. Sodium chloride (1 to 4%), calcium chloride (1 to 2%) and ammonium chloride (0.5 to 2%) have been traditionally added as percentages of rations to increase water intake and produce acidic urine, with inconsistent results.

The traditional addition of these salts as a simple percentage of the diet without consideration for the components of the total ration may lead to inconsistent and unsuccessful maintenance of low urinary pH. The concept of DCAD states that with increased cations in the diet, alkalotic tendencies will occur. Conversely, increased anions in the diet have acidifying potential. Different commercial diets are commonly formulated using various commodities, and these commodities are interchanged regularly in feed preparation based on availability. If a feedstuff of a particular batch of feed is higher in cations, or anionic salts are fed in conjunction with a high-potassium forage, the DCAD of the diet will be raised and urinary acidification may not occur, despite the addition of the standard dose of anions. This one-dose-fits-all method may be the major cause of sporadic urolith formation in animals being fed anionic salts. The use of DCAD balancing for goats and urolithiasis is mentioned as a recommendation in some sources, and it is recommended that high cation-containing feedstuffs such as alfalfa and molasses should be avoided. Few controlled studies for target DCAD levels currently exist, but a DCAD of 0 mEq/kg appears to achieve urine pH of intact and castrated goats of less than 6.5. To accurately assess the efficacy of salts in the diet, whether DCAD balanced or not, owners should be encouraged to periodically assess urine pH at home.

Early castration is commonly thought to reduce the positive influence of testosterone on urethral diameter as well as diminish normal prepucial to penile attachments that are present in the neonate. Delaying castration in pet animals may serve to increase urethral diameter as well as increase the ability to examine the penis. Prophylactic removal of the vermiform appendage in young small ruminants may also serve to reduce the likelihood of obstruction.

Grazing of females on pastures which have high silica content of soil and plants is preferred to the grazing of males on these pastures. If males are to be grazed in these locations, water intake should be encouraged by maintaining desirable and accessible water sources and supplementation of anionic salts.

Summary

For prevention of urolithiasis, major efforts should be focused on reducing the grain and increasing the for-

age composition of the diet. A 2:1 Ca:P ratio should be attained, magnesium lowered to less than 0.6%, and anionic supplementation or DCAD balancing should be considered. Palatable, fresh water should be consistently available at temperatures which encourage consumption. Because urolithiasis is multifactorial, it is difficult to achieve consistent results from preventative strategies and can be very frustrating for producers and veterinarians. With adherence to the above goals, significant reductions in clinical cases can be achieved. Veterinarians should seek input from FARAD to determine withdrawal times for analgesics and sedatives used in an extra-label manner.

References available upon request.

Pig C-sections

In my experience, swine presenting in dystocia are often in a compromised state. Particularly in the case of pet pigs, owners often lack awareness of the normal birthing events and monitoring of livestock, resulting in delays in presentation to the veterinarian. Owners of show pigs tend to be more knowledgeable, and commercial swine are rarely presented to a veterinarian for dystocia.

The most common cause of dystocia in swine is primary uterine inertia, followed by maternal undersize. Uterine inertia can usually be resolved with oxytocin, calcium and manual assistance. That works in commercial and show pigs, but is more challenging in potbellied pigs due to their small pelvic size. If you can't get your hand in to rule out obstructive dystocia, oxytocin and calcium are absolutely contraindicated. So, we often go straight to c-section on those.

We offer every client the choice of injectable or gas anesthesia with monitoring. The costs are vastly different, but we want the clients to make an informed decision. For injectable, we use a combination of xylazine (1mg/kg) or butorphanol (0.1mg/kg) with midazolam (0.2mg/kg) and ketamine (5mg/kg). Preoperatively, we also administer ceftiofur CFA (swine product) and flunixin. We have a chart for these drugs by weight to take the calculations out of it.

We place the gilt or sow in right lateral recumbency and may do either a lumbosacral epidural or a simple line block with 2% lidocaine. The approach is paramammary, just lateral to the left mammary chain. Skin and muscle are incised with a scalpel, while my preference is to open peritoneum with an initial protected stab incision with a scalpel, followed by opening with scissors.

The uterus is located and exteriorized. Particularly if you know or are suspicious of dead piglets, I recommend placing an impervious drape around the exteriorized uterus. Palpate the piglets and incise over the pig most distal in the uterine horn. Piglets can then be extracted by "milking" them towards the incision. The second uterine horn may need an additional incision based on the arrangement of the piglets.

After extraction, we spend a good amount of time lavaging the uterus and removing blood clots. This is repeated after we suture the uterus. The uterine incision(s) are closed in a Utrecht inverting pattern using 2-0 PDS on a taper needle. If the uterus is very contaminated, I recommend a second layer closure on the uterus. The clean uterus is replaced into the abdomen.

We perform an initial closure of the body wall with 2-0-0 PDS of the peritoneum and muscle layers using a taper needle in a simple continuous pattern. For a large gilt or sow, I would recommend closing in 2 to 3 runs of suture. A second layer of the fat/subcutaneous tissue is then closed, followed by the skin in a Ford Interlocking or other suitable skin pattern.

We allow the preoperative ceftiofur to complete the postoperative antimicrobial protocol and provide meloxicam orally at 0.4mg/kg PO q 24 hours. We often find that some benefit from opioid pain control, but pigs are very susceptible to opioid-induced ileus and constipation and will go off feed. So, if we provide opioid pain management (0.1mg/kg morphine IM q4-8h), we will prophylactically use canned pumpkin, Hill's a/d and sometimes lactulose to keep things moving along. Veterinarians should seek input from FARAD to determine withdrawal times for analgesics and sedatives used in an extra-label manner.

Pregnancy Toxemia

Pregnancy toxemia in sheep and goats is one of 3 syndromes falling under the heading of hepatic lipidosis. Thus, its pathophysiology is related to that of fat cow syndrome in dairy cows and protein-energy malnutrition in beef cows. The underlying cause of each of these syndromes is a negative energy balance, typically occurring at a time of metabolic drain and/or poor feed availability. In sheep and goats, this condition most often occurs in the last 2 to 4 weeks of gestation in dams carrying multiple fetuses. Contributing to the negative energy balance in late-gestation does and ewes is the increased demand of fetal growth, decreased abdominal space, poor feed availability (winter), cold, shearing stress, lack of exercise, stress of movement, and intestinal parasitism.

Clinical Picture

Affected dams typically present anorexic, depressed, recumbent and may have significant neurologic signs. Diagnosis is most easily based on the presence of ketonuria (>60 mg/dL). Hypoglycemia is variably present and it is not recommended that a normal or high blood glucose be used to rule out pregnancy toxemia. Other laboratory findings may include metabolic acidosis, hypocalcemia, azotemia, elevated GGT and AST, hypokalemia, increased FFAs, increased beta-hydroxybutyrate [BHB] (>5-7 mmol/L), increased NEFAs (>0.4 mEq/L), and stress neutrophilia. I strongly recommend that a fecal flotation be run on all cases, as I find most are heavily parasitized, contributing to the negative energy balance.

When I approach treatment of an individual case of pregnancy toxemia, my first question to the owner is, "Who is the bigger priority to you: the doe/ewe or the kids/lambs?" If the dam is the priority, induction of parturition should be strongly considered. Goats are CL-dependent throughout pregnancy, while in sheep, the placenta takes over at about day 50 of gestation. In goats, 5 to 10 mg of dinoprost or 100ug/45 kg cloprostenol will cause parturition in 27 to 55 hours. In ewes, 20 mg of dexamethasone will result in parturition in 48 to 72 hours. In both species, I typically use both a PG and dexamethasone to expedite delivery (12 to 24 hours) and to prepare the lungs of kids for delivery. Cesarean sections may be considered, but dams should be stabilized prior to surgery. Dams with pregnancy toxemia experience a high rate of dystocia and offspring are often born weak, with high rates of failure of passive transfer. When owners want to maintain the pregnancy, treatment is determined by severity of signs and owner preference. Dams which are still eating some and are still able to stand up on their own may be maintained with oral medications. Once animals are anorexic or recumbent, however, intravenous maintenance is usually necessary.

Treatment and Monitoring

Conservative therapies include oral propylene glycol (30 to 60 mL q 12h), increase in compact, high-energy nutrition, B vitamins, 15 to 20g NaHCO3/50mL water orally, and nursing care. High-energy calf scour rehydration solutions may also be administered. For more severely affected, I generally place a catheter in the jugular vein and begin polyionic fluids with 2.5% or 5% dextrose and 10 to 15 mL B complex vitamins/L fluids. My preference is to administer this as a constant infusion, however, 100 mL boluses of 50% dextrose q 6 to 8 hours may be substituted. Other additives may include 25 to 75 mL/ L of calcium borogluconate and 10 to 30 mEq/L KCl / L. Urine glucose and ketones should be monitored to assess for need to reduce rate of dextrose administration. Rumen transfaunation (1 to 2 pints) may be considered, particularly if animals have been previously treated with propylene glycol. Insulin (PZI) at 0.4 u/kg SC q 24 h for 3-4 days or regular insulin at 0.1u/kg SC once (with glucose monitoring) increases glucose utilization and assists with reducing hyperkalemia in acidotic animals.

Monitoring throughout treatment should include serum electrolytes, acid/base balance, urine glucose and ketones and fetal viability via ultrasound. There is a good prognosis for both dam and fetuses if cases are treated early and aggressively, when dams are still ambulatory and have only a small reduction in appetite. The prognosis is poor for dams who are recumbent, have total anorexia, become ill prior to 2 weeks prior to due date, or have clinicopathologic evidence of severe hepatic lipidosis and renal failure.

Prevention

Prevention of pregnancy toxemia should first focus on obtaining an appropriate body condition score at breeding (3/5), maintaining that through parturition (3.5/5). High-energy feeds (small grains, legumes) should not be provided in the first 4 months of pregnancy, with 8 to 10% protein hays provided. In the last month to 6 weeks of gestation, concentrates should be introduced into the diet, and increased over a 2-week period to provide increased energy in the last 2 to 4 weeks of gestation. Grazing on lush spring pasture, legume hays, and alfalfa pellets may also be used to provide this additional energy. In late gestation, owners may, for example, plan for 3.5 to 4# of good quality hay (>10% protein, >55% TDN) and 1.5# concentrate (whole shelled corn) once daily, increasing concentrate from 0.5#/head/day to 1.5#/head/day over about 2 weeks. Severe winter stresses increase energy requirements and concentrates should be increased to 2 to 3#/head/day, divided into 2 feedings, to provide for this increased metabolic strain. Other strategies that have been used include ultrasound pregnancy examination (45 to 90 days) and separation of dams with multiple fetuses for increased feeding, monitoring for presence of urine ketones, and the determination of BHB levels in plasma. Pooled plasma may be used for herd screening of BHB, with values of 0.8 mmol/L indicating adequate energy intake, 0.8 to 1.6 mmol/L indicating inadequate dietary energy and values >1.6mmol/L indicating severe malnutrition.

LDA surgery tips and aftercare for recent grads

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Abstract

Correction of Left Displaced Abomasum (LDA) is one of the most common surgical procedures performed by livestock veterinarians. As a recent graduate, you can expect your surgical abilities and outcomes will be scrutinized by your clients. High quality outcomes start with a thorough physical examination, consideration of prognosis and future value to the dairy operation. Good restraint and sedation are paramount to patient and surgeon safety. Careful surgical prep and technique must be married to efficiency to maintain high surgical standards in a compromised environment. Aftercare and record keeping ensure a full recovery, and follow-up communication with clients will verify outcomes and build your credibility.

Key words: bovine, left displaced abomasum, LDA, surgery

Diagnosis and Restraint

Successful left displaced abomasum (LDA) surgery outcomes depend on a thorough and accurate initial physical exam. Be systematic in your approach, be comprehensive and record your findings.

Cows should be well restrained for a physical exam, and certainly so for surgery. If you need to catch an unwilling cow, one trick I have found most helpful is to toss a few handfuls of dry hay in the feed bunk. If no dry hay is available, a piece of paper towel is equally enticing to a curious cow. Either way, place it far enough ahead that she'll have to reach for it and thereby lock herself in the headlocks.

Whenever I examine fresh cows, whether an individual animal or a pen of 250 head, I palpate along the left paralumbar fossa and press in behind the last rib. Cows that are eating well should have filled their abdomen within a few days of calving. A firm left flank (rumen pressed tight against the body wall) gives a quick summary of how the cow has been eating for the past few days. It is easy to detect an LDA with this quick flank palpation as well. An LDA will often feel like a balloon squished between the rumen and the last rib. This is a 5 to 10 second exam along with observing udder fill, manure, and vaginal discharge behind the cow. I also try to observe the cow's eyes as there is a subtle change in many cows with toxic or metabolic challenges, in addition to the obvious changes in dehydrated animals. For any cow that does not feel full or fails on another of my quick observations, I will use my stethoscope to listen for the strength and frequency of rumen contractions +/- rectal exam to check for the presence and consistency of manure and for rumen fill. Variable tone pings vs monotonous pings: not all left-side pings are LDAs, and not all LDAs will ping. It's important to differentiate between rumen pings, empty abdomen pings, and LDAs. To my ear, LDA pings are variable in tone as you flick different spots across the musical area. Rumen and abdomen pings, in contrast, will often be monotonous across the entire flank and paralumbar fossa. If she pings way up near the transverse processes of the lumbar vertebrae, it's unlikely that is caused by an LDA.

Another useful diagnostic technique is ballottement of the left flank. While holding your stethoscope against the flank in the area of the suspected LDA, use your fist to push assertively in and out on the lower flank of the cow just cranial to the stifle. Metallic tinkling or sloshing sounds are consistent with an LDA.

The Liptak Test can be performed to differentiate an LDA from rumen gas as well. Fluid is aspirated from just below the tympanic area and checked using a pH strip or meter. Rumen fluid has a pH of 5.5 to 7, whereas abomasal fluid will be <4. The practical limitations of this test are the requirement for a long (3 to 4") needle and indication for a sterile prep prior to abdominocentesis.

In many cases if I am suspicious of an LDA but cannot confirm it with my physical exam, I will increase abdominal fill and pressure by pumping alfalfa meal drench and water into the rumen. A few gallons are usually sufficient to elucidate a recalcitrant ping. More than that will make your potential surgery more difficult.

If you are proceeding to surgery, a second form of physical restraint is advisable. A halter, even if tied loosely, will keep a cow close should the headlock or stanchion become open. If you do tie a cow's head during surgery I recommend turning her head to the same side you will be operating on. That way if she happens to lie down during surgery her incision should be on the up side.

Establishing Prognosis

Duration off feed or down on production provides an estimate of how long an LDA may have been present. Cows that have been struggling for a longer period of time should be scrutinized for potential complications that may impact your ability to correct an LDA or the cow's ability to thrive post-surgery. These include abomasal ulcers, adhesions, vagal indigestion, and chronic ketosis.

Be sure to consider potential concurrent conditions including retained placenta (RP), metritis, uterine tears, peritonitis, lameness or mastitis. Be sure you don't advise surgery on a cow with significant concurrent disease that carries a

poor prognosis. A cow's ability to recover her lactation curve is also somewhat dependent on stage of lactation. It is also easier for a late-lactation cow to fly under the radar prior to detection, potentially increasing your risk of complications. Be sure to consider and note significant defects, especially those that involve the udder, feet and legs. These factors have the potential to hamstring an otherwise perfect LDA repair.

Records Review

Your assessment of a surgical candidate should include consideration of her future economic value to the farm. While her past production does not guarantee her future performance, it is a good metric of what her potential future lactations may yield. Think about components in addition to raw pounds of milk, since energy-corrected milk is a closer approximation of economic value to the farm. Relative Value in DairyComp is another metric to consider but it has limitations. In addition to future milk yield, potential future daughters may factor into a farm's perception of cow value.

I'd recommend against surgical correction on cows with chronic somatic cell count issues or chronic mastitis, especially if a contagious pathogen is implicated. Many farms now have their records in the cloud so you can check DairyComp or DHI events or metrics from your phone.

I try to keep track of herd stocking density, heifer inventory flow, and cull cow prices to help inform my recommendations. A herd that is struggling to keep the barn full will likely want a DA done on a less-ideal cow compared with a herd that has ample replacements, especially if cull price is high. In rough terms, replacements cost $1800 to $1900 to raise and cull cows are bringing around $700 at present. In a herd inventory that is well balanced, there is plenty of room for surgery and treatment costs to keep a good cow in the herd.

Surgical Prep

I favor the "Ket Stun" sedative cocktail for my standing surgeries: 40 mg ketamine, 4 mg butorphanol, and 20 mg xylazine given IV. I use this with great results on Holstein cows and heifers. For Jerseys, I will reduce the xylazine dose according to size. While I don't have scientific proof, anecdotally I would say a cow is more likely to stay on her feet with this cocktail vs 20mg of xylazine alone. It seems to keep their feet planted, and I rarely have had a cow lie down. I frequently give this IV via the coccygeal vein, but I always pull back several times as I inject to see a flash and ensure proper placement. Perivascular administration won't help you much. If the cow is haltered, I'll use the jugular vein.

I clip the right flank with a 40 blade. It's a little bit slow, but with a few tricks it works well and you get a much tighter clip than with other blades. One pet peeve - keep your sterile bucket away from the cow while you clip. It's better if you don't have a pound of hair floating in it later. I find it helps to grab a handful of hide below where you're clipping and pull some tension across your field. I hold the clippers so that the heel of the blade is about 30 degrees off the skin. Keep some clipper lube close, especially in sand-bedded barns. I am very particular about clipping 100% of the hair in my field and I like nice straight edges to the clip job. If your work looks professional you are more likely to be valued as a professional. While straight clipper margins don't improve outcomes, they can impact client perceptions about the quality of your work.

Scrub with chlorhexidine scrub, typically 3 times prior to blocking and 3 times after blocking. I rinse with warm soapy water (chlorhexidine solution) between scrubs and rinse the last scrub off with alcohol. The alcohol should run clear and a sterile 4x4 should wipe no perceptible debris or color off the cow should you test it. There is no such thing as "more sterile" or "less sterile". Sterility is binary. It is or it isn't. Surgeries should be!

I use a distal paravertebral block. I find it to be fast, effective, and safe to perform. I like the regional block because I don't have lidocaine distorting the tissue around my incision. I prefer the distal over proximal paravertebral block because I can stand a safe distance from the cow while performing it. I use a syringe gun with a bottle of 2% lidocaine attached and fan out 3 to 4 injections of 4 mL each at the 6 landmarks for this block. My left hand is typically on the cow's right hook with my arm fully extended, so that if the cow takes a swing at me I move away from her as she comes towards me. The only occasion where I do a line block is in obese cows where the landmarks are too blurry to trust. Then I'll do a line block with a 18x1.5" needle.

