

1 **Fresh cow disease investigation**

2 Nicole Costello DVM MPH

3 **Abstract:**

4 Breakdowns in the transition period are very expensive to both the dairy producer and the cow herself.
5 Correctly diagnosing transition issues and identifying their root cause are essential skills for any dairy
6 practitioner. Evaluating the individual cow, cohorts in the dry period and post-fresh pen as well as ration
7 and pen dynamics are all necessary when identifying the underlying cause to a transition issue. The
8 primary tool necessary to identify issues during this stressful period are the veterinarian's observational
9 skills and ability to organize retrospective and current data. Outside of observational skills metabolic
10 indicators such as nonesterified fatty acids, urine pH, ketone levels and serum calcium/phosphorus levels
11 are useful tools. Taking a holistic look at both the dry period and post-fresh period balanced with client
12 perceptions will ultimately lead to the root cause(s) of any issues in the transition period.

13 **Keywords:** Transition period, hyperketonemia, ketosis, hypocalcemia, milk fever, retained placenta, metritis,
14 blood BHBA, NEFA, Urine pH, transition disorder

15 **Introduction:**

16 Evaluation of the transition cow has evolved from a skill possessed only by dairy practitioners to one performed by
17 lay people daily with variable veterinary oversight. However, proper diagnosis and treatment in the transition period
18 determines the success of the cow in her current and subsequent lactations. Key aspects to a cow's success in the
19 transition period starts in the dry period with appropriate body condition, appropriate acidification (if feeding a
20 dietary cation-anion difference (DCAD)), and appropriate energy mobilization evaluated by body condition score,
21 urine pH (when appropriate) and Non-Esterified Fatty Acids (NEFA). In the post-fresh period appropriate body
22 condition, appropriate serum calcium and serum phosphorus levels, appropriate blood/urine/milk ketone levels and
23 appropriate classification of uterine disorders. This area of the dairy is one where the young veterinarian can make
24 an impact and build a consultative portfolio quickly and without significant up front cost by their employer. By

25 understanding how to approach a transition cow crisis and monitor for early signs of a transition issue the young
26 veterinarian can help their clients achieve success both before, during and after an issue arises.

27 Uterine Disorders – Retained Placenta and Metritis:

28 Common uterine disorders in dairy cattle include retained placenta and metritis. Retained placenta can be defined as
29 the failure to expel fetal membranes within 24 hours of calving. In many cases retained placentas are treated within
30 48 hours of calving after evaluating the animal's appetite, attitude, body temperature and presence of retained fetal
31 membranes. Comparatively, metritis can be defined as a foul vaginal discharge, with or without a fever, inappetence
32 and decrease milk production. Metritis cases can be treated up to two weeks after calving. These disorders are often
33 presented to the veterinarian as cows that aren't cleaning or a foul-smelling fresh pen.

34 Diagnostics involved in working-up uterine disorders rely primarily on the veterinarian's observational skills and
35 evaluation of what is happening to the cow in the present moment after understanding the herd's baseline. For
36 example, is this an acute problem, a chronic problem, does the herd run a moderately high level of uterine disorders
37 and have recently experienced an acute spike in cases. In the fresh pen cows should be evaluated for their body
38 condition score, both clinical and non-clinical cases, the presences of additional disease processes and dry period
39 length. Outside of the cow the fresh pen should be evaluated for cleanliness, stocking density and ration adequacy in
40 both the pre and post-fresh pen. Calving pens and pre-fresh pens should be evaluated for cleanliness and stocking
41 density as well. Differentiating between the diagnosis of metritis and retained placentas will determine which areas
42 require more focus in working up the cause of uterine disorders.

43 Hypocalcemia – Milk Fever:

44 Clinical milk fever can be defined as a cow who is unable to rise, hypothermic, tachypneic, quiet and unresponsive
45 often with a characteristic "S" curve to the neck. In all reality there are degrees to severity of hypocalcemia which
46 can result in incomplete presence of all clinical signs. When measured, hypocalcemia is defined as a serum calcium
47 level $<6.5\text{mg/dL}^1$. Sub-clinical milk fever can present as cows with suppressed milk production, variable weakness
48 in the post-fresh pen and a slower start to lactation. When measured hypocalcemia can be defined as a serum
49 calcium level between 6.5 and 8.0mg/dL^1 . This is often presented to the veterinarian as a high number of milk fever
50 cows, having to IV a lot of cows recently, or cows are struggling in the fresh pen.

51 Work-up of hypocalcemia relies directly on the veterinarian's observational skills for the individual cow as well as
52 group dynamics. Evaluating the body condition score of affected animals, evaluating the dry period length, timing in
53 the pre-fresh pen, and the timing of hypocalcemia relative to freshening. It is also important to evaluate the animal's
54 ability to respond to treatment with intravenous calcium to differentiate from hypophosphatemia which can present
55 similarly. In addition to understanding what is happening to the individual animal it is important to understand if
56 there have been any changes to how animals are treated in the transition period and ration changes in both the pre
57 and post-fresh pens. It is also essential to understand if this is a perceived or real deviation from baseline for the herd
58 you are working with.