Scrub up hands and arms and glove up. I use a sterile palp sleeve on my left arm and sterile gloves. I've never needed to be in more than hand-deep with my right hand on a DA. By contrast, I do sleeve both arms for C-Sections.

I use a disposable paper drape approximately 3'x4'. I recommend placing 4 blebs of lidocaine where you plan to place your towel clamps when you do your block. When you hold the drape up, you'll see a spot of blood soak through where you blocked - clamp your edna towel clamps on in those spots. This is a great time to get kicked if you don't block for your clamps. During surgery I like to hang my needle drivers and C curve needle on the upper right towel clamp, so I place it 6 inches or so in from the edge of the drape.

Surgical Details

I make my incision vertically 3 to 4 inches caudal from the last rib down at the bottom of the paralumbar fossa. My incision is much shorter on a small skinny cow than a large fat one; just depends how thick I expect the omentum to be. If I need to extend later I can, but incisions usually look best if they're done full length in one pass.

I incise the external abdominal oblique (EAO) to match my skin incision. Once I'm through the EAO I can see the change in the muscle fiber direction (EAO runs caudoventral like your fingers when you put your hands in your jacket

pockets; IAO runs cranioventral). I pop my thumb through the IAO midway down my incision and spread my thumb and middle finger to separate a gap in the fibers without cutting them. On all but the fattest of cows, this will give you plenty of space to work and it is far less trauma for the cow to heal. I do the same thing with the transversus abdominus, splitting dorsal to ventral. If a cow is obese, you likely will need to incise all 3 layers dorsal to ventral. But when possible, I prefer the grid technique.

On most surgeries I simply rupture through the peritoneum with my thumb. If it doesn't give with moderate pressure, pick up a tent with rat tooth forceps and incise. Use extreme caution here, as it's easy to nick the duodenum during a careless entry. You'll never cut the duodenum with your thumb.

Check the margins of the liver. If markedly rounded, consider fatty liver / chronic metabolic issues. Don't specifically palpate the uterus, but gently assess its size. Note any free fluid or fibrin present in the abdomen. Reach into the dorsal abdomen. The right kidney should be obvious directly medial from your incision. Pass your left hand caudal to the kidney and past the dorsal attachment of the omental sling. Continue along they caudodorsal aspect of the rumen until you reach the left body wall, then proceed cranioventral to the displaced abomasum. Assess the size of the DA.

Some DAs can be easily swept under the rumen without deflation. If sweeping under I reach around the caudal aspect of the rumen, place an open palm on top of the DA and push it down and under until it slides up on the right side. The pylorus will frequently float up and appear at the incision on its own. If great force is required, you should deflate the abomasum first. It isn't worth traumatizing the viscera to save 2 minutes.

With a larger cow, shorter arms, or a very large DA it is important to deflate before correcting the DA. I use a large bore needle made for Encore implants which I have pressed into a length of plastic tubing. If there's a second person around, you can use a vacuum to deflate faster. If you use a deflation hose, kink it off before removing so any fluid in the hose doesn't drain back into the abdomen.

Before I reach under to sweep a deflated abomasum up to the right, I place a bite of suture bottom right of my incision through the IAO, TA and peritoneum. I put my needle drivers and the C curve needle attached to that first bite in the upper right towel clamp so it's easy to reach one-handed once I have the pylorus up.

The pylorus is a brighter white color than the intestines, firm, and is a bit more 3-dimensional. You should palpate the pyloric sphincter to confirm you're in the right place. Do not mistake the duodenum for the pylorus. The duodenum is far more vascular, less raised from the omental surface, and does not have a palpable sphincter.

I use No 3 catgut suture for the pexy and body wall closure. Some advocate the use of non-absorbable suture such as Supramid for the pexy. This is typically fine, but be aware that is provides a potential for fistulation should an infection arise in your incision, especially if you mistakenly take a full-thickness bite in the wall of the abomasum. Since I have the first bite of suture in place before I retrieve the pylorus, it is easy to tack once I have it up in the incision. I place 3 bites partial thickness in the wall of the abomasum 1-3" proximal to the pyloric sphincter, right to left, left to right, right to left. Then I take an inside-to-outside bite in the body wall, same layers as the first bite and tie that off. Tie the first square knot and then check that the pylorus is well apposed to the body wall. If not, you can pull on one tail of the knot to convert the square knot over to 2 half hitches. Slide the knot to tighten that throw, and then pull on both tails to convert back to square knot. A few more squares and you're set. So you've got the pylorus tacked in your first throw. I use this to anchor a continuous suture line up the IAO, TA and pylorus, including omentum with each successive throw (3 to 4 bites of omentopexy).

I like to close the internal layers bottom to top, because the last bite or 2 are typically blind; less likely, you'll pick up a viscera near the top vs the bottom. It's important to remember that you are suturing living tissue. Don't strangulate it. You are just looking for good apposition. The wound healing process will do the rest.

When I suture the EAO, I like to take deep bites periodically in the center to kill dead space between the EAO and IAO. Without this, you invite a seroma to form.

I use No 3 Supramid suture for skin. I want the skin sutures as tidy and regular as possible. This, along with a clip job, are all that the client will see of your work. You could be absolutely meticulous inside where it matters, but if the sutures look like they were done by a 3 year old that's how the client will assume all your work is done. Make sure to use sharp S curve needles. They're not expensive. If you direct the needle perpendicular to the hide rather than obliquely through it, you'll have a much better time of it. On the left side of the incision, I use my left thumb and index finger to brace the skin adjacent to where my needle will pass through and pop it through with a flick of the right wrist. I see many fourth-year students struggle to suture bovine skin. It's a technique issue, not a strength issue.

Aftercare and Record Keeping

I treat most DAs with 3 to 5 days of ampicillin, 25 to 30 mL IM once daily. Some cows are treated with ceftiofur, and some receive no antibiotic. Most cows with a DA have a concurrent metritis, so they're often on antibiotics anyway. Don't give antibiotics until after you've brought the DA over. If you get one that has adhesions, you'll regret having just slapped a meat withhold on her.

Pump with an alfalfa meal/electrolyte/probiotic/proprionate drench. I typically use 5 gallons unless for a very large, very empty or severely dehydrated cow, then 10 gallons. Oral fluid therapy should be continued daily if cow is not back on feed and water the next day.

If the cow presents as ketotic, I recommend 3 d of propylene glycol after the initial pump, with the option to omit if the farm can recheck her BHBA and confirm resolution.

Banamine (flunixin meglumine) is a reasonable option for post-surgical pain and inflammation. Remember, it is contraindicated if you suspect abomasal ulceration.

Client Feedback

I recommend you follow up with your clients on surgical cases, especially early in your career. Here is a list of follow up questions I would encourage:

1. Appetite: the cow should be back to eating once the sedation wears off. Some will go to the bunk as soon as they are released. Ask your client about the cow's appetite and fill in the days after surgery.
2. Temp: checking temp in the days after surgery is recommended, especially if there is incisional swelling or the cow is not eating well
3. Milk trend: anecdotally or via parlor weights - is daily milk production increasing? This is a very sensitive monitor of cow wellbeing.
4. Condition of incision: there should not be any swelling or pus on the majority of your incisions. If you have ugly incisions, consider whether you are breaking sterility during the surgery. Most commonly I see sterility breaks when the surgeon reaches deep into the abdomen and touches the field with their shoulder above the sterile sleeve. This is especially problematic if you preg checked earlier in the day and have manure stains on your shoulder. Shorter practitioners may want to wear a sterile shoulder shroud or gown to prevent contamination.

Retrospective Analysis

You may find it beneficial to review your outcomes and benchmark with your peers. Don't hold cows with known complications against your surgical record, but if you missed a complication on physical examination you should look for ways to prevent it in the future.

My practice has a policy of providing a gratis post-mortem exam for any animal that unexpectedly dies after a routine surgical procedure. This demonstrates integrity to your clients, allows you to learn from any potential mistakes, and observe the condition of your surgeries after the healing process has begun. I like to have the client present and show them complications like stomach ulcers, uterine tears or peritonitis so they better understand the significance of these diagnoses when we make them in the future.

Practical rules and tools of colostrum management

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Abstract

Colostrum management, from administration of dry cow vaccines to harvesting, feeding, and monitoring its success, is a significant opportunity for direct veterinary involvement and oversight on all dairy herds. It is well known there is a critical need for colostrum to provide calories and a source of immunoglobulins for transfer of immunity from dam to her naïve offspring. The purpose of this article is to review practical steps for helping dairy clients achieve these new guidelines, from the dry period to colostrum harvest, feeding, and monitoring colostrum programs.

Key words: colostrum, management, passive transfer

Introduction

Colostrum plays a pivotal role in influencing the metabolic and endocrine systems, both of which are influenced by the gastrointestinal tract's surface area for absorption of nutrients[13] and quality of gut microbiome[4]. Recent guidelines proposing higher levels of serum IgG (g/L)[7] when assessing passive transfer rates are achievable for well-managed farms with proven calf benefits relating to mortality, health, growth, and longevity.[16] This presentation reviews 9 practical steps for helping dairy clients achieve the new guidelines for colostrum management from the dry period to colostrum harvest, feeding, and monitoring colostrum programs.

1. **Specific management factors are known to have a negative impact on colostrum.** Stressors such as overcrowding and heat during the dry period not only impact colostrum quality, but recent work has demonstrated reduced ability for calves born from dams experiencing heat stress to absorb colostral IgG[3]. In addition, a short dry period (less than 21 days) should be avoided to allow enough time for sequestration of IgG in the mammary gland during colostrogenesis, especially if administering vaccines targeted to protect the newborn calf against scours-causing pathogens through colostral antibodies. A shortened photoperiod, such as one that occurs because of diminishing day length during autumn and winter, may also be associated with reduced colostrum production[5]. Herds that experience a seasonal shortage of colostrum should prepare for inadequate colostrum yield by feeding colostrum replacer or banking and freezing extra colostrum. Delayed colostrum harvest can dilute colostral IgG concentration by up to 20% at 6 hours post-parturition[12]. Producers should be aware that parity of dam does not dictate colostrum quality. Colostrum from primiparous dams has been shown to be comparable to multiparous cows and can be fed to calves.[15]
2. **Focus on timely, clean colostrum collection.** Colostrum harvest should occur within 1 hour after calving. Heat-treating colostrum (140°F, or 60°C for 60 minutes) should be considered for herds with goals to reduce transmission of diseases such as *M. Avium* subsp *paratuberculosis, E. coli*, *Salmonella* spp, and *Mycoplasma* spp. Pay special attention to the cleanliness of the colostrum collection bucket, milking unit, and all feeding equipment used for colostrum. This equipment should be cleaned and sanitized between all cows and calves. Evaluate cleaning processes using an ATP luminometer for real-time feedback of protocol compliance.
3. **Feed 4 quarts of high-quality colostrum in the first 2 hours of life.** Feed clean colostrum that measures greater than 22% BRIX (>50 g/L IgG), providing at least 150 to 300g IgG[7]. Delayed first-colostrum feeding by more than 6 hours significantly reduces the newborn calf's ability to absorb colostral IgG, and thus overall serum IgG concentration[4]. Calves can be fed colostrum via esophageal tube or bottle; both are equally effective at transferring immunoglobulins when a volume of colostrum greater or equal to 3 quarts is fed to calves[6]. Goals for bacteria levels in fresh colostrum are less than 100,000 cfu/mL total plate count and 10,000 cfu/mL total coliform count[11].
4. **Colostrum should be prepared for storage if not fed within 1 hour following collection.** Bacterial numbers in colostrum can double within 20 minutes. Cool promptly and store colostrum in containers labeled with harvest date, BRIX %, and donor name/number. Colostrum can be refrigerated at 40°F (4°C) for up to 7 days with addition of potassium sorbate, or frozen for up to 1 year.
5. **Reheat stored colostrum without destroying IgG.** Avoid water temperatures greater than 140°F (60°C), which will denature IgG proteins. Temperature-controlled water baths can be made with a 50-quart cooler and sous vide/immersion cooker. The process of thawing and reheating 1 gallon of colostrum using this system is approximately 30 to 40 minutes, depending on storage container.
6. **Be prepared when colostrum is unavailable due to inadequate quality and/or quantity.** The first option is to feed stored colostrum from a donor. The

second option is to feed a high-quality colostrum replacer. Herd veterinarians should recommend clients provide at least 150g IgG in the first feeding when using colostrum replacer and follow manufacturer's guidelines for serum total protein (STP, g/dL) cut points that reflect serum IgG levels associated with successful or failure of passive transfer. Manufacturer's guidelines for a specific colostrum replacer product should not be extrapolated to another product.

7. **Monitor colostrum management.** Direct measurement of serum IgG (g/L) via radial immunodiffusion remains the gold standard for assessing passive transfer status of immunity. Other more practical, calf-side tools such as a refractometer to measure STP (g/dL) can be used to determine failure of passive transfer status at the herd level. Another option is a BRIX refractometer, which can be used cow-side to measure BRIX (%) content of colostrum and calf-side to measure blood BRIX (%). To survey a herd's colostrum management program, draw blood from 12 calves, ages 1 to 7 days of age, and evaluate serum using a refractometer. Since STP and BRIX are proxies of serum IgG (g/L), it is recommended these are only used for overall colostrum management analysis and not individual calf health decisions. Note that dehydration, systemic inflammation, and age can impact refractometry results. Table 1 illustrates the most recent proposed goals of serum IgG status recommended for producers to benchmark their herd's colostrum program and overall passive transfer status[7].
8. **Add supplemental colostrum to scours prevention and treatment protocols.** Consider a second feeding of colostrum 6 to 12 hours after the first feeding to boost serum IgG concentrations[8] if calves are not reaching new recommendations defined in Rule #7 or calves are raised in a system associated with increased health challenges. Feeding colostrum after gut closure provides a source of local IgG for protection against scours-inducing pathogens and growth factors for enhanced gastrointestinal tract development[13]. Providing supplemental colostrum has been associated with reduced morbidity and treatments[2] as well as improved weight gain in the first month of life[1]. Practical implementations of providing supplemental colostrum on-farm include the following:
   a. Freeze colostrum (BRIX % >20) in ice cube trays and add 2 cubes per feeding to milk or milk replacer
   b. Feed desired amount of IgG using colostrum replacer (20 to 64g IgG per day have proven benefits[1,2])
   c. Incorporate transition milk (first 6 feedings) into pasteurized milk or collect separately and feed transition milk for the first 3 days of life
   d. Feed a milk replacer containing plasma as part of the protein profile[14]
9. **Promote and praise consistency in colostrum management.** Build a management team dedicated to colostrum management and early life calf health. Making the effort in maternity to ensure each calf is provided with clean colostrum to promote adequate passive transfer of immunity will save time and money for those involved in calf care and beyond.

Conclusion

The maternity area on any dairy is one in which all cows and calves must spend a short, although crucial, amount of time. Thus, maternity and colostrum management are critical areas for all veterinarians to provide direct oversight for dairy clients and their cattle. For recent veterinary graduates, training of maternity protocols such as calving assistance, tubing colostrum, and drawing blood provides an opportunity for relationship-building that is not only essential for new veterinarians and their clients, but often for the success of a herd's colostrum program.

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Table 1. Proposed recommendations for assessing herd-level successful passive transfer rates.

Serum IgG status	IgG conc. (g/L)	Equivalent STP levels (g/dL)	Equivalent serum BRIX levels (%)	Calves in each category (%)
Excellent	≥25.0	≥6.2	>9.4	>40
Good	18.0-24.9	5.8-6.1	8.9-9.3	~30
Fair	10.0-17.9	5.1-5.7	8.1-8.8	~20
Poor	<10.0	<5.1	<8.1	<10

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How to win clients by taking the right samples and ordering the "best tests" for bovine respiratory disease

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Abstract

Respiratory disease in nursing beef calves presents unique challenges, from recognizing disease to obtaining samples. New graduates need to be able to use a combination of basic knowledge of disease and risks as well as soft skills to advocate for diagnostics and communicate with the client. Utilizing these skills can foster trust with clients. Ultimately, there is opportunity to turn this challenging disease into professional relationships for life.

Key words: beef, calf, necropsy, pneumonia

Introduction

While years of veterinary school have prepared graduates to identify, diagnose, treat, and prevent bovine respiratory disease (BRD), there can be a gap between the graduate's knowledge and the producer's willingness to utilize that knowledge. Added to this conundrum is the fact that BRD in a nursing beef calf can look different than in a feed yard. Because pneumonia is not identified as easily in the nursing calf, the client may not recognize the true problem or at least the scope of the problem.[2,4] This can lead to a situation where a producer is faced with disease outbreak, but does not mention it when the new graduate stops by to treat a different animal. But by utilizing soft skills and being well prepared, a veterinarian can use BRD in nursing beef calves to build lasting relationships with producers. This paper's goal is to shed some light on preparation and soft skills that can be combined with already acquired knowledge to help bridge the gap.

Foundation Knowledge about BRD

Data from the Meat Animal Research Center (MARC) in Nebraska,[2] surveys in the northern Great Plains region[4] and private practitioners experience all point to a greater than 10% morbidity from BRD in nursing beef calves. The causative agents are often the same agents we consider in feedlot workups and are thoroughly discussed in text books.[5] However, up until the last decade, the specific risk factors were rarely studied or reported. When reviewing the classic risk factors for feedlot cattle, many of those risks simply weren't present in cow/calf herds.[4] Since 2015, a series of excellent papers have been published discussing the risk factors at the calf level and herd level, as well as ongoing research into both causes and prevention protocols.[1] All veterinarians working with cow/calf herds can be familiar with these sources through proceedings and recorded sessions in the AABP continuing education portal. New graduates will also benefit by making a crib note of the most common local agents (both viral and bacterial) and what they would look like at necropsy. This additional foundation knowledge will help to form a differential list at the time of necropsy while lab results are pending.

Soft Skills Necessary

Having an abundance of knowledge about causative agents and risk factors will not be enough to generate caseloads for the new graduate. A vital soft skill that every vet can use is to stay in interest with the client. Seek to understand what their daily struggle is, rather than to be understood. As you crawl out of that truck for the last call of the day, look around the farm. Is there a cow/calf pair in the corner of the barn? Why are they there? Is there a pile for the rendering truck to remove? Why are they there? Does the exhausted producer ask you if you have antibiotics on your truck for pneumonia when you arrive to put in a prolapse? That's an interesting question. How does the producer like those calf huts that you saw when you came up the drive? Utilize an open-ended question that allows the producer to tell you what they like, what they hate, and what their current struggle is. This will fill the awkward silence while you struggle to put in a 3-day-old prolapse that "the old vet could have done out the window of his truck while staying in low gear." All the new graduate needs is conversational skills and preparation.

Preparation Necessary

For the topic at hand, preparation involves also having the equipment on your truck to help classify the degree of pneumonia while taking samples to diagnose the causative agent. Once again, there are a wealth of resources that help identify the degree of pneumonia, and instruct any veterinarian about how to take and prepare the samples. Laminated copies of these score cards and sample guides can be stored in the truck and pulled out during those "oh, by the way" moments. A well-stocked vet box will have multiple guarded culture swabs and culturettes for those impromptu nasal sampling requests. Finally, the vet should have a sharp necropsy knife, a hand-held knife sharpener, a gallon plastic bag containing gloves, sample bags, formalin jars and a Sharpie.

This enables the vet to transition from the original procedure to a necropsy with the calf completely laid open in less than 5 minutes. While it may take an afternoon to polish up a kit, it is neither expensive nor complicated. Being able to do the necropsy quickly will remove one of the barriers to having a necropsy done.

Necropsy

The necropsy itself should be systematic and complete. Once again, this foundational knowledge was presented throughout veterinary school and in veterinary literature in various formats. But in order to become proficient at this skill, it needs to be practiced. Do not be afraid to offer follow-up necropsies for cases that you have been working on. While the primary goal of a case is to return it to production, offering a complimentary necropsy when things turn for the worse is a great relationship builder. The veterinarian shows how much they care by calling and following up on the case. The vet also will benefit from seeing the final disease state and looking for co-morbidities. The client, if not overwhelmed by the process, can become an active participant. The animal should be positioned in left lateral recumbency, and opened from larynx to coxofemoral joint with the neck, thoracic cavity and abdomen exposed. This view, regardless of suspected disease, affords the opportunity to discuss both the good and the bad. Good can include things like adequate body fat on ribs, heart, and kidneys. Good may also include a healthy larynx, umbilicus, and gastrointestinal tract. The bad sections help show the degree of severity. If a producer sees pneumonia destroying 95% of the normal lung parenchyma, the conversation shifts from "why didn't this antibiotic that you sold me work" to "what do I do to prevent this?" Finally, the necropsy is the best chance at linking causative agent identified with culture to the histopathological changes in the tissue. If there are multiple animals to necropsy, necropsy every one of them, and choose samples based on gross lesion, treatment state, and condition of the carcass. If the producer has an untreated, acute case, submit diagnostic samples to guide future herd health prevention measures.

The Treatment Plan

For all of the benefits that necropsy and laboratory diagnoses afford, the biggest drawback is the lag time between necropsy and final lab report. This could be viewed as a barrier to getting consent to send lab samples. But, by having a crib sheet of common lesions for each pathogen, veterinarians should be prepared to give a working diagnosis and potential treatment/prevention plan pending lab results. Foundational knowledge found in books and proceedings provide a wealth of information that veterinarians can reference when formulating a plan.[3,5] If a producer has an action plan that they can follow this week and can view the lab results as a playbook to prevent future wrecks, they will be more likely to consent to lab samples. Therefore, the role of the veterinarian is to create a working differential list before sampling and a working treatment plan before driving away. Then, the veterinarian should plan to follow up in 2 and 5 days to see response to treatment as well as update the producer on the lab findings. The veterinarian can also use this time gap to further review risk factors and potential strategies to prevent future outbreaks. Ultimately, when a veterinarian can stay in interest with the client and take the constructive criticism that comes with working up these cases, they can help the producer obtain the product of healthier calves. Any veterinarian that can consistently get the product will be rewarded with more opportunities, regardless of their years of service.

Conclusion

While often frustrating to the producer, BRD in nursing beef calves is an opportunity to develop a long-term professional relationship between the veterinarian and the producer. Veterinarians should possess foundation knowledge and soft skills that result in an invitation to walk the herd and take samples. The valuable final product for the producer is when timely results and treatment plans are utilized in a manner to slow an outbreak and develop herd health plans for the future.

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But what does it taste like? How to get your clients through a complete scour workup in their herd

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Abstract

Neonatal enteritis in beef calves can be challenging because the timeline for intervention doesn't leave room to delay if successful treatment is to occur. Possessing knowledge of disease, sampling techniques and prevention strategies is imperative if the new graduate hopes to achieve results that helps them move into the role of a trusted herd advisor.

Key words: beef, neonatal, enteritis

Introduction

While years of veterinary school have prepared graduates to identify, diagnose, treat, and prevent enteritis in beef calves, there can be a gap between the new graduate's knowledge and the producer's willingness to utilize that knowledge. A common obstacle to a complete neonatal diarrhea work-up is the lack of desire for diagnostics by the producer. Due to the aggressive nature of the disease in young beef calves, all parties can agree that treatment must be instituted before most diagnostic results could be returned from the lab.[6] This can cumulate with a well-meaning client standing at the front desk passionately describing the color, consistency, odor, and volume of the feces in hope that the vet can recommend a suitable treatment for them to take home. The appropriate response could be "what does it taste like?" When the producer cannot describe that quality, the vet should seek to find common ground of other diagnostics that could be performed.

Foundational Knowledge

There is a wealth of printed resources describing the various pathogens that cause enteritis in calves as well as the risk factors and diagnostic tests.[4,7] Veterinarians should have a good grasp on the nuances between the pathogens that cause dehydration and mental depression due to acidosis vs the pathogens that cause depression with septicemia and minimal dehydration.[1] New graduates will also benefit by making a crib note of the most common local agents (both viral and bacterial) and what they would look like in a sick calf. A firm grasp on this foundation knowledge will help to form a differential list at the time of examination or necropsy while lab results are pending.

Getting Invited to the Cattle Yard

Armed with a good list of differential and risk factors, a veterinarian must now employ soft skills such as open-ended questions and work ethic to get a chance to walk the calves and get samples. One notable difference between working up a case of beef calf enteritis vs nursing calf pneumonia is that the insult causing the enteritis is likely still occurring, and can be found through a herd visit. Compare this to calf pneumonia, which may have been triggered by an event (e.g. a roundup to artificially inseminate the cows or to change pastures) that has since passed.[5] Because of this, there is an advantage to doing sample collection for enteritis in the cattle yard if possible, rather than relying on the producer to bring an affected calf or samples to the office. This does increase the length of the workday, but it can also add valuable insight. When a veterinarian is in the yard for any procedure, he or she should look around for signs of other problems or risk factors that can range from a pile of carcasses, unsanitary conditions, poor body condition, newly purchased animals, swollen navels, or piles of empty electrolyte bags. These are all opportunities for the veterinarian to ask open-ended questions that start with "walk me through your typical day…." The vet should be armed with the knowledge of all the areas that calf rearing can go awry, so those areas can be inspected on arrival.[4]

Getting Samples

Fortunately, once the vet has identified the best candidates for diagnostic samples, preparation involves having a minimal amount of equipment on the vet truck to get the samples. If the current outbreak consists of high morbidity, but low mortality, grabbing multiple fecals in a hard-sided container with a sealable lid is the first option.[2] Plastic flip-top vials work well for this. Ideally, there is a fresh, acute case for necropsy. A well-stocked truck should have a sharp necropsy knife, a hand-held knife sharpener, a gallon plastic bag , gloves, flip-top vials for feces, plastic specimen bags, formalin jars, and a marker. This allows the veterinarian to transition from the original procedure to a necropsy with the calf completely laid open in less than 5 minutes. While it may take an afternoon to polish up the kit, it is neither expensive nor complicated. And being able to necropsy quickly will remove one of the barriers to having a necropsy done.

Necropsy

The necropsy itself should be systematic and complete. Once again, this knowledge was presented throughout veterinary school and in veterinary literature in various formats. But in order to become proficient at this skill, it needs to be practiced. Veterinarians should not be afraid to offer necropsies for cases that they have been working on. While the primary goal of a case is to return it to production, offering a complimentary necropsy when things turn for the worse is a great relationship builder. The veterinarian shows how much they care by calling and following up on the case. The vet also will benefit from seeing the final disease state and looking for comorbidities. Often the clients are really interested in seeing the anatomy of a calf and want to be there for the necropsy. The animal should be positioned in left lateral recumbency, and opened from larynx to coxofemoral joint with the neck, thoracic cavity and abdomen exposed. This view, regardless of suspected disease, affords the opportunity to discuss both the good and the bad. Good can include things like a clean navel, healthy lungs, and an undamaged larynx despite repeated tubing. The bad sections help show the degree of severity including the lack of body fat, the degree of damage to the stomach and intestines, and any peritonitis or septicemia. If a producer sees massive septicemia (e.g., from an umbilical abscess) the emphasis shifts from the best oral electrolyte therapy and shifts toward prevention. Finally, the necropsy is the best chance at linking the causative agent identified with culture to the histopathological changes in the tissue. This added level of cause and effect is extremely valuable if multiple agents are found at the lab. If there are multiple animals to necropsy, the vet should necropsy every one of them, and choose samples based on gross lesion, treatment state, and state of the carcass. An untreated, acute case, is the ideal for submitting samples to the diagnostic lab.

Follow up

As mentioned in the introduction, the client is looking for a treatment immediately. Given the rapid progression of enteritis in a neonate, the veterinarian should be prepared to advise on appropriate treatments before leaving the farm.[3] Advice may range from electrolyte therapy that should be given, to medications that should be avoided. Once again, there is a wealth of information in peer-reviewed journals and textbooks about these subjects.[2,6] But it is important that the client has clear, written instructions and understands how to use the product before the visit is finished. Each producer varies with their comfort level when using an esophageal tube feeder. If the producer is not confident on how to tube a calf, the veterinarian can use the carcass of the calf to show them the technique and the landmarks. While waiting for lab results at the office, the veterinarian should review risk factors and prevention strategies for future calving seasons. This is also an opportunity to set a reminder to call the client 2 and 5 days after the samples are received at the lab to follow up on response to treatment as well as convey updated lab results. The end product of this labor is a reduction in calf morbidity and mortality for the client this season, as well as a well-documented and mutually agreeable plan on how to reduce risk factors in the future. These notes can then be attached to the client's medical records to review before the next season.

Conclusion

While living through an enteritis break in the spring can be challenging, it does open opportunities to build relationships with clients. Veterinarians should possess foundation knowledge and soft skills that result in an invitation to walk the herd and take samples. The valuable final product for the producer is when timely results and treatment plans are utilized in a manner to slow an outbreak and develop herd health plans for the future.

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Finding the answer in that mess of numbers

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Abstract

A complete blood count (CBC) can be an important extension of the physical examination in ruminants, and may be used to suggest certain disease processes when exam findings are vague, and is useful for establishing a prognosis in many cases. Because of the high prevalence of inflammatory diseases in cattle, the CBC and plasma proteins are often the most valuable set of parameters to gather. Common abnormalities seen in ruminants include regenerative and nonregenerative anemias, blood parasites, inflammatory leukograms with left shifts, panhypoproteinemia, panhyperproteinemia, and transient or persistent lymphocytosis.

Key words: complete blood count, total protein, anemia

A complete blood count (CBC) can be an important extension of the physical examination in ruminants, and may be used to suggest certain disease processes when exam findings are vague, and is useful for establishing a prognosis in many cases. Whole blood in EDTA is the preferred sample, with the vacuum volume of the tube fully replaced by the sample. An unstained, air-dried blood film should be made within 15 minutes of collection and submitted with the remaining sample in the tube for laboratory analysis if the time to analysis is greater than 2 hours. An accurate CBC can be achieved in properly stored samples in tubes up to 24 hours. If platelet counts are of particular importance, those counts should be made within 4 to 6 hours. If samples are to be shipped to an outside laboratory, they should be wrapped in packing material to protect from breakage and shipped on ice. Automated analyzers must be properly calibrated for the species of interest and stained smears should undergo manual examination.

Erythron

Red Blood Cell Parameters

A complete evaluation of RBCs should include a PCV and/or hematocrit (HCT), RBC count, hemoglobin (Hgb), MCV, and MCHC, RBC morphology, and parasites.

The PCV is determined by centrifugation of a microhematocrit tube and determination of the percentage of RBCs per volume of blood. This is easily performed in-clinic. The HCT is a calculated value based on RBC size and number.

The MCV, MCH, and MCHC are characteristics of the RBCs, indicating average cell size, average cell hemoglobin content, and average cell hemoglobin concentration, respectively. MCV may be calculated, but most instruments directly measure red cell volume, reporting the mean. A decreased MCV is termed microcytosis; increased MCV is macrocytosis and normal MCV is normocytosis. Note that many microcytes or macrocytes must be present to change the MCV since it is a mean value.

There are also 2 cellular hemoglobin measurements reported by many automated analyzers, MCHC and MCH. The MCHC is considered the more useful of the 2 cellular hemoglobin measurements, and is a calculated value. Descriptive terms relative to MCHC are normochromic, hypochromic or hyperchromic for normal, decreased and increased cellular hemoglobin concentrations, respectively. The most common cause of a slightly decreased MCHC is a strongly regenerative anemia, because immature red cells (polychromatophils) contain less than a full complement of hemoglobin. Iron deficiency anemia may also cause a decreased MCHC, and hypochromasia (pale red cells) may be visible on the blood film.

Red Blood Cell Parasites

A variety of hemoparasites may be observed on the blood film. The rickettsia *Anaplasma* spp, bacteria *Mycoplasma* spp (formerly *Eperythrozoon*), and 3 protozoal parasites, *Babesia* spp*, Theileria* spp, and *Trypanosoma* spp, may affect ruminants. *A marginale* (cattle) and *A ovis* (sheep and goats) appear as small, round basophilic inclusions on the periphery of RBCs. A significant hemolytic disease is seen in adult cattle infected by this parasite through tick transmission in the southeastern and western US.

Mycoplasma organisms, *M wenyoni* in cattle, *M ovis* in sheep and goats, and *M haemolamae* in camelids, may appear on the surface of RBCs or free in the background on the blood film. They typically cause anemia only in immunocompromised animals. A syndrome in heavily parasitized cattle has been described with signs including hind-limb edema and lymphadenopathy.

Anemia

Anemia is a common abnormality seen in the blood profiles of ruminants. Physical examination findings may include pale mucous membranes, weakness, exercise intolerance, and mental depression or aggression. Anemia is subdivided into regenerative or non-regenerative anemia using RBC morphology and the reticulocyte count, limiting the list of differential diagnoses.

In ruminants, the presence of any polychromasia or reticulocytes indicates some degree of regeneration. Other common findings in a regenerative response include basophilic stippling, Howell-Jolly bodies, nRBCs, an increased MCV,

and decreased MCHC. In the absence of polychromasia and reticulocytosis, the anemia is considered non-regenerative; however the clinician must remember that ruminants typically take 2 to 4 days to mount a bone marrow response, with the peak response occurring at about 4 to 7 days.

Causes of Regenerative Anemia

Hemorrhage/ Whole Blood Loss – low PCV with proportionately low TPP

- Internal – Whole blood into a body cavity
  - Hemoabdomen, hemothorax – Erosion of vessel by abscess or neoplasia, rupture of middle uterine artery
- External – Whole blood exits the body
  - Abomasal ulcers
  - Parasites – *Haemonchus*, sucking lice
  - Hemorrhagic enteritis
  - Caudal vena cava syndrome
  - External trauma

* Abnormalities in the PCV and TPP are not noted after acute blood loss for 24 to 48 hours and it may take 2 to 4 weeks after the insult has ended for the PCV to return to its original level.

Hemolysis – low PCV, normal to increased TPP

- RBC parasites: *Anaplasma* spp, others
- Infectious: *Clostridium novyi*, *Leptospira* spp
- Toxins: copper, onion, *Brassica* spp, red maple leaves, water intoxication

Causes of Non-regenerative Anemia

Anemia of Inflammatory (Chronic) Disease – normocytic, normochromic

- Gastrointestinal disorders
  - Lymphosarcoma
  - Chronic BVDV infection
  - Johne's disease
- Chronic abscess
- Hepatic diseases
  - Liver abscesses
- Endocrine diseases

Anemia of chronic renal failure – normocytic, normochromic

Chronic Nutrient Deficiencies

- Iron – microcytic, hypochromic anemia
- Copper – microcytic, hypochromic anemia
- Cobalt- normocytic, normochromic

Intrinsic bone marrow disease – often have neutropenia, thrombocytopenia

- Bracken fern toxicity
- Myelofibrosis
- Myelophthisis

Polycythemia/Erythrocytosis

Polycythemia, or increased PCV, is another frequent finding on the ruminant CBC. The most common is a relative polycythemia, caused by dehydration. This can be confirmed clinically by detecting prolonged skin turgor, tacky mucous membranes, recession of the globe, and an elevated TPP and albumin.

Absolute polycythemias, in which the red cell mass is truly increased, rarely occur in ruminants, but may result from systemic hypoxia seen in animals living at high altitudes, chronic pulmonary disease, or right-to-left cardiovascular shunting. Blood gas analysis and consideration of the animal's geographic origin confirm this etiology.

Leukon

A differential count by cell type is more important than is the total white blood cell count, as increases and decreases in individual cell types may occur simultaneously, leaving the total WBC count unchanged.

Neutrophils

Neutrophils function by migration into damaged tissue within 2 hours of an insult for phagocytosis of foreign material and bacteria. Neutrophils are the dominant WBC in young ruminants, but with age, the lymphocyte becomes the dominant WBC, with a normal neutrophil:lymphocyte ratio of 1:2 in adult animals. Goats may have equal or slightly increased neutrophil numbers when compared to lymphocytes.

Two types of neutrophils exist: mature, segmented ruminant neutrophils and immature, band neutrophils. Bands are frequently released into circulation with acute inflammation. Toxic changes may be noted on manual differential counts and indicate changes to the neutrophil morphology from severe inflammation, usually associated with gram negative organisms and septic shock. Toxic changes occur in the bone marrow and include Döhle bodies in the cytoplasm, toxic granulation, diffuse cytoplasmic basophilia, bizarre giant forms, and cytoplasmic vacuolation or foamy cytoplasm. It is important to note that cytoplasmic vacuolation may be artifactual from prolonged exposure to EDTA which can be avoided by prompt blood film preparation. Hypersegmentation of neutrophils may occur as an artifact of aged EDTA samples and as a result of corticosteroid treatment.

Neutrophilia is primarily caused by the presence of mild to moderate inflammation or during recovery from more severe inflammatory conditions, such as infectious processes, tissue injury, neoplastic diseases, and non-inflammatory conditions. Bovine Leukocyte Adhesion Deficiency (BLAD) is a significant genetic cause of neutrophilia in Holstein cattle, which, with a monocytosis, results in WBC counts in excess of 40,000 cells/μL. With this condition, leukocytes fail to express adhesion receptors on their surface that are required for movement from the vasculature to tissue sites of inflammation. Affected calves may have recurrent bacterial infections, diarrhea, pneumonia, lymphadenopathy, dermatosis, and stunted growth.

Neutropenia is caused by acute, severe inflammatory diseases in cattle including gram negative sepsis, metritis,

mastitis, peritonitis, pneumonia, *Salmonella* infection, and many others. It may also be seen with bone marrow injury such as that caused by bracken fern poisoning, often accompanied by non-regenerative anemia and thrombocytopenia.

Lymphocytes

Lymphocytes are predominantly B cells or T cells, functioning in antibody and cell-mediated immunity, respectively. Normal and reactive large lymphocytes in the bovine may have atypical features often associated with malignancy in other species, and should be interpreted by experienced pathologists.

Pathologic lymphocytosis is unusual in ruminants, but may be associated with chronic viral infections, chronic pyogenic conditions or autoimmune diseases. Approximately 30% of cattle infected with bovine leukemia virus (BLV) will exhibit a benign persistent lymphocytosis of B cells. This does not indicate the presence of a tumor; however BLV-infected cattle with persistent lymphocytosis are at increased risk for developing a lymphoid malignancy.

Lymphopenia may be seen with stress or corticosteroid administration, acute viral or bacterial infections, endotoxemia, BVD virus infection, and rare immunodeficiencies.

Eosinophils

Eosinophils function in the immune response to parasites, allergens, and other inflammatory processes. Cattle normally have higher numbers of eosinophils than other species, but eosinophilia may result from parasite migration, atypical interstitial pneumonia, acute bovine pulmonary emphysema, and milk autoantibody formation in dairy cattle.

Basophils

Basophils are present in very small numbers in normal ruminants, functioning in allergic and inflammatory processes by releasing heparin, histamine and other inflammatory mediators in immediate hypersensitivity reactions. Their numbers may be increased with allergic dermatoses and hypersensitivity reactions.

Monocytes

Monocytes enter the tissues from the circulation to become macrophages, capable of phagocytizing infectious organisms, particulates, and cell debris. Their numbers are quite variable in cattle and are not sensitive indicators of disease processes. Increases may accompany chronic inflammation, tissue necrosis, hemolysis, or a stress response. Low monocyte numbers have been associated with endotoxemia and viremia.

Inflammatory Leukogram

Inflammatory diseases occur commonly in ruminants and it is important to note the changes that occur in the leukogram with inflammation at various stages of the disease process. The lack of a significant segmented (mature) neutrophil bone marrow storage pool in adult cattle results in an initial neutropenia for 24 to 48 hours in the face of severe inflammation, decreasing the neutrophil:lymphocyte ratio. Stress associated with the disease process may also cause lymphopenia and eosinopenia. A left shift, signified by the appearance of numerous immature neutrophils (bands or earlier forms) in circulation, typically appears within 24 hours with acute inflammation. A degenerative left shift refers to the situation when immature forms outnumber segmented neutrophils, or to a left shift with concurrent neutropenia. While this is considered a poor prognostic sign if persistent, it is not unusual in ruminants due to their initial neutropenic response to severe inflammation. A regenerative left shift occurs as the bone marrow responds to the inflammation with increased production, resulting in increased mature neutrophil numbers in addition to bands, with mature neutrophils outnumbering immature forms.

The bone marrow is normally able to replenish the bone marrow pool of neutrophils in 4 to 5 days, returning counts to normal if the inflammation is resolved. A neutrophilia with or without a left shift may appear if the inflammation is ongoing. As inflammation becomes chronic, lasting for a few days to weeks, the WBC and differential counts will often return to normal, making the diagnosis of chronic inflammation difficult in ruminants. In some cases, there may be slight increases in the neutrophil, lymphocyte and monocyte numbers.

Stress Leukogram

The stress leukogram results from glucocorticoid administration or release, generally from a non-inflammatory disease, such as a displaced abomasum or indigestion. Typically, there is a normal or increased total WBC count, mature neutrophilia, lymphopenia, eosinopenia, and mild monocytosis. The neutrophil:lymphocyte ratio may be 2 to 3:1, but there is no left shift.

Physiologic Leukocytosis

Physiologic leukocytosis results from epinephrine release during excitation or exercise. An increase in blood pressure and splenic contraction leads to a transient, mild leukocytosis, mature neutrophilia, and a lymphocytosis. This phenomenon is not as prevalent in ruminants as in other species.

Platelets

Platelets form the initial hemostatic plug to damaged vasculature and maintain vascular integrity. Petechia and mucosal bleeding tendencies are clinical signs that warrant evaluation of platelets. Thrombocytosis is usually secondary (reactive thrombocytosis), and may occur with exercise, stress, or inflammatory conditions. In ruminants, a false elevation in the platelet count can occur due to the counting of small RBCs as platelets by some automated analyzers.

Thrombocytopenia is defined as a platelet count less than 100,000 cells/μL, with prolonged bleeding occurring when platelets number less than 40,000 cells/μL, and spontaneous bleeding at less than 10,000 cells/μL. Extensive hemorrhage may result in mild thrombocytopenia due to platelet loss in whole blood. Specific causes of thrombocytopenia in ruminants include septicemia, endotoxemia, vasculitis, bracken fern and trichloroethylene toxicities, *Salmonella* infection, mastitis, metritis, neoplasia, disseminated intravascular coagulation, bovine viral diarrhea virus infection, and bluetongue virus infection in sheep.

Plasma Proteins

A TPP level can be achieved in-house by use of a handheld refractometer. In order to interpret alterations in the TPP, one should consider the differential values of albumin and globulins. This will require additional testing than what is typically included on a CBC. If TPP is elevated, it must be determined if albumin or globulins are elevated, or both (panhyperproteinemia). Conversely, decreases in TPP may be due to low albumin, low globulins or both (panhypoproteinemia). The normal albumin:globulin (A:G) ratio is 0.84-0.94 in cattle.

- Panhyperproteinemia
  - Dehydration
- Panhypoproteinemia
  - Nematode parasitism, Johne's disease, salmonellosis
  - Hemorrhage
- Albumin
  - Hyperalbuminemia
    - Dehydration
  - Hypoalbuminemia
    - Inadequate production: severe, chronic liver disease, poor intake
    - Loss: renal, GI disease, hemorrhage, exudation
- Globulins
  - Hyperglobulinemia
    - Chronic inflammatory disease: traumatic reticuloperitonitis, liver abscess, chronic pneumonia
    - Hepatic disease
  - Hypoglobulinemia
    - Not common alone in mature cattle
      - Neonates with failure of passive transfer

Fibrinogen is an acute phase protein, readily analyzed by most laboratories. Fibrinogen increases over a period of 2 days after initiation of inflammation of bacterial, viral or chemical origin, or trauma. Dehydration may cause a relative hyperfibrinogenemia in addition to a relative hyperproteinemia. To correct an increased fibrinogen for hydration status a TPP:Fibrinogen ratio should be considered. If the ratio is <10:1, there is an absolute increase in fibrinogen, indicating inflammation. A potential problem with this analysis is that inflammation may also increase globulins, causing an absolute increase in the TPP, so clinical hydration status should always be considered when interpreting plasma proteins. A decreased fibrinogen is unusual, but may be caused by liver disease and disseminated intravascular coagulation.

Suggested Readings

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Zoonotic disease – messaging to producers

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Abstract

Zoonotic diseases of cattle can negatively impact the people caring for them. Veterinarians understand the potential health risks associated with contracting a zoonotic disease and are critical to communicating to clients. Educating about disease exposure routes, of which there are 6, is one way to simplify the health message. Messages should be clear, short, action oriented, and free of scientific jargon to be understood by animal caretakers. Numerous resources exist to educate people about zoonotic disease prevention.

Key words: zoonotic disease, communication, prevention

Introduction

Worldwide, there are at least 45 zoonotic diseases of cattle, of which the majority are bacteria.[4] The list of more commonly seen diseases may be a dozen or less yet the risks from some, like anthrax or rabies, can severely impact people. Veterinarians take an oath swearing to use their knowledge and skills to benefit society through "the promotion of public health" among other important statements.[1] Through their training in public health, veterinarians understand the potential health risks associated with contracting a zoonotic disease. This makes them the perfect conduit to educate clients about practical, easily implemented steps to protect themselves from zoonotic diseases. Effective communication of health messages can be challenging. Information needs to be presented in a way that has meaning to the listener and can be easily understood and acted upon to prevent zoonotic disease exposure.

Identifying Who is at Risk

Animal caretakers contact animals on a daily basis, increasing their risk of zoonotic disease exposure. Immunocompromised people are more vulnerable to zoonotic diseases. Immunocompromised individuals include the elderly, children under the age of 5, pregnant women, chemotherapy patients, organ transplant recipients, persons with HIV/AIDS, and people with chronic diseases such as diabetes. Since a person's immune status is often unknown to the veterinarian, it is better to err on the side of informing all clients of the risk and let them determine the next best steps. One does not need to be immunocompromised to be exposed and become ill. Therefore, if a zoonotic disease is suspected or diagnosed, all should be made aware of the risk and how to protect themselves.

Preventing Disease by Preventing Exposure

Zoonotic disease agents can be spread between animals and humans through a variety of transmission routes. Depending on the disease agent, humans can be exposed by more than 1 route of exposure. The majority of clients have not taken a bacteriology, virology, parasitology, or food safety course. The specific details for all of the pathogens taught in veterinary school are largely irrelevant to the majority of the public. Distilling disease transmission down to the routes of exposure, of which there are 6, is one way to simplify the health message. The 6 ways diseases are spread include aerosol, direct contact, oral, fomite, vector, and zoonotic.[2] Zoonotic transmission can occur through all of the previously mentioned routes. Once it is understood that some diseases can be acquired orally, like salmonellosis and cryptosporidiosis, and others are breathed in via aerosol transmission, like Q fever, it is easier to control exposure to them and prevent disease.[4] This approach is effective and easy for animal owners to understand without requiring knowledge about a wide range of diseases. This approach can also help protect against emerging zoonotic diseases.

In the case of a cow with leptospirosis, a human can be exposed through urine splashing into their mucous membranes (eyes, mouth) or through cuts or cracks in the skin.[5] Preventing leptospirosis exposure relies on measures that prevent entry into mucous membranes or abrasions in the skin. Contaminated food or water is another source of leptospirosis exposure. Focusing efforts on clean hands, cooking surfaces, and water sources can prevent exposure. These prevention steps also work against other diseases that rely on the same exposure routes. Using this approach in communication simplifies what clients need to do to protect themselves.

Communication Tips

Veterinarians are taught the intricacies of diseases – etiology, clinical signs, pathogenesis, diagnostics, prevention, and more. After 4 years of rigorous education, taking that complex information and presenting it in a way so that others may understand is critical. Start by presenting the most important information first, then actions, leaving the "why" for last.[3] For example, always wash your hands with soap and

water for at least 20 seconds after handling the calves. Crypto is spread in feces and it can make you sick.

Less is more. Do not overwhelm the listener with details that do not contribute to actions around prevention. Crypto etiology, while fascinating to veterinarians with its low dose infectivity and reinfection rate in humans, is not relevant to most clients. State your messages actively with positivity. For instance, "washing your hands can keep you healthy. Washing your hands can keep your family healthy".

Carefully choose your words. Readability in writing is based on the number of syllables in a word, among other things. Whether writing to clients or talking in person or over the phone, shorter words are best. If translation is necessary, shorter words can be easier to translate meaningfully.

Veterinarians know a lot of scientific wording and jargon. Save that for colleagues. Simplify it for clients. "Crypto" instead of cryptosporidiosis. "Garden hose diarrhea" instead of profuse, watery diarrhea with cramping.

Another important consideration is presenting information in a culturally appropriate way. As your client base becomes more diverse, consider working with people that have experience communicating to audiences of different cultural backgrounds. Effective communication often involves testing messages and delivery, using verbal and non-verbal cues, to ensure understanding.

Lastly, be aware of non-verbal communication when speaking to clients. Use of body language, body position when speaking, tone, speed, volume, and physical appearance such as facial flush or sweating can impact message receipt. Self-awareness when communicating to clients can increase understanding of barriers and strengths when delivering health-related messages.

Zoonotic Disease Resources

There are a variety of resources to effectively communicate about zoonotic disease prevention available to veterinarians and livestock producers.

- Center for Food Security and Public Health at Iowa State University: www.cfsph.iastate.edu
- Compendium of measures to prevent disease associated with animals in public settings, 2017: http://nasphv.org/documentsCompendiumAnimals.html
- Compendium of veterinary standard precautions for zoonotic disease prevention in veterinary personnel, 2015: http://nasphv.org/documentsCompendiaVet.html
- Disinfection guidance: http://www.cfsph.iastate.edu/Disinfection/index.php
- Healthy pets, healthy people: Farm animals: https://www.cdc.gov/healthypets/pets/farm-animals.html
- Stay healthy at animal exhibits: https://www.cdc.gov/features/animalexhibits/index.html
- Bring home the blue, not the flu, preventing disease in animals and people: https://content.cfsph.iastate.edu/bluenotflu/

Conclusion

Veterinarians are uniquely trained to identify and diagnose diseases of animals, some of which are zoonotic. Zoonotic disease prevention is essential to the health and safety of animal caretakers. Veterinarians delivering effective health messages to people require an understanding of how people receive information. Health messages need to be simple and clear to be understood. There are a number of zoonotic disease resources available to veterinarians to use to effectively educate their clients.

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How to open doors for producers to use your services

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Abstract

Becoming a successful food animal practitioner takes more human psychology than most of us care to admit. Working through individual cow medicine into a leadership role on an operation allows a more substantial veterinary-client-patient relationship (VCPR), greater loyalty from clientele, and increased profitability. Reaching this goal requires an ability to perform physical tasks while encouraging herd-based medicine. These can be accomplished by capitalizing on opportunity, being available, and then following up to develop your desired relationship.

Key words: mixed animal practice, associates, services, practice management

Introduction

Differing demographics and client goals determine the need for individual animal medicine. By design, individual animal medicine is on an as-needed basis and does not allow a consistent, predictable income for veterinarians. Clients are becoming more capable of performing these tasks without the input of a veterinarian, leading to a need for consistency and demand for veterinary services. This can be combated by making yourself valuable to your clientele through tangible services.

Selecting Opportunity

When considering associate positions, ask the right questions that will allow you to select opportunity. Most students will ask me what percent different species we see as a practice. While this does help you to determine current case load, it does not help you to determine what your caseload will be. Consider what you actually want your job to be. Do you want to work large herds, small hobby farms, and/or valuable individual animal medicine? Not all positions and therefore not all opportunities are created equal. You must consider what value opportunity holds for you. Are you willing to take a lower financial offer that will allow you the opportunity to develop the clientele you want? Does your personality type fit with taking over an existing clientele or the clients the owner doesn't want or do you fit better with forging your own path? The following are more fitting for veterinarians who want to forge their own path and develop their own clientele. Taking over an existing clientele from a departing veterinarian is another task that is most likely more based on that clinician's style.

Consider Profit Areas and set Tangible Goals

Determine the quantitative value of your desired case load if it does not currently exist or the quantitative value of you offsetting the current caseload or adding services to these clients. You must know what your goal is to know if you are winning. An example here, would be to add a certain number of clients quarterly, or to transition "shot gun" clients to managed clientele. Setting a tangible goal will allow you to determine billable hours for that task, the support staffs that you will require, and the longevity of the endeavor.

In our practice we developed what we affectionately call our CO-OP. It is not a cooperative by design, but more a retainer fee status clientele that allows us to retrieve charges that we were leaving on the table and to develop clients into operating with standardized management plans instead of disaster management. We included service items, accessibility of their chosen veterinarian, and group-purchased drug sales into this group to demonstrate value to the client. Since the initiation of the group, we have billed more chargeable hours for both physical services and consulting services on all clients enrolled. We have also been able to develop a VCPR more thoroughly with these clients and have orchestrated a sort of hierarchy in our practice area where new clients desire to be a part of the group.

Demonstrate Physical Ability

Being available is the number one client starter. One of my associates described this as "be the yes man". Most large animal consultation-based clients start with individual animal medicine of one species or another. I have made numerous ranch clients through emergency services for various species. Clients perceive work ethic and availability value to exceed perfection in performance of task. In my experience, clients will accept a steep learning curve for a whole lot of try.

Demonstrate Mental Ability

A well-rounded veterinarian should be prepared to work and talk within the same interval. Prime time to capitalize on being physically able is during or immediately after the event. Prepare management talks about common individual animal problems.

- Have a vaccine teaser talk prepared for sick calves.
- Have a genetics and bull selection talk for calf pulls.
- Have a biosecurity and prevention talk prepared for "broke bull" calls.

Make these talks be short and concise. Be specific and do not ramble. Always be too busy to stay for the full discussion at that moment but show eagerness to get back together and help review. You sure do not want them to have to spend money on this issue again, you are there to help them prevent as much as medically possible. You are the yes man and will follow up.

Initiate Follow up

Do not leave an individual animal call without a plan for follow up. Follow ups can vary from calling owner to check on the animal's recovery to sitting down to write a formal management plan. Regardless of the follow up reason, allowing the client to speak to you in the aftermath opens the door for questions. We have also found that follow up from a company stance is important. You can offer this through educational meetings, handouts, or through advanced scheduling opportunities. An example here is during bull breeding soundness testing season, call the clients who have not classically tested their bulls. Tell them you are working through your schedule and do not want them to miss out getting on your books. Leaving doors open for services is the second step that takes being the yes man to the next level of orchestrating management.

Conclusion

To successfully be "THE" large animal veterinarian you want to be, you must first define that for yourself and select the appropriate position. Subsequently, being physically available, accessible, and willing allows you the opportunity to demonstrate your mental ability. Once you have set this groundwork, always follow up. Lastly, ensure that you are circling back around to your tangible goals to know which of your efforts are working and being profitable.

We've been doing it all wrong: Working with cattle producers to right the parasite control ship

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Abstract

Anthelmintic resistance in cattle is a growing concern with widespread resistance reported, especially to the avermectin drugs. Treatment of all animals, use of long-acting products, and lack of seasonally strategic plans have all contributed to the problem, along with other factors. Beef cattle veterinarians and producers should come to terms with this reality and start testing for anthelmintic resistance at the level of production groups. Based on individual herd data, holistic and refugia-based parasite control programs should be developed which include considerations of nutrition, climate, strategic selection of animals for treatment, and pasture management.

Key words: beef cattle, *Ostertagia*, *Cooperia*, parasites

What's the Problem and How did we get Here?

Well, we dewormed every single animal twice a year every year, that's how.

Don't believe in parasite resistance? Talk to the goat people.

Beef cattle parasite resistance is a burgeoning area of research due to the increased recognition of resistance on individual farms and ranches. At this time, there are only a couple of completed, published studies, but there is growing data awaiting publication. There is widespread resistance of *Cooperia* sp to the avermectins across the board. In stocker calves in Arkansas, using a fecal egg count reduction test (FECRT), the reduction of fecal egg counts after ivermectin, doramectin, and moxidection were 57.0%, 41.2%, and 91.2%, respectively.[5] The goal is >90% reduction. In a grazing study in the upper midwestern US, *Haemonchus placei* was shown to be resistant to all anthelmintics, and *Cooperia* was resistant to the macrocyclic lactones. Levamisole retained efficacy, but even those animals retained small populations of *Ostertagia*.[2] In a grazing study, yearling heifers in northern California were treated with injectable ivermectin, moxidectin, fenbendazole, and oxfendazole. The white wormers produced a 90% reduction in *Cooperia* epg and moxidectin was 88% effective, while ivermectin produced no adult reduction. Ivermectin was not efficacious against developing or L4 inhibited larvae.[1] Data out of Dr. Kaplan's lab in Georgia indicate that 90% of farms tested through their lab have ivermectin resistance, particularly to *Cooperia* and *Haemonchus*, but also *Ostertagia*. There is substantial data to support this phenomenon from New Zealand, Argentina, Australia and other countries.

Cooperia resistance to the avermectins in calves is well-established and *Ostertagia* resistance evidence is growing. This resistance is of critical concern in permanent pasture situations on the cow-calf side. Many believe that resistance in the parasites of stocker and feedlot calves is of little concern, and therefore little consideration needs to be given to deworming practices in these facets of the beef industry. That may be true while they are in the production unit, but how they come in really matters. What about put-together calves from multiple origins who may be carrying resistant parasites to be shared? How does that impact anthelmintic selection on arrival or during the stocker grazing period? How will that stocker pasture be managed - is it going to be grazed through or harvested?

Several management practices contribute to anthelmintic resistance. Frequent deworming, deworming without regard for parasite biology relative to the climate, deworming all animals and placement on a clean pasture, and the use of long-acting drugs on permanent pastures. Also, recall that not all apparent inefficacy is due to resistance. Improper storage of drugs, expired product, use of generics, and mismatching drug to target parasite may all lead to a failure of parasite reduction, but do not represent inherent parasite resistant to drugs.

Diagnostics

It is imperative that beef cattle herds start to actively evaluate their herds for parasite numbers and characteristics which may be reducing production. The real costs of ineffective parasite control programs are found in reduced milk production, inhibited growth, impaired immunity, and poor feed conversion. These costs are being paid long before the first skinny, rough-coated animal is recognized.

Screening herds for parasite burden and anthelmintic sensitivity is best done using the FECRT. This will not only provide initial parasite quantification, but an *in vivo* sensitivity test for products used. There are several egg quantification procedures available and these must be selected based on the target parasite(s) and overall sensitivity. Where *Haemonchus* or *Cooperia* are the target, a lower sensitivity test like McMasters can be sufficient because these are heavy egg shedders. For *Ostertagia*, *Trichuris* and others, a more sensitive tests such as the Modified Wisconsin or Mini FLOTAC should be

considered. Traditionally, a Modified Wisconsin sugar method was considered standard for cattle over a year of age, while the McMasters was preferred for cattle less than a year. New studies out in the last couple of years show the Mini FLOTAC optimizes egg recovery compared to more traditional methods.[4] At this time, it is a matter of getting reference laboratories on the same page regarding standardization of offerings for livestock fecal examination.

When performing FECRT for herd evaluation, weaned animals that are less than 16 months of age are the best representatives. At least 15 animals per treatment should be sampled, treated, and then have a repeat FEC by the same method on the same animals. If sampling of the same animals is not possible, 30 random-grab samples should be used to evaluate drug effectiveness. Mini FLOTAC or modified Wisconsin are ideally used. The goal is 90% reduction in FEC. The time of the second sample collection for FECRT varies by product class used. Post treatment intervals for fecal sampling are: non-avermectins – 10 to 14 days, avermectins – 14 to 17 days, and moxidectin – 17 to 21 days. If combination treatment is used, 14 days should be observed. Interpretation of FEC has been outlined.[3]

Refugia-based Programs

Refugia is the population of parasites not exposed to anthelmintics. Refugia are beneficial in that they dilute the genetics for resistance in a given population of nematodes. When every animal in a herd is dewormed, especially if then turned out on a clean pasture, refugia populations are greatly diminished and resistant worms are all that remain.

In small ruminants, FAMACHA has been the method used to preserve refugia - you simply don't deworm those animal who aren't anemic. In cattle, however, parasitism is more insidious without a real way to so clearly identify who does and does not need treatment. The source of *Ostertagia* refugia is the adult cows while *Cooperia* refugia is maintained by calves. Two treatment strategies are used in cattle to retain refugia: target selected treatment and selected non-treatment. These are just 2 ways of looking at the same thing. In targeted selected treatment, you are focused on treating susceptible animals, such as those with lower BCS, fluffy hair coat, or are younger. In selected non-treatment, the focus is on animals who do not need treatment, such as older animals, those with the highest BCS in the group, etc. This can also be done randomly - send them through the chute and skip every 10th calf. The target percentage for non-treatment for replacement heifers is 10 to 30% and for calves is 10%. For the adult cow herd, treatment should be based on fecal egg counts (performed seasonally or quarterly) to determine necessity. If treatment is necessary in adults, a strategy is to only deworm those cows that are less than 5 years old, leaving the older, more immune cows to harbor refugia for the group. Bulls, because of their increased susceptibility should be treated at BSE time. Consider the climate. *Ostertagia* is a cool season parasite, while *Haemonchus placei* and *Cooperia* are warm weather parasites. Preserving refugia means not treating in times of low parasite burden.

Of course, when refugia- based strategies are implemented, management must rise to meet the new herd standard. Protein and trace mineral nutrition should be evaluated and holes closed, points of stress should be identified (significant risk factor for rise of *Ostertagia* specifically), and pasture management evaluated. Practices that reduce parasite burdens on pasture include grazing dry cows after calves, grazing other species (if you believe this works, there are papers that prove you are right and if you don't believe in this, there are papers that prove you right), pasture rotation to change the lifecycle of the parasite, so there are no clear-cut rules for this, but certainly do not graze the same production group on the same pasture year after year, and make hay. These strategies can help to create clean/safe pastures and cattle movement should take restoring contaminated pastures into account.

Treatment

It's clear that not every animal should be treated in a group and we have options for how to select those for treatment. When we do elect to treat a portion of the population, what do we need to consider?

Farm-specific FECRT should be guiding our choices of drugs. There are some things that we know to be true. *Cooperia* has almost no susceptibility to ivermectin or eprinomectin, so they are of limited utility in calves; the white wormers do a much better job. The use of long-acting avermectins (especially the very long-lasting preparations) in situations of permanent pastures will eventually kill off refugia. Also, given the high rate of resistance to this class, are they likely to be effective at this particular place? Generic products and pour-ons have limited efficacy and can contribute to anthelmintic resistance. In-feed or block anthelmintics should be avoided. Intake is variable and the animals who most need to be medicated are likely the ones with the lowest intake of feed and, therefore, drug.

An example plan based on a typical spring calving cow-calf cycle; only real modification for fall calving is time of year to deworm pre-weaned calves.

- Spring: FEC on cows to serve as sentinels for calf parasite exposure; treat bulls at BSE; optional fluke treatment*
- Summer: Deworm calves <1m before weaning; no cow treatment because low *Ostertagia*
- Fall: Treat cows <5y; treat replacements (leave 10% untreated); fluke treatment*
- Winter: Monitor nutritional stress, may need additional treatment

*Flukes are refugia killers because all animals must be treated in problem areas. It is standard to treat for flukes in the fall to diminish pasture contamination of

adult flukes that were developing all summer, followed by a spring treatment for an additional kill. An option would be to treat for flukes in the fall, keeping some animals untreated, and then coming up and treating those animals in the spring.

There is growing evidence to support the concept of combination deworming or deworming an animal with 2 (or more) classes of drugs, most commonly a white wormer and an avermectin. Where there is anthelmintic resistance and these classes are both exhibiting fecal egg reduction of less than 90%, their use together becomes additive and can achieve >90% kill. This MUST be used in a refugia-sparing plan. Combination deworming of all animals is just a really handy way to lose efficacy of 2 classes concurrently.

Summary

When working with clients on any herd health problem, I find it useful to make a list of issues for my medical record, but I don't throw that at the owner. It's overwhelming, it looks expensive, and it's a lot to comprehend, especially if it goes totally against traditional thinking. So, they don't do any of it.

Pick maybe 2 things for them to do first and focus them on that. Maybe you start with getting them on a good mineral program and get them to stop using generic pour ons. Then, they start skipping every 10th calf. When they see all the calves don't melt down, they may be more open to hearing you suggest they stop deworming older adult cows. Have them be thinking about their pasture situation. That's potentially expensive and takes planning. Just keep adding until you get them where'd you like them to be or close enough. Every bit helps and after a few years, they are reaping benefits of a couple of manageable projects a year.

For Your Consideration

Deworming everyone and putting them on clean pasture
Babying poor doers; select against parasite susceptibility
Consider worm genetics with the discernment you use for cow genetics
Paying cold hard cash for resistant parasite importation
Accuracy of dosing by eye
Meeting physiological needs to allow cattle to minimize immunologic distractions
Product storage conditions and duration

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Introducing milk quality services to your practice

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Abstract

Milk quality services are an excellent and often-overlooked opportunity for veterinarians to improve the profitability of their clients' dairies and their practice. There are a number of simple procedures and services you can perform without substantial investment in equipment. These include milk culture services at your clinic, utilization of DHI test data in your herd health appointments, on-farm audits of environment, procedures, and cow outcomes, DairyComp data analysis, and employee training.

Key words: milk quality, mastitis, consulting

Lab Services

Basic milk quality laboratory services are a great way to help your clients while adding a new revenue stream to your business. Milk culture is relatively simple, has low start-up costs, and can be handed off to tech staff once your workflow is up and running. Cultures can be run to inform treatment decisions on a 24-hour turnaround basis, or they can be run simply to collect data about pathogen prevalence in the herd to inform future management decisions. A mastitis culture lab needs the ability to detect the full range of mastitis organisms, although some labs will send out mycoplasma cultures due to the additional expense and complexity of running a CO2 incubator or candle jars. Mastitis-causing organisms will all grow in 24 to 48 hours with the exception of mycoplasma, which takes a week.

I recommend ordering a copy of the *NMC Laboratory Handbook on Bovine Mastitis*, which has excellent protocols for lab techniques and pathogen identification. Beyond that, you'll need a basic incubator, blood agar and MacConkey plates, sterile swabs, a microscope and a Gram's stain kit. You should also keep coagulase on hand for confirming *Staph aureus* cases. You may want to have prototheca and mycoplasma agars on hand as well, especially if you plan to perform bulk tank cultures or if you'll be handling those 2 pathogens in-house.

For bulk tank cultures, a pipettor or other calibrated measuring device will be necessary to plate a consistent volume of milk for quantitative culture. Bulk tanks are used to survey the pathogens present in the herd and their levels. They can give you a good idea of how prevalent subclinical or chronic mastitis is in the milking group, and they are imperative for early identification and removal of contagious pathogens.

If you have clients using washable towels, you may wish to add towel culture to your toolkit. It is common to find heavy bacterial loads on "clean" towels when the washer or dryer has been overloaded or is otherwise not functioning well. Basically you just take a few towels at random, snip out a specified area, soak in sterile water and then plate the water for quantitative culture.

Offering in-house lab services will help you open conversations about milk quality with your clients, steer your other efforts based on the pathogen profile of the herd and add a new revenue stream to your practice.

Utilizing DHI Data

Many dairy farms are enrolled in monthly DHI testing but the vast majority, in my experience, are not actively engaged with their milk quality data every month. In particular, I try to emphasize the new infection list and the chronic cows list.

You can access DHI results and reports online, or you can ask your client to include you in the distribution of paper copies by mail. I would recommend you bring useful information like this to your herd checks to discuss while you do your fertility exams. Including the milk quality component is an important part of making a "Herd Health" program rather than a "Preg Check" program.

Suspected new infections are those cows that had a previous test <200k somatic cell count (SCC) and current test is >200k SCC. These cows should be investigated with a California Mastitis Test (CMT) paddle, with hot quarters submitted for culture and/or treatment. New infections have a good chance of cleaning up with appropriate treatments.

Chronic infections, or those cows with multiple successive test days >200k, should have their history evaluated and perhaps a culture submitted. If the affected quarter is deemed beyond repair, options include quarter-kill treatments or culling. It's important to note that while addressing chronic cows can have a big impact on the bulk tank culture and cell count, you can't cull or "three-quarter" your way out of milk quality challenges. Make sure to address the new infection pressure at the same time you clean up yesterday's challenges.

Basic Milk Quality Audits

There are a number of simple audits you can do either while you are on the farm for a routine visit or as part of a dedicated milk quality visit. Keep your head on a swivel and take notes. I find it best to verbalize observations and recommendations directly to the key decision maker on the farm, but I also try to always put my work into writing. The written form provides a basis for future follow up and it

provides clear evidence of the work you did. As veterinarians we often struggle to charge adequately for less tangible services. A report gives you something deliverable that you should feel proud to bill for.

Stall design and condition are important components of milk quality. Take note of the stalls while you work in the pens, especially with respect to how the cows index in the stalls. Do the majority of the cows lie comfortably in the stall in a position that manure and urine land in the scrape lanes? If not, look at the position of the brisket rails if present, and the neck rail. It is very common to see neck rails pushed forward over time. Cows positioned too far forward or on a diagonal in their stall will result in extreme contamination of the bedding and an uptick in environmental mastitis organisms.

Bedding upkeep is a constant job on a dairy. Take note of how employees clean the curbs and contaminated beds. Is adequate bedding added in to all of the stalls? Is the new bedding clean and dry? In deep-bedded stalls, you can use a soil core tool or a shovel to evaluate the cleanliness of the sand below the surface as well. There is often a black line of sand, which harbors bacteria and moisture. If this is present, the back ⅓ of the stalls need to be dug out and refilled with clean, dry sand. Any type of cow bedding can be submitted for quantitative cultures -- this may be a worthwhile tool to help clients stay on top of their bedding practices.

Manure accumulation in cow traffic lanes is a serious problem on many dairies. Splatter onto the legs and udder on the way to or from the parlor can be a major source of mastitis. Look for poorly drained areas or spots where manure is not adequately removed and take pictures. Sometimes a picture or a video will explain the problem far better than words. Leg and udder hygiene scores also help point out the significance.

Proper use of the crowd gate and calm movement of cows to and from the holding area and especially into the parlor has a big impact on milk letdown, and therefore all other parlor metrics. Cows that are frightened will have poor milk flows and suffer excess vacuum as a result, damaging their teat ends and creating a vicious cycle of unpleasant experience for the cow. Many times in your work around the farm you will see behaviors that need to be corrected. Be sure to never tacitly endorse these behaviors by not saying anything. However, it is imperative that you be on the same page as ownership before taking any bold action to correct the behavior. Play your cards carefully when working with farm employees. You want them to trust you and respect you. It can be very difficult to critique their work without scalding those relationships.

Water hoses in the parlor are directly related to calm loading. Cows that are scared as they enter are more likely to defecate on the deck, and you will frequently see employees reach for a hose to spray the manure away. Any use of hoses to wash down the deck while cows are in the parlor is not recommended. It will increase the amount of manure splatter on the teats and udder.

You can assess teat end condition before or after milking. Use the National Mastitis Council (NMC) scoring system for grading the teat ends and monitor changes over time. If a high percentage of the herd has everted teat ends, there likely are issues with machine function or poor letdown. It helps to carry a flashlight when you score teat ends, unless the parlor is exceptionally well lit. Another check I like to perform is whether the end of the teats have been cleaned well prior to milking. During the gap between dry wipe and attachment, take an alcohol-soaked 4x4 gauze square and wipe the end of the teat. The pads should come away still white. Take a photo of the wipe and if there are multiple milkers, make note of which ones have clean or dirty wipes. Usually they will be much cleaner on the next side of cows once the milkers realize what you are looking at.

Post-milking strip yields can give you an idea of whether machine detachment is happening at the correct time. Immediately after detach, hand strip each quarter into a measuring cup for up to 15 seconds. You should be able to recover 40 to 100 mL of milk from each quarter. Greater than 500 mL (composite) indicates a problem with milk out. Conversely, if you cannot recover any milk there may be overmilking (check the teat end condition). Pay attention to whether the parlor is equipped with automatic take-offs, and whether some or all of the milkers are using manual mode to override the ATOs.

Learn the milking routine for your herds. If it is not already posted on a wall near the parlor, consider making a laminated description and post it. Watch the milkers and see if they carry the routine out consistently. If you're at the farm late at night for a dystocia, peek in the parlor and see if the night shift follows the routine. It is far more common to have lapses in protocol on the night shift.

Grab a stopwatch and check the prep-lag time. The timer starts when the teats are stimulated. Forestripping is considered the best stimulation, but dry wiping with a towel is also acceptable. Ideally there should be 10 seconds of stimulation. Given that letdown is a neuroendocrine reflex, it does not matter if the stimulation is of 1 teat or all 4. However, forestripping (with observation of the strippings from all 4 quarters) is another important component of milk quality. The timer stops when units are attached. The goal is 60 to 120 seconds; on the longer side for herds milked 3x and shorter for herds milked 2x. Check the first and last cow of a prep sequence, as there is sometimes a substantial difference between them if each step of the sequence does not require the same amount of time.

One of the easiest overarching audits to perform in the parlor is to observe cow comfort. If cows are standing calmly in the parlor chewing their cuds, this is a sign that the machines and procedures are going well. If cows are dancing, kicking, or looking apprehensive, there are problems you need to identify. Never get so focused on the technical minutiae that you forget to listen to what the cows are telling you.

DairyComp Analysis

Some of your herds will have DairyComp305 or another herd records software. There are many reports and monitors in these programs that you can use to troubleshoot milk quality issues. I work primarily in DairyComp.

Econ\s is a list that shows you cell count and milk yield data from the most recent test day. The report factors pounds of milk and SCC to estimate bulk tank contribution from each cow. The report will show you the percent of overall herd SCC the cow is estimated to contribute, and the herd SCC if she was removed from the herd. It also shows you how many test days >200k SCC the cow has had in this lactation. I never recommend culling directly off this list. Rather, take the CMT paddle and confirm the test day information. You may be able to make a big impact via treatment, culling or quarter-kill recommendations.

The Drylog table is a tool for monitoring change in SCC from the test day prior to dry-off to the test day after freshening. It breaks the herd down into a 2x2 table so you can look at the percent that dry off clean and freshen clean, the percent that dry off clean and become subclinically infected, the percent that dry-off subclinically infected and are cured and the percent that remain chronically infected. Remember that this is not simply a scorecard for whatever dry-cow therapy the farm is using. Rather it encompasses up to a month ahead of dry-off, the act of dry-off including tubes and employee procedures, the environment during the dry period, maternity pen and up to a month of the fresh period, cow immunity factors and milking procedure performance.

You can set up items in DairyComp to log data at the time of events. One example is to capture the most recent test day SCC at the time of a mastitis event. This allows you to see if the cow had a high cell count prior to the mastitis event (likely a chronic infection) vs a new infection in a cow with a history of low cell count. Another item can be used to capture the post-mastitis event SCC. Then you can build reports that show you the pre- and post-mastitis event SCC, allowing you to analyze the impact of different culture results or treatment protocols.

I also like to monitor the outcomes of different pathogens and protocols by monitoring treatment extensions and relapses. I consider treatment extensions to be additional protocols assigned 1 to 14 days after a first protocol. Relapses are additional protocols assigned 2 weeks to 2 months after the first event. I use both of these monitors to assess the efficacy of different protocols on different pathogens.

Parlor performance metrics are a great tool for those farms that have daily milk weights downloading to their farm computer. You can get a very good idea how different employees, milking stations or protocols are performing by monitoring these parameters. DairyComp has a number of built-in reports that will capture this information. When possible, set goals and utilize the reports to call out good performance or to seek opportunities to train for better performance. Examples of metrics to watch are milk/cow/hour, cows/stall/hour, milk in the first 2 minutes, peak flow rate, average flow rate in the first 15 seconds, second 15 seconds from 30 to 60 seconds (look for these to be increasing), seconds in low flow, and average pounds of milk per minute and average duration.

Employee Training

It may be helpful to hold meetings with farm employees explaining the basic biology behind milk letdown, machine milking and udder health. If you are unable to communicate in the language spoken by the milkers, ask the farm to bring in a translator to help.

Hands-on training in the parlor is critical for proper administration procedures of intramammary products. The most common mistakes involve dry-tubes and orbeseal, with contaminants pushed up the streak canal or teal sealant shot up into the gland rather than held down in the teat. You'll be surprised what you see if you take the time to work with the milkers on these basic, yet critical procedures.

Some farms may wish to implement an on-farm culture system. This is a great opportunity to add some milk quality time to your herd health appointment or other visits. Check in regularly with the person running the cultures, make sure their results are accurate and that they understand the significance of different results. Encourage them to log the results into DairyComp so they can be used for retrospective analysis and day-to-day decision making on the farm.

Making the right culling decisions on the dairy: Helping young veterinarians advocate for their patients and prevent animal suffering

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Abstract

Data indicates that the decision to ship compromised cull cows is too common. Compromised culled dairy cattle continue to arrive at slaughter plants. Leadership within the industry is needed to address this welfare challenge. Dairy cattle veterinarians are uniquely positioned to and responsible for meeting this task. It is supposed by the author that while the next generation of cattle veterinarians are also uniquely qualified to deliver meaningful progress, there is no secret weapon, treatment or single answer that will deliver success; merely one simple ingredient, compassion.

Key words: bovine, animal welfare, culling decisions

Introduction

Professional Duty

As veterinarians our charge is clear. We have all taken an oath to protect and promote public health and food safety and the welfare of animals. Evidence, however, would indicate that, as a profession, we have often chosen our economy over our ethics. The decision, whether passive or active, to look past issues on farm that unequivocally compromise the welfare of cattle, is too common. Justified by economics, efficiencies or simply profit, veterinarians seem to struggle with finding a balance between serving their client and practice and serving their patient. While some may suppose this predicament is unique to food animal veterinarians, it is not. All veterinarians are placed in a uniquely burdensome position of advocating for patients with no autonomy, completely reliant on the will of the caregiver to recognize and offer relief from suffering. The burden may seem greater for new graduates, with the added pressure to ingratiate themselves to new clients and accounts. For this reason, it is essential that as a profession, we support and equip all new graduates with the confidence and tools to advocate for their patient in a way that does not compromise the security of practice.

Business Case

There is a business case to be made for promoting and protecting the welfare of dairy cattle. Although the intention is to keep all animals healthy, there are times when an animal must be culled, or euthanized when chances of recovery are low, the animal's pain is not manageable, and/or its quality of life has deteriorated. Promoting good welfare, preventing disease, and timeliness of euthanasia are each equally critical components of animal welfare. It is not reasonable to expect that every client shares our values or financial commitment to the patients in our care, nor can we demand that they do so. Nor is it necessary to justify every provision or treatment with a financial equation that proves "providing good welfare pays for itself". The reality is, sometimes it doesn't. The cost of good welfare, however, does not preclude it from making a compelling business case. Activist groups have called out the dairy industry on each of these issues, representing a serious risk to the profession, dairy farmers and the dairy industry as a whole.

Reputational Risk

The use of undercover videos by animal rights activist organizations to expose poor practices on farms and influence the supply chain to make policies regarding animal welfare has become commonplace. Four separate undercover video investigations by animal rights activists in 2017 and again in 2019 are some of the most recent examples of impactful dairy supplier failures on their customer(s). Videos released presented evidence of veal calves, calves raised at a calf ranch or calves raised on a dairy in addition to adult cattle on dairy farms that were not provided timely euthanasia or that were handled inappropriately. In response to the video release, retailers suspended milk pickups from the farms in question, pulling associated brand product off the shelves. The videos also caused some customers to revise their animal welfare audit programs and policy. In addition to the financial loss related to decreased sales, product recall/destruction, and cancelled customer contracts, which are difficult to quantify and not shared publicly, an additional risk in the form of consumer litigation alleging consumer fraud, has emerged as a new and potentially significant financial risk. While the impact of poor performance on the dairy industry is difficult to quantify, it is important for dairy farmers to appreciate that supplier performance in this specific area can negatively impact customers and may result in the immediate cancellation of their contract, leaving then with no market.

What can you do? Train and Track

Factors impacting animal welfare on the farm include caretaker training, availability of protocols, treatment decisions, quality of life assessment, human-animal bond, and economic influences. Cattle veterinarians can develop a culture of care to every farm that promotes making better decisions sooner, while working to improve the success of preventive measures. Culling decisions and euthanasia decisions are interconnected. In the United States, nearly 1/3 of dairy cows are culled from farms annually. Cows culled that are an outcome of involuntary culling decisions, those that are culled as a result of a health issue such as infertility, lameness, mastitis or injury are often compromised and may deteriorate quickly. The reality is that some of these culling decisions should be euthanasia decisions. Not all culled cattle should be sold into the supply chain. If they are suffering and not fit for transport, we should elect to euthanize these animals, rather than sell them. Additionally, we should consider that the euthanasia decision be made even sooner and not be just a consequence of a culling decision, as this could be too late in regards to the animal's welfare. The opportunity for veterinarians to insert themselves as the chief animal welfare officer on every dairy, taking a leadership role in strategically leveraging conversations to develop a habit of thought in culling decisions that is cow-centric, promoting the welfare of the cow will be essential to the survival of individual clients and the industry at large. To presume there is one way, one conversation, one practice or one protocol to navigate this issue is to underestimate it. The only consistent measure is that each veterinarian must first decide that they are willing and prepared to meet the task to advocate for the cow, above all, and in doing so commit to finding a way to bring each client along as individuals on the journey promoting compassion as a habit of thought, exercising the habit such that over time our and our clients perspectives shift from that of being narrowly focused on the immediate economy of the moment to the broader and lasting economy of our collective actions.

Becoming the associate: Finding your niche and keys to personal and professional success

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Abstract

Young veterinary professionals today are often hired by practices right out of school, and unfortunately these practices often lack the skills and training to set them up for long term success. These professionals have been taught what and how to learn for the better part of 2 decades and are now expected to self-motivate, identify, and educate themselves in such a way that they can grow and develop while in practice.

These expectations often come with little to no formal guidance from the practice's management team. Yet, these associates represent the best chance for practices to overcome the existing biases within their system and find new avenues to grow and expand. By understanding and harnessing their underlying psychology, associates can create an environment in which they can practice, identify, and excel in their own niche with, or in the absence of, qualified guidance and oversight. This psychology can then be used to create an environment of growth through pursuit of their purpose while leveraging their unique talents and routines. By educating our budding peers on the discussed self-development system, we can help them achieve their own niche by whatever definition they choose to use.

Key words: self-determination theory, niche, high performance

Introduction

Every veterinarian remembers the day they signed their first employment contract, the first time they were able to leverage their hard-earned veterinary degree for a tangible return. On that day many of us believed we were signing on to provide veterinary services for that practice, services such as rectal ultrasound, D/A surgeries, and sick cow exams. However, many contracts fall short on communicating exactly what will be expected of an associate in the area of developing a niche or specialty that benefits the practice beyond the basic services that they would provide.

What many young veterinary students and associates fail to realize is that their practice is not handing them an average salary of $70,282 for basic day-to-day work.[14] Employers will expect these young vets to perform these basic tasks at a high level, but the more progressive practices pay this sum for something much more valuable such as the associate's brainpower, their ideas, vision and creations.

While brainpower will not often show up as a financial statistic in the year-end books, it does provide future ideas, growth, and opportunity for aspiring associates and growing clinics. Associates hired for this reason often represent a clinic's best chance at refreshing internal ideas, medicine, and vision. This is because associates manifest something unique in veterinary medicine, something that we as tenured practitioners lose over time. They manifest what authors Amy Chua and Jed Rubenfeld theorize is the Triple Package.[2]

The Associate Advantage

Chua and Rubenfeld created the Triple Package thesis when they asked themselves what made American minority groups successful and,

"Why do these and other groups come out on top?"[2]

This simple question was used to investigate why these minority groups obtained the American Dream more frequently than larger, more mainstream groups who have recently begun to flounder in modern America. What they observed were 3 cultural traits within said groups: a belief in group superiority, a deep-seated feeling of individual inferiority, and deeply rooted impulse control which caused these groups to feel a higher degree of empowerment than their peers. The expression of these 3 traits in turn allowed them to experience success by any definition (money, fame, spirituality, professional success, etc.) at a higher level than their mainstream peers.

The author contends that this thesis can be taken one step further and applied to another unique group, the recent graduate veterinarian. This individual, or associate, has been forged through the fires of veterinary school, the likes of which could only be survived with a healthy belief in oneself.

This mindset begins with the belief that at some level they have superiority over others. It can be as superficial as the classic statement, "I'd rather go to a vet than a doctor", or go as deep as classmate-to-classmate competitions for grades and highly coveted job prospects. Chua and Rubenfeld reflect how this behavior is condemned and often avoided in today's society.[2] The author also contends that by the time the associate graduates, the concept of achieving and maintaining superiority over circumstance or others has become deeply ingrained in who they are. In fact, this trait will inevitably be brought to the graduate's first job, and as a result will interact with the second trait of insecurity, tending to drive the associate's professional development.

Insecurity, anyone who has spent 10 minutes with a recent graduate can perceive this trait in them. They are unsure of their place, their client's belief in them, and their skill set. This "anxious uncertainty" gives the associate the Triple Package as well as a potency for growth. This uncertainty drives the associate toward continuous self-improvement as they mentally manifest feelings of derision, disrespect, or suspicion secondary to their insecurity. Later, we will discuss how this trait can be harnessed in these individuals to create circumstances required for continuous professional growth. This growth can potentially change an associate and practice forever.

Finally, these individuals through the tempest of veterinary school, have learned how to resist temptation via impulse control. Many times throughout school, they have had the temptation to quit, give up, and walk away from what might be described as an "arduous or daunting" task. Mastering impulse control builds the stamina needed for long, hard tasks that require concentration, perseverance, and resistance of temptation. This means they are primed to take on large, difficult projects such as developing new services for a practice, reinvigorating internal clinic management technique or revolutionizing the type of medicine practiced.

Chua and Rubenfeld describe the melding of these 3 traits as creating, "A goading chip on the shoulder, a need to prove oneself or be recognized." This means the associate enters a practice with an insatiable desire to push to the top, establishing superiority and seeking continuous growth while loving the hard work and process.

Readers may be asking:

"Why do practices need this 'new blood,' to push development?"

As associates progress from new graduates to seasoned vets, and on to become clinic owners, often what happens is the superiority complex continues to exist but the feelings of insecurity about their skill and talents decrease. The work begins to come easier, requiring less impulse control as the work becomes easier, less problems need to be persevered through, and adversity decreases. The compound effect of these changes being the eroding of the practitioner's driving desires to grow and create.

This erosion of the insecurity and impulse control traits of the Triple Package causes seasoned veterinarians to become complacent, which stagnates the generation of new ideas, slows practice growth, and leads to the setting in of significant biases within the practice. But before we get to how associates can leverage their Triple Package skill set, we must first address the group biases that undermine clinic leadership and practice growth and the role the young associates play in challenging them.

Biases in Veterinary Clinics

New associates bring a clean slate to the practice; they lack exposure to the clinic team, and specifically the biases created by previous interactions within that team. On their first day, their interactions with the clinic team will open them up to all kinds of biases in their decision making, idea generation and task implementation. While defining the origin and effects of these biases could formulate the basis for a great post-doctoral thesis, the author will select 2 biases that are most relatable to the reader and pose the biggest risk to the clinic teams. These are the biases of Groupthink and the Anchoring.

Groupthink is a human psychological phenomenon by which participants in a group strive for consensus within a group to avoid conflict and subsequent ostracization from the group.[1] This is an evolutionary trait linked to the essence of self-preservation in group-dependent species. Therefore:

> *"Groupthink causes individuals who are opposed to the decisions of the group to remain quiet and keep the peace resulting in a lack of dissenting opinions and an increase in the potential for tunnel vision as well as catastrophic failure of ideas."*[1]

This Groupthink can lead clinic team members to believe a wide variety of assumptions, such as thinking everyone on the team is on board with an idea, cause the team to ignore moral problems, empower the team to rationalize decisions based upon lack of objections, stifle other teammate's ideas, and even foster a sense of invincibility. All of these can lead team members to be overly optimistic and engage in otherwise unadvisable behavior, medicine or business practices.

While there are many causative factors for this, the author is convinced that an associate can break up this negative behavior. New associates can disturb and reorganize the cohesiveness in the clinic team by challenging the team's interaction dynamics, adding diversity to a clinic's team, requiring a fresh leadership approach and/or fostering the development of a new healthy mentoring process, thereby bringing new ideas to the clinic. By rewarding these new associates with praise and recognition for their new perspective and creativity, clinics can leverage this new perspective to "refresh the tree of Groupthink."

The next common bias seen at a clinic level is referred to as an Anchoring Bias. Anchoring refers to the human brain's bias to make decisions based upon information recently taken in. In essence, the mind uses this recent information as a reference point and adjusts its next decision or estimated outcome based upon this point.

Perhaps the most famous example of this is "The Dice Study", in which judges were given an example case booklet.[4] At the end of the booklet the prosecutor's sentencing recommendation was listed as a blank, only to be filled in after the judge rolled a pair of dice to determine the recommendation. In this trial, the dice were rigged to land on a low number for one group of judges and a high number for another group of judges, essentially creating a "low" and "high" anchor point for each group.

The researchers found that judges who rolled a low number gave an average sentence of 5 months while judges

who rolled a high number gave an average sentence of 8 months. This difference translated into a 60% longer sentence simply because of a roll of the dice!

We can see similar effects within our practices when it comes to treatment duration, dosage, and even idea generation. If a mentor at a clinic tends to treat on the higher end or longer duration, their mentee is at risk to extend and increase treatment duration and dose as well. Similarly, if an owner is predisposed to place more value on preserving revenue from something like late night milk fevers, their current staff are more likely to overvalue this revenue source as well. This is where new associates can challenge these biases by asking the invaluable question,

"Why do we do it this way?" "Is this really the right assumption or does a bias exist?"

Now that owners and associates clearly understand the power of onboarding new talent and the role it can play in a progressive practice. Let's dive deeper into how associates can make the maximal impact possible within their practice.

Your Niche is Yours Alone

Finding and determining an associate's place within their practice is not a task this author can do for every reader. Each practitioner has their own unique set of strengths and talents that makes their clinic team role and niche different. Discovering one's niche is often best facilitated by a healthy relationship between the new associate and their mentor-owner. However, this relationship may not always be available to an associate and therefore the author will discuss several mental techniques, books, and daily routines that will discuss how the individual can drive his or her own discovery, growth, amplification, and creativity. Ultimately, achieving their full personal and professional potential.

One of the key psychologic factors that can help drive associates to find their role or niche in a practice is the innate human desire to seek continuous growth and achievement; otherwise known as Self-Determination Theory. In 2017 Ryan and Deci showed that Self-Determination Theory (SDT) is an excellent predictor of an individual's intrinsic motivation level or the likelihood they will:

"Seek out novelty and challenges to extend and exercise one's capacity to explore and to learn."[3]

That study went on to show that the level of an individual's intrinsic motivation could predict their aptitude for enhanced learning, performance, creativity, optimal development, and psychological wellness. All of these are critical traits for any high-functioning veterinary associate.

Therefore, understanding the core driving principles of SDT and their implementation means that associates can consciously increase their inclination towards finding their own intrinsic motivation at work and therefore expand their capacity to learn, take on challenges and to grow on their own; yielding unheralded results. One of the theory's authors, Dr. Ed Deci, described SDT in an interview with The Brainwaves Video Anthology as follows:

"[Not] asking how you can motivate other people…. [instead] asking how can you create the conditions within which other people will motivate themselves."[5]

Self-Determination Theory suggests that humans will be inherently unhappy until we can fulfill 3 basic tenets: Autonomy, Competency, and Relatedness. Consequently, each of these play a role in how an associate can begin to develop their niche within practice.

Autonomy refers to the individual's ability to feel that they have control over their undertaking of actions, decisions, and outcomes. In expressing Autonomy, the associate is learning, working, and growing of their own accord, not because of external stimulants or rewards.

Given the solo and isolated nature of large animal practice, Autonomy is often met more naturally than in small animal practice, but it remains critical that owners not micromanage their associates or risk suppressing the benefit of this tenet. As early as 1950, Harlow showed that the application of external rewards, seeking to further encourage growth-type behavior in monkeys, actually suppressed the monkey's intrinsic motivation for the activity and ultimately reduced the expression of the growth-type behavior.[7] Therefore, associates and owners should be cautious in seeking out or extending external rewards to compensate associate growth.

Over-aggressive management can also cause associates to shun growth opportunities in practices and ultimately reduce their potential in the long term. Micromanagement erodes the associate's feeling of self-growth by making them feel that their growth is being controlled and directed by the owner or manager. Over time, management such as this will threaten to erode the associate's feelings of self-determination, and therefore their intrinsic motivation for their job.

For their part, associates also need to recognize that Autonomy is necessary for their growth. This type of self-driven decision-making yields frequent recognition of patterns and curious investigation of new techniques, services, and treatments. This encourages a healthy manifestation of SDT, further fostering the individual's intrinsic motivation. Not calling for backup, unless necessary, has the potential to empower you, via self-determination theory and intrinsic motivation, more than any other growth technique.

The second tenet of SDT, Competency, refers to the basic need of the individual to feel that he or she has an area of expertise or specialty. This is the essence of finding a niche. Individuals who find, embrace, expand, and share their Competency are much more likely to be happy and achieve at a high level.

Associates who can pursue and grow their areas of Competency are more likely to enjoy their job and be retained in the long term. Therefore, associates seeking to find their niche need to investigate, pursue, review, and grow areas in

which they show interest and skill in order to help themselves achieve happiness through increases in their personal intrinsic motivation.

The final tenet of SDT, Relatedness, is less tied to the associate and instead is tied to the social support and relationships they have. Associates need to seek out individuals who improve their access to information, provide external resources, ally with them, and reduce stress.[11] These individuals may come in the form of a manager, owner, mentor, or peer. Who they are matters less than their expression of unconditional friendship, as expressed not by value to each other but by a true unconditional caring for one another.

Relationships such as these can be difficult to find, but will play a central role in the associate's career. Without Relatedness, the associate will always struggle to truly find happiness at work, as well as experience an incomplete or faltering sense of intrinsic motivation, stunting their long-term growth. One can argue that Relatedness is the most important tenet in establishing healthy, growth-oriented, intrinsically motivated associates. Williams in 2009 showed that active exclusion from relatedness-type relationships, even at a virtual level, led to negative effects and psychological distress to the individual's psyche.[13] Obviously this is not ideal for creating a growth-based mentality for associates.

Each of these SDT tenets can be well served by leveraging the previously discussed Triple Package skill set we know associates possess. Properly fostered, Autonomy, Competency and Relatedness can fulfill the individual's Triple Package needs to prove superiority, provide the tools to address and reduce feelings of inferiority, and force them to employ impulse control along the way as they grow via their own intrinsic motivation.

Associates should now understand the psychological methods that they, as well as clinic owner, can employ to leverage their intrinsic motivation and aid in the discovery of a niche. But theory and psychology are not enough to create successful associates. These extraordinary individuals also need the right tools and routines to continually fuel their growth.

Tools for Finding and Growing Your Niche

Once the associate has begun to embrace Self-determination theory and the intrinsic motivation garnered from engaging it in conjunction with their Triple Package traits, they will begin to experience more volition, motivation, and engagement than before. The harnessing of this psychology is key to creating high performing and persistently creative associates. At this stage of their development, the associate must be made aware of exactly why they are pursing this higher level of performance and the unique tools or strengths they can engage along the way to facilitate their journey. The knowledge of why their niche appeals to them and how they will achieve competency within that niche will help direct their creativity toward a niche that will never lack a clear purpose, and create a plan for its development.

The most powerful tool an associate can utilize in the actualization of a niche is their "why." In Intentional Living, author John Maxwell describes the power of finding an individual's "why" by saying:

> *"Once you find your why, you will be able to find your way."*[8]

In this context, the why provides a reason for the individual to proceed by showing them their true purpose for being there.

When an individual understands their purpose in the context of their "why," they will be able to find the energy to continually seek growth, overcome obstacles, and fuel endless creation. If readers think back to the Triple Package belief system, they will recognize that the associate's "why" can provide them with the fuel to apply toward their Impulse Control to give up when their growth becomes difficult and progress stagnates.

A great "why" also makes the individual attractive to others. When someone has a visible purpose, they will appear larger than life, compelling others to join them in their journey toward competency and significance. Maxwell describes how these individuals have an "air of distinction" that is not driven by ego or arrogance, but instead simply by a clearly delineated sense of purpose.[8] Individuals reaching this stage of "why" can leverage this presence to cultivate powerful relationships via the SDT tenet of Relatedness, stated simply: this air of distinction attracts like-minded individuals like flies to honey, and results in the expansion of the individual's network and relationships.

An individual's "why" is unique to them, and the knowledge of it often lies dormant and unknown to the individual without their being prompted and guided to think and actively discover it. However, there are many ways for an associate to discover their why. The author will briefly introduce 3 "why" discovery techniques below:

1. In the first technique, John Maxwell describes his "why" discovery process by having the reader ask themselves 3 distinct questions:
    a. ***What do you cry about?*** What issues or problems cause you so much discomfort that you feel motivated to act and find the situation?
    b. ***What do you sing about?*** What strikes you at a deep level, causes joy to rise up inside of you? What would you consider doing for free, just because you feel it should be done?
    c. ***What do you dream about?*** What would you do if you knew you could make a difference on a larger scale?[8]
2. The second technique for discovering your "why" is the author's personal favorite. In 1930 Sakichi Toyoda, founder of the Toyoda Industries, invented a thinking technique known as the 5 Whys. This technique originally was used to understand the true causes of manufacturing errors, but can be applied as well toward finding an individual's why.

a. First the individual asks, ***"Why do I do what I do?"***
b. Second, they take the answer to that question and ask again "***Why do I want to [answer to a.]?"***
c. This continues until the individual concludes they can go no deeper in the question line, often after approximately 5 iterations of this singular question.[6]

3. Finally, for those seeking greater and more in-depth guidance when finding their "why", the author recommends buying *Find Your Why*, by Simon Sinek.[12]
   a. In this book, Sinek will take readers step-by-step through a discovery process for their why.
   b. At its core, this book will take the reader through a process that gets them to answer their why in the format of this statement: ***"[My why is] to do _____ (contribution) so that I can _____ (impact)."***

Assuming an associate does the work of discovering their "why", they are now left with the troubling task of discovering how they can accomplish it. How will they use this newfound knowledge? Do they have the skills needed to really turn their "why" into something of impact and significance? The best way for individuals to begin this journey is to understand the strengths, talents, and skills they are working with. Business guru Peter Drucker best describes the critical nature of this journey to discover your talents when he says:

"Most people think they know what they are good at. They are usually wrong…And yet, a person can perform only from strength."

A good way to start this journey is with a simple combination text and test created by author Tom Rath and managed by the Gallop Company, via the *StrengthsFinder 2.0* book.[9] This small text is the ultimate tool for discovering an individual's talents, which can then be built into areas of strength using the routines we will discuss later. After reading 31 pages of text, readers will take a 40-minute talent discovery test: the StrengthsFinder 2.0. This test will rank test takers on 34 unique talents (the author highly recommends paying the upcharge to see the full 34) that span from "Achiever" to "Woo."

Once an associate procures the knowledge of their personal talents, there are many unique ways they can apply and leverage them. For example, if they rank low in Woo, a talent for interacting with other people, they may wish to delegate personnel or client interaction to other peers within the clinic. Whereas individuals ranking high in a trait like Ideation (a trait linked to a propensity for creating connections and powerful brainstorming) might excel in a rolle of discovering and developing new services for their clinic.

No matter what talents the associate excels in, they can now use these talents to craft the story of how they will pursue their "why." They will now understand what they need to do, who they will need to engage to help and what roadblocks may occur along the way. This means the only piece remaining is to craft a system or routine that will continually feed into these talents, driving the pursuit of their "why" and subsequently fostering the development of their niche within their clinic.

A System for Perpetural Niche Growth

To satiate their natural intrinsic need for growth, associates will now need to focus on creating an organized and systematic system for the growth to occur. The author recommends readers concentrate on a system that leverages the activities of Input, Thought, Creation and Reflection. There are many variations on this type of system, but in its simplest form the basic system described below will work well for associates looking to jumpstart the development of their niche.

For an associate to develop and refine their niche, they will need to continually input new information into their system. This means they need to regularly collect, organize and consume content in various forms as it relates to the pursuit of their why. This is critical, because as Ronald Osborne states:

"Unless you do something beyond what you have already mastered, you will never grow."

Continuous input is generally accomplished through media consumption. This media can be in a variety of forms such as books, magazines, webpages, podcasts, or video. The type is not important; what is more important is the consumption and exposure to new ideas and connections. Below, the author will list several quality media sources that he invites readers to select from as they see fit.

1. **Books** – A link to the author's continuously updated, personal Trello library of recommended idea and developmental texts can be found at tinyurl.com/qrx6ddp.
2. **Magazines and Journals** – *Hoards Dairyman, Progressive Dairyman, Feedstuffs, Journal of Dairy Science* and *Dairy Star* are all credible quality resources for the large animal dairy practitioner to source new topics and ideas.
3. **Websites –** *Medium, Harvard Business Review* and *TheLadders* will provide the reader good information on professional development, as well as cutting-edge business research.
4. **Podcasts** – There are many high quality podcasts out there, and readers should select shows in their areas of interest. The author personally enjoys the following podcasts: *Have You Herd, The Brendon Show, TED, The Gary Vee Audio Experience, Marketing Secrets, The Life Coach School, The John Maxwell Leadership Podcast*, and *The Ed Mylett Show* on a regular basis.

However, uncontrolled input is not necessarily going to drive the niche growth associates are seeking. Along the way, they must seek to encourage the application and connection of these different ideas with their day-to-day experiences. As Marie Forleo describes:

"Eventually we [want to] weave innumerable skills, experiences, and ideas into a multilayered, multi-faceted, one-of-a-kind career tapestry."

We can encourage this type of growth via thought. This means an associate needs to actively consume the information by taking notes, creating links between ideas, and brainstorming possibilities along the way. While there are many different possibilities for accomplishing the application of thought, the author recommends 1 simple one: brainstorming via Blind-Writing.

Blind-Writing is the act of blocking out a set amount of time every day to sit down with one's thoughts and notes from recently consumed media and simply letting thoughts flow onto paper. During this period, the associate writes and explores connections between their current knowledge and the newly consumed content. This is when ideas can be more deeply researched as targeted growth points or conflicts are identified and broken down on paper. It matters not what is thought about. What is more important is the allowance of dedicated time for the brain to process, absorb, and tie together the different ideas and experiences of the associate.

By the end of these Blind-Writing sessions, a plethora of patterns and possibilities will become clear to the reader. This is the point at which they must switch gears from theoretical processing to action. For as Leonardo Da Vinci eloquently stated:

"It has long since come to my attention that people of accomplishment rarely sat back and let things happen to them. They went out and happened to things."

The reality of this systemic approach to the pursuit of one's "why" is that it can easily become bogged down in the acts of media consumption and thought. These behaviors are low risk and do not force the associate to grow in any measurable way. Without visible or measurable growth, the associate risks undermining their intrinsic motivation through a lack of progress of their self-determination traits. Therefore, the author must impose a strict diet of routine action on appropriately developed ideas.

Not every idea is going to change the world, make thousands of dollars or develop a new service, but the simple act of action will cause the associate to grow, learn new skills, and improve their sense of Autonomy, Competency and Relatedness, creating a positive feedback loop. The author cannot overstate the importance of this singular step and its role as the #1 reason associates fail to continually grow. Because as Tobe Brockner says:

"Ideas, even great ideas, are a dime a dozen. Without implementation-without action-those ideas are ultimately worthless."

The final step in this niche development system is known as reflection. This means the reader simply looks back on the action, thought, and input steps and reviews how they worked. This is the stage where associates can take this system and craft it to their own interests or strengths. Examples of reflection revelations might include struggling to read books but loving podcasts in the truck, and therefore changing the type of input they seek. Maybe they acted on a new service idea but selected the wrong client to implement it at and need to reevaluate who they seek to partner with in the future. Or they may just find that they need to work harder to develop their thoughts before taking action. No matter the conclusions from reflection, they will have a positive effect on the associate. This is the step in which they learn from their experiences regardless of the positive or negative result of their actions. As the famous Nelson Mandela said:

"I never lose. I either win or learn."

Conclusions

That is it, associates! A simple system that leverages your neurobiology, psychology, "why", and talents to send you on a path of self-discovery, resulting in a niche that you will perpetually be motivated to refine and grow.

While it may seem like a lot of information to simply find your niche, a superficial understanding of how each of these factors ties into your long-term success will ensure you are educated enough to identify whether one of these areas begins to slip during the development of your niche, and you will know how to correct it.

The author will leave readers with one final thought for those of you who feel as though you lack support within your current clinic for such a self-growth plan. You may feel alone and unsupported currently, but know that there are those of us out here taking note of your growth and achievements. Rare does an individual go unnoticed in his/her quest to have an impact. Until that day, take solace in this Paul Arden quote:

"We all want to be proud of the company we work for. It enhances our reputation, makes us look good, feel good and gives us access to the best people… But not everybody is fortunate enough to be able to work for the outfit that is currently favored. So, given that not everyone in your company is an idiot, what are you personally going to do to make it the company of the year? Start by talking it up. Begin thinking and behaving like a winner. It will stop the rot. It will temporarily halt negative thinking and a defeatist attitude...people will soon get the idea…Decide you are going to make the company great; at least decide you are going to make a difference…..

You are on your own. Just do it. Better."

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Parlor analysis – parlor anatomy, basic system tests and how to perform this service

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Abstract

Milk quality on the dairy farm is influenced by the cow environment, the milkers, and the milking machine. A total milk quality program must therefore not overlook the milking system. The milking system can influence milk quality, bulk tank somatic cell counts, and clinical mastitis rates in many ways. Understanding what each part of the milking system does and how to test that it is functioning appropriately is key to providing milking system evaluation and milk quality troubleshooting services at your dairy practice.

Key words: milking system, milk quality, parlor analysis

Goals of Milking

The goal of milking is to efficiently remove milk from the udder while maintaining stable teat end vacuum. We do not want to harm the cow by either causing pain during milking or by causing teat end damage over time. We want to prevent contamination of the milk during milking and to cool the milk as fast as possible after collecting the milk in the bulk tank.

What are the Non-sanitary Components of the Milking System

The non-sanitary portion of a milking system involves all components that do not touch milk. This includes everything from the vacuum pump to the sanitary trap. The vacuum pump is the vacuum source of a milking system. Its main function is to create a vacuum. It can either be a conventional pump that runs continuously at the same vacuum level, or a variable-speed pump that changes speed as the system requires a change in vacuum level. A variable-speed pump saves electricity and is very efficient.

The filter/distribution tank is designed to prevent accidental introduction of items or debris into the pump which would cause damage to the pump. It also serves as a reserve of air to maintain vacuum in the system.

A regulator or vacuum controller allows atmospheric air to be introduced into the system as needed. Systems with a conventional pump require a regulator to let air into the system to maintain system vacuum. Systems with a variable-speed pump do not require a regulator, but do have an electronic vacuum controller component that regulates air administration as the system requires vacuum.

A pulsation system is used during milking to decrease milk slugging and establish consistent milk flow during milking. This system allows for alternating milk and rest phases to be applied to the teat to effectively harvest milk without causing damage to the teat ends.

Automatic take-off units are used to automatically remove the milking cluster from the udder at the end of milking. The goal is to remove the milking units when the teats are still plump with milk but the udder is empty. This involves setting the automatic takeoffs with 2 settings. One is the end of milk flow rate, measured in pounds of milk being extracted per minute. The other is the end of milk delay, which is set at seconds that the milk is flowing at a certain rate. The combination works well to remove milk without applying vacuum to teats that are not plump with milk.

A sanitary trap is the component of a milking system where the sanitary and non-sanitary sides of the system meet. The sanitary trap prevents milk on the sanitary side from getting contaminated.

What are the Sanitary Components of a Milking System

The sanitary components of a milk system are all the components that touch milk during milking. This extends from the milking inflation all the way to the bulk tank.

The inflation is the flexible piece that actually touches the cow. It provides massage to the teat-end through vacuum which causes the milk to be extracted. These can be made of either rubber or silicone. The milk runs through the inflation and into the bowl component of the milking cluster. From the milk bowl it runs through a milk hose into the milking line. The milk line is typically a stainless steel pipe that the milk flows through and leads to the receiving jar. When milk reaches a certain volume in the jar measured by electrodes in the jar, a transfer pump turns on and pumps the milk from the receiver jar to the bulk tank. The purpose of the receiving jar is to prevent slugging of milk in the bulk tank to prevent fat molecules from breaking down, causing milk spoilage. It also eliminates the need to have the bulk tank under vacuum.

As milk is pumped from the receiver jar headed to the bulk tank it goes through a milk filter. This filter removes any dirt, debris, bedding, or manure that happened to contaminate the milk during milking.

Milk is collected in the bulk tank where it stored until a milk company picks it up. The bulk tank has 2 functions, storage of milk and milk cooling. Milk must be chilled to less than

45°F (7.2°C) within 2 hours of being removed from a cow. Bulk tanks have coolant circulated through their tank walls to cool the milk. There is an agitator motor that circulates a paddle at the top of the bulk tank to agitate the milk and keep the fat component of the milk from settling on the top.

Milking System Analysis Overview

Some of the steps of a milking system evaluation can be performed on a static system (not during milking); however, most steps should be performed dynamic (under load, during milking or simulated milking). One of the primary advantages of being able to perform a milking system analysis during milking is that it enables the tester to also observe the milkers. This step should never be overlooked. I have found that if I just stand in the parlor and watch milkers, they know they are being watched and often their behavior is altered by the presence of an observer. However, if the milkers think you are testing the system you will get their normal activities in the parlor.

Equipment you will need to test milking systems includes a digital vacuum gauge, an air flow meter that allows a measured amount of air into the milking system, a pulsator analyzer (Triscan or Digimet), inflation plugs, tubing, timers, strip yield cups, test ports, short pieces of milk hose, lag time and teat end health data logging system (I use apps on an Ipad), Lactocorder milk flow measuring device, and VaDia vacuum evaluators.

Static Testing of a Milking System

The first step in performing a milking system evaluation is to measure system vacuum. This is best done at the receiver jar, pulsator line, regulator, and the vacuum pump. At no point should vacuum vary by more than 0.6 in Hg. I like to compare my measurement to the parlor's vacuum gauge. I find that the gauges in parlors are rarely accurate!

The next step is measuring effective reserve. Effective reserve is defined as the maximal amount of air that can be let into a system and still maintain stable vacuum. I do this by placing an air flow meter near or on the receiver jar. I open air flow meter holes to allow enough air to lower system vacuum by 0.6 in Hg. I record the amount of air in cfm that was admitted. The goal for effective reserve is 1 ½ to 2 cfm per unit + 35 cfm. Example = 10 milking units would need 50 to 55 cfm of effective reserve.

Reasons for low effective reserve include inadequate vacuum pump output, excessive air leaks allowing air to escape, and poor regulator performance.

The next step is measuring manual reserve, which is the amount of air that can be admitted and maintain stable vacuum with the vacuum controller (regulator) disabled. This measurement is for non-variable speed systems only. I perform this by removing the regulator and plugging the pipe it was connected to. I then place an air flow meter on the receiver jar as I did when measuring the effective reserve. Caution: make sure enough holes are open to accommodate pump capacity or you can collapse the receiver jar. I then close the openings on the air flow meter until the vacuum measurement is 0.6 in Hg below system vacuum. I record the amount of air in cfms.

Reasons for low manual reserve include inadequate vacuum pump output and air leaks in the milking system. In a perfectly functioning system, the effective and manual reserves will be the exact same. The regulator efficiency is the ratio between the effective reserve and the manual reserve. Example – if effective reserve is 50 cfm and manual reserve is 100 cfm, then regulator efficiency is 50%. Goal is to have regulator efficiency over 90%.

The next step in testing a milking system is to measure the vacuum pump capacity. All vacuum pumps are rated at 15 in Hg. You can expect a vacuum pump to produce 10 cfm of air per horse power. This means a 10 HP pump should have a capacity of 100 cfm.

I test vacuum pumps by disconnecting the vacuum pump line from the milking system and use my airflow meter again to measure the amount of air displaced by the pump at 15 in Hg. I record this amount of air. I also use this time to evaluate the belts on a belt driven pump to make sure they are not too loose or worn.

After a milking system passes all the static testing (not during milking), I then will perform the dynamic tests (during milking).

Dynamic Testing of a Milking System

I start the dynamic testing by measuring teat end vacuum at the inflation short milk hose during peak milk flow. Peak milk flow usually occurs at 30 to 45 seconds after unit attachment. The goal for teat end vacuum is 10.5 to 12.5 in Hg with less than 1 to 1.5 in of fluctuation in a low line and less than 2 to 3 in fluctuation in a high line-style parlor.

My observation is that fluctuation is highly variable between different types of milking systems.

During milking, I evaluate for proper unit removal. If units are manually removed, the vacuum should be shut off before removal. I don't want to see any machine stripping! I rely on my VaDia and Lactocorder reports to evaluate whether automatic takeoffs are functioning properly and at an acceptable time. I evaluate strip yields immediately after removal. The strip yield goal is to have over 70 to 100 mL per quarter or 250 to 400 mL per cow. It is difficult to have too high of strip yields! I also like to evaluate teat-ends after unit removal. Teats should not be discolored or have a ring of compression/banding.

I like to evaluate all pulsators with a Triscan machine when the units are under load. Check to see if pulsators are pulsating side-to-side or front-to-back. Proper Triscan graphs should display : A + B phase = milking phase. Should be 50 to 65% of the cycle.

B Phase = time in milk, should be >450 msec. C + D phase = rest phase. Should be 35 to 50% of cycle. C phase should likely be over 100 msec. D phase = time in rest. Should be >200 msec. Rate = number of cycles per minute. Goal = 60. I like to evaluate the ratio of rest to milk phase time as well. I like to make sure all the pulsators match between and within by 5 to 10%.

Lactocorder machine graphing provides a lot of useful information. It can measure startup milk and the presence of bimobality, peak milk flow, average milk flow, total milk time, and end of milk unit removal. I like to see no or minimal bimodality. I want peak milk flow rates of greater than 8 lb (3.6 kg) per minute. With good milking routines, 10 lb (4.5 kg) per minute is attainable. I like to see milking units removed when milk flow rates drop to 2 to 3 lb (0.91 to 1.4 kg) of milk flow rate for 3 to 5 seconds.

VaDia vacuum recordings are also very useful. VaDia units can be plugged into the mouthpiece, short milk tube, and pulsator hoses during milking. Continuous recordings while milking provide very valuable information at several data points.

Mouthpiece vacuum levels should be less than 5 inches during overmilking and less than 4 to 5 inches during peak milk flow. If high mouthpiece vacuum is present, it indicates the teat is not sealed against the inflation. This can be from an inflation that does not match the teat size of the herd, poor stimulation or improper lag time (overmilked at beginning of milking), or overmilking at end of milking (delayed take off, improper ATO settings). I like to see less than 15 seconds of over-milking and less than 5% of VaDia graphs displaying bimodality.

Milker Routine Evaluation

I prefer to evaluate the milkers during milking without them knowing they are being evaluated. I like to see if there is a milking routine? Is it written? Are employees trained and evaluated? The veterinarian is a useful resource for developing and writing a milking routine, as well as training employees along with future evaluations of compliance.

I like to see if the routine is consistent between employees and between cows? What is teat and udder hygiene as cows enter the parlor? Do milkers wear gloves? Is predip applied to adequately cover all teats? Is predip removed in a manner to thoroughly clean teat ends and provide stimulation? Are cows properly forestripped in each quarter = 1 to 2 good squirts of milk? Is lag time appropriate and similar for all cows? Lag time should be 90 to 180 seconds. Teats should be plump with milk when units are attached. Lag time begins with forestripping stimulation, not predipping. Inadequate lag time leads to bimodal milk letdown and poor milk flow rates. Prolonged lag time is often associated with good startup milk without bimodality but poor milk flow rates due to loss of oxytocin effect. I like to see if units are attached in a way to minimize air admission? Are units properly aligned on every cow? Do cows stand nicely for milking and preparation or are they uncomfortable and nervous? I also like to see if teats are covered with a post dip after milking.

Teat End Scoring

I like to score teat-ends on as many cows as possible during milking. I like to score them right before the post milking dip is applied. On small herds, 100% of the teats should be scored. On large herds, a minimum percentage of the cows should be scored in each pen (usually >80%). I use an app on an Ipad to quickly record teat end scores. The goal is to have 85% of teats with a score of 1 to 2, 10% with a score of 3, and <5% with a score of 4. Reasons for poor teat-end condition include unstable teat end vacuum due to inadequate reserve, poor pump capacity, improper regulator function, excess milk hose length, slugging of milk, lifting milk, and inadequate pipeline size for number of units. Also improper teat end vacuum (too low or too high), poorly functioning pulsators, especially inadequate rest phase (D<200 msec), poor pre-milking stimulation …short lag time, long lag time, improper stimulation, or the action of overmilking cows (improper ATO settings or improper manual removal).

I prefer to compile all the information I gather during the static and dynamic testing and write a detailed report with my findings and my recommendations for the dairy producers. I find that including pictures taken during the dynamic testing are very helpful when dairy producers have team meetings to help train their milking team. I recommend to each of my dairy clients that their milking systems should be evaluated every 12 months, or sooner if milk quality concerns develop.

Buying into a practice – Personal experience and advice for new grads

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Abstract

Buying into a practice can be a scary proposition, but by doing 3 things you can set yourself up for success both professionally and financially. Upon graduating veterinary school, we have been consistently trained to use our left brain much more than our right. As we transition from mastering technical skills involved in routine bovine practice into more of a managerial or leadership role, we must grow and practice using our right brain. It is vital to first build a solid foundation as an associate based on work ethic, communication, and selflessness. Practicing leadership, reading to absorb new ideas and information, and learning from your colleagues and mentors is a great place to start.

After deciding that you are a good cultural fit and would like to purchase a practice, you must have an accurate valuation based on the true profitability of the business, complete a feasibility analysis, and create a buy-in/buy-out agreement that is fair for both sides of the transaction. The holy grail of practice ownership is that you are acquiring equity while having the business actually pay for your buy-in.

Key words: veterinary practice, leadership, buy-in, equity

Using your Entire Brain

As scientists generally and veterinary students/new grads specifically, we have been trained to be analytical, rational, planned, and logical. All of these are left-brain skills which allow us to think through the scientific method quite well. We were hired to perform technical skills by using these left-brain thought processes. There are many parts of bovine medicine that require almost no thought after you have mastered the technical skill itself. These skills thus are the table stakes that are required to be an experienced bovine veterinarian. Progressing into an ownership role you must possess more soft skills such as compassion, emotional intelligence, judgement, empathy, and creativity. These are all right-brain skills and are normally less developed in our left-brain-dominant profession. To take that next step to become a practice owner who is a leader and possesses these right-brain skills, we must train our mind. The foundation on which you can build upon should be built as an associate. A few simple ways to strengthen your skills include finding your niche and creating a new revenue source for the practice; effectively leading staff and peers by showing dedication, hard work, respect, and selflessness; and training farm employees to perform a task. In addition to deliberately practicing, you should read or listen to audiobooks as much as possible and across all different subjects. This will help broaden your mind and form linkages between subjects that you probably wouldn't have otherwise. Lastly, look to your colleagues and mentors for guidance. Instead of recreating the wheel, learn from them and ask questions to understand why and how they do certain things. Implementing these few things will set up the foundation allowing you to become a leader within your veterinary practice. Every day you should show leadership as a practice owner by empowering, inspiring, and motivating people so they can accomplish more than even they thought possible by giving them objectives and goals while also giving them the tools to achieve them.

Does it Make Financial "Cents"?

Now that you have starting developing your right-brain skills and have decided that you would like to be an owner, it is time to dive into the financial health of the business, and this is done by first understanding what you are purchasing. It is important to note that no matter how much financial knowledge you might have, it is extremely important to obtain outside professional help to guide you through this process. Veterinary appraisers, accountants, and attorneys all play a role in making sure that the process is a fair and smooth transaction. When assessing the value of a practice, you must first know what you are buying. Profit from business operations is the key financial metric to be considered when deciding on a valuation of a veterinary practice. A feasibility analysis will help determine if the valuation of the practice is at fair market price and includes the use of last 3 years of profit/loss statements, tax returns, and productivity reports.[1] It is important to make sure that you do not strictly look at the tax returns to identify the profitability, because these numbers can be skewed for various reasons. The analysis must first include the monies flowing to an owner including profits, owner's compensation as a veterinarian, owner's compensation as a practice manager, and any rental income. If this total compensation will cover the principal and interest payments, taxes, and provide sufficient personal income, then it is a fair price and it should be considered safe to move forward with the buy-in process. I want to repeat: the business should be profitable enough and have sufficient cash flow so that the business itself is buying you in, while also receiving an increased salary compared to that of an associate. This is what some call the "holy grail" of buying into a practice. As the

business buys in for you, the financial equity you have in the business is increasing steadily. So not only should you have an increased salary due to becoming an owner, you should also have the business buying in for you with the purchased equity as the compensation. Lastly, when and if you sell, you can also enjoy the increase in value the practice has incurred under your tenure.

Buy-Sell Agreement

The last step in making sure that buying into and selling out of a practice is a smooth process is making sure that the operating agreement, also known as the buy-sell agreement, is fair to all parties. This is the key document laying out how the ownership stake will be divided, the terms of the buy-in and buy-out, and what happens in the event of marriage, divorce, bankruptcy, disability, or death. It also details how the purchase price will be determined, and usually sets up a non-compete clause if there isn't already one in place. It is vital that you do your due diligence to make sure this document is fair, especially if you are the first associate to buy in or you are buying the practice outright. A veterinary attorney should be involved when creating or updating the buy-sell document.

Conclusion

There are 3 separate but equally important factors to consider when buying into a practice. You must first develop your right brain to improve skills that will make a more successful and effective leader, you must make sure that the practice is a good fit culturally and financially, and you must make sure that you have a buy-sell agreement in place that is fair to both the buyer and the seller. These three activities will allow you to make an informed decision while also setting you up to succeed as an owner of a veterinary practice.

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Buying into a large animal ambulatory practice: The good, the bad, and the finances

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Abstract

Most large animal ambulatory veterinary practices are owned by 1 or more of their practicing veterinarians. For associate veterinarians who aspire to be practice owners, there are several areas which should be investigated before purchasing a share of a business. The advantages and disadvantages associated with ownership should be recognized and considered heavily. Having a working knowledge of the business finances, partner pay structure, decision-making process, and ownership contract details makes for an informed buyer. Before purchasing into a veterinary business, it is important to understand what is included in the purchase price and how the purchase will be paid If financing outside of the current business owner(s) will be used, there are several requirements that must be met to be considered eligible for a business loan from a lending institution.

Key words: practice ownership, debt, veterinary business

Introduction

Practice ownership is a large decision, both financially and emotionally. To make a wise decision, the aspiring owner should have a clear understanding of the advantages and disadvantages of ownership in general. They should research the business to be comfortable with whether it will align with their professional and personal goals. An understanding of what is being purchased at the buy-in and how to finance the endeavor is also pertinent information to be discovered before purchasing. It is this practice owner's opinion that obtaining information in these areas will allow an individual to make a well-informed decision on their future as a practice owner in a large animal ambulatory veterinary practice.

Advantages of Practice Ownership

Practice ownership offers an individual the ability to have a direct impact on the direction of the future of their practice. An ownership share gives an individual the voting right to influence upcoming changes in their business and allows more control over their own outcome. In addition, veterinarians typically see a significant increase in net income after practice ownership is achieved. Veterinarians early in their career (21 to 34 years) see an average of 1.35X and 2.11X increases in average salaries for women and men, respectively. Mid-career (35 to 44 years) and late-career (45+ years) veterinarians also see increases in average salaries ranging from 1.1X to 1.7X higher than their associate counterparts.[1]

A sense of pride and self-satisfaction in one's business is another benefit of practice ownership. A 2020 AVMA economic study found that practice owners have statistically significant lower values for burnout scores and secondary traumatic stress cores than their associate colleagues. They also have statistically significant higher compassion satisfaction scores than associates.[2]

Disadvantages of Practice Ownership

Alternatively, there are several disadvantages associated with practice ownership. The most easily realized disadvantage is the purchase cost for the ownership share, which usually includes monthly debt service payments.

Due to business cash flow fluctuations month over month and year over year, the owners can expect to see variations in owner pay. This may be drastically different if they were accustomed to a guaranteed and consistent monthly salary as an associate. A veterinary business's shareholder pay structure can include production, salary, or a hybrid pay system. Any of these structures along with the frequency of owner distributions has the potential to change the level of volatility in partner pay. A veterinarian's tax liability can be also different and potentially higher as a practice owner. This is strongly dependent on the business tax structure and should be discussed with a professional tax advisor before entering ownership. All of these financial changes can drastically affect a veterinarian's household cashflow situation and should be planned for in advance.

In addition to the fiscal repercussions, emotional investment in the practice after ownership can be significant. Dependent on an individual's personality, they may find ownership to increase stress levels due to their new ownership responsibilities and liabilities.

Considerations in Choosing a Veterinary Business

There are several considerations that need to be investigated and understood before deciding to purchase a share in any specific veterinary business.

Personal Considerations

The first is to evaluate whether the practice culture is a good long-term fit for the individual's professional and personal goals. Attention should be paid to how the partner(s),

clientele, business values, and mission statement will interact with the veterinarian's professional goals. In many cases, these are all aspects of a clinic that are difficult for the new owner to significantly change. Thought should also be put into whether the local community and schools, geographical area, and personal connections align with the individual's long-term personal interests and goals.

Business Considerations

An analysis of the veterinary business should include details on how the business is managed and how profitable it is. This entails an understanding of how and when the shareholders are paid, what the business's financial status is, how decisions are made, and how an owner can leave the business.

Regarding partner pay, there are many variations of pay structure which may include salary, production, or a hybrid pay structure which includes both production and salary (also called "ProSal"). The way in which these values are calculated should be completely understood by an individual who will be paid from such equations.

General knowledge of the business's current financial situation is imperative before buy-in. This should include transparency from the current owners and a review of the tax and financial statements by a third-party financial advisor.

It is recommended that the individual buying into the practice has been privy to conversations involving practice decisions, including owner business meetings. Understanding how decisions are made and having an insight into upcoming changes in business expenses, incomes, or policies are important for the soon-to-be shareholder as these will have a direct impact on them. The final business consideration that should be evaluated is what the contract and buy-sell agreement will entail when a partner leaves the business. Scenarios within the contract that should be evaluated are divorce, disability, death, removal of a partner, and a non-compete clause. A lawyer representing the purchasing veterinarian is strongly recommenced to protect their interests.

What is Purchased at a Buy-in?

Veterinary private practice buy-in includes the purchasing of 3 items: assets, accounts receivable (AR), and blue sky (also called goodwill). Assets are the tangible items of value, including trucks, products, equipment, and possibly the associated real estate. Accounts receivable is the money owed to the business which is typically outstanding client bills from work done in the previous month(s). The buying veterinarian should know how much of the AR is current and how much is from delinquent clients. Receipt of payment from a bill that is 2 years overdue is highly unlikely and should be considered and valued accordingly when calculating an AR buy-in value.

A business's blue sky is its potential to generate revenue in the future. This can include the current client list, pre-scheduled appointments, and the practice's reputation. Differences in business structure and philosophy allow for significant differences in the value of blue sky across veterinary practices. Knowing the value of blue sky upon entrance and the eventual exit from the practice is important for the individual to be knowledgeable on. The blue sky can also be viewed as a future liability, as the new owner will be expected to help fund payment of this value to any outgoing partners. If a young associate becomes owner with 3 other owners who are all near retirement, that individual should expect significant blue sky buy-out expenses in the near future. Therefore, it is beneficial for the buying individual to find a practice with historically low turnover rate in owners and for there to be diversity in the ownership age demographics.

How is Practice Ownership Financed?

Most veterinary practice shareholder buy-ins include a loan for the purchasing individual. This can be achieved by an "in-house" loan, which is financed by personal loans from the current owner(s) of the business, or an external loan, which typically comes from a lending institution such as a bank or a credit union. An in-house loan offers significant flexibility in many areas including rate, down payment, and amortization length.

When working with a bank, there are several parameters lenders may look for in choosing to loan money to a veterinarian buying into an ambulatory practice. Because these practices have relatively low amounts of tangible collateral, it is considered a "cashflow dependent loan." This means the individual must be able to demonstrate their ability to support their total debt service within the means of their proposed wages. This type of loan is commonly a Small Business Administration (SBA) 7(a) loan[2] which is partially guaranteed by the federal government for up to 85% of the loan value. Due to the nature of this loan, it is important for the individual to not be delinquent on any existing debt obligations to the U.S. government (including student debt)[3] and have a debt-to-income ratio of ≤ 45% using their expected ownership financial numbers.[2] For associates who aspire to become practice owners, achieving these requirements as well as proving to the bank that they can save money and pay down debt are action steps to take as they work towards ownership.

Conclusion

There are many facets in the decision to buy into a large animal ambulatory veterinary practice. It is recommended that the buyer have a clear understanding of advantages and disadvantages of practice ownership. Such an individual should pay close attention to the business they choose to buy into, know what they are purchasing, and realize the types of financing options available. Having knowledge of these areas paired with the help of professional tax and legal advisors are this veterinarian's suggestions to being a fully informed buyer.

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