59 Hyperketonemia – Ketosis:

60 Sub-clinical ketosis can present as a slight decrease in milk production with or without inappetence. Clinical ketosis
61 can be defined as an anorexic, lethargic cow with decreased milk production and weight loss. In some cases, the
62 breath may have an acetone or sweet smell and in severe cases neurologic signs may present as well. These cases are
63 often presented to the veterinarian as off feed cows in the fresh pen or possible displaced abomasum (DA) cows.
64 Veterinarians are most commonly asked to work up and identify causes of clinical ketosis as sub-clinical ketosis
65 often goes undetected in a herd unless ketosis monitoring is a part of routine fresh cow monitoring and results are
66 recorded. Diagnosing ketosis relies on the ability to identify ketone levels in the body through either blood, urine or
67 milk ketone levels, listed in order from most to least sensitive. It is also important to consider the body condition
68 score of the ketotic animals. Animals that are severely over-conditioned are more likely to present with ketosis due
69 to inadequate liver function and animals that are severely underconditioned may also present with ketosis after being
70 off feed for some period of time during the transition period. In addition to body condition score knowing how many
71 days in milk (DIM) a cow is at ketosis diagnosis can help identify the source of ketosis. For example, a cow
72 presenting with ketosis <7 DIM is more likely to have a root cause in the dry period as compared to a cow
73 presenting >7 DIM who is more likely to have a root cause in the post-fresh period. It is also important to consider
74 compounding disease processes as in many cases a breakdown in the transition period can result in multiple issues.
75 Identifying the primary issue then becomes the task of the veterinarian.

76 As ketosis is primarily a feed related disorder it is important to evaluate the entire post-fresh pen. Understanding if
77 any ration changes have been made within a week of identifying the ketosis issue. Identifying the current stocking
78 density of the fresh pen as it pertains to headlock space as well as free stall space, when applicable, and

79 understanding if the current stocking density is a deviation from normal. Identifying any time frame in which
80 animals are without feed and if that time change has been altered within a week of the ketosis issue arising. Looking
81 back even further and identifying the stocking density of the dry cow pen both now and when the ketotic animals
82 were housed there is also important. In the case of ketosis understanding the entirety of the animals environment is
83 an important part of identifying and correcting the root cause. In many cases it will be multifactorial and may correct
84 itself to some extent before the root cause is identified. However, in the process of working up a ketosis disaster on
85 farm a veterinarian may implement a fresh cow screening process that can turn into a long term consulting
86 opportunity and aid in identifying breakdowns more rapidly in the future by identifying sub-clinical ketosis before
87 clinical ketosis presents itself.

88 Transition Period Monitoring Basics – Dry Period:

89 Evaluating an animal's body condition score at key points in her lactation is one area that is often over looked by
90 veterinarians but is quite simple to not only perform, but track and use as an analytic tool combined with other
91 monitoring strategies. During the dry period an animal should not lose body condition or gain excessive body
92 condition, but rather maintain her body condition until calving. Seasonality plays a major role in how an animal can
93 maintain her body condition throughout her lactation and dry period. By routinely monitoring and recording an
94 animal's body condition score the veterinarian can communicate and work closely with herd owners and
95 nutritionists, but also anticipate issues in the post-fresh period before they arise. Animals that dry off
96 underconditioned require more energy in the dry period to calve at an appropriate condition whereas animals who
97 calve over conditioned are best suited to maintain condition through the dry period and aim to adjust during their
98 next lactation as opposed to decreasing condition during the dry period.² Utilization of body condition score during
99 the dry period is not only a great monitoring tool to anticipate problems in the post-fresh period, but is also an
100 indicator of the health of the herd as they finish their lactation.

101 Some herds utilize a dietary cation-anion difference (DCAD) diet during the close-up portion of the dry period.
102 When fed appropriately the DCAD diet works by acidifying the cow's overall pH to approximately 5.5-6.0 which
103 will improve calcium mobilization and decrease the incidence of hypocalcemia after calving. Routinely monitoring
104 the herds urine pH is a simple task that can be performed as a part of routine herd health or delegated to veterinary
105 technicians. To monitor the DCAD urine samples are collected from cows who are at a minimum of 14 days post-
106 dry off/movement into the close-up group and evaluated using a pH meter or pH paper. Over acidification can lead

107 to loss of body condition due to inappetence which leads to increased clinical/sub-clinical ketosis in the post-fresh
108 period while under acidification is ineffective in decreasing the clinical incidence of milk fever.³ Variation in urine
109 pH can be caused by inconsistent mixing, inconsistent feeding rates, changes to other aspects of the ration impacting
110 palatability and dry matter intake. Routine monitoring aids in rapid identification in variability outside of the target
111 range and minimization of issues in the post-fresh period.

112 Evaluation of Non-Esterified Fatty Acids (NEFAs) in the pre-fresh period can be an excellent evaluation of the state
113 of an animal's energy balance as she enters the stressful calving period. NEFAs should be measured 2-14 days pre-
114 calving with a threshold of $>0.3\text{mEq/dL}$.⁴ While NEFA testing can be done at the individual cow level it is most
115 commonly used as a surveillance tool in the pre-partum period. Herds with a NEFA level $>0.3\text{mEq/dL}$ in 15-20% of
116 the herd are more likely to have a higher incidence of transition disorders vs herds with a lower percentage
117 $>0.3\text{mEq/dL}$.⁴ When paired with post-partum NEFA levels or post-partum BHBA levels this can be a very useful
118 tool in understanding how stressful the calving period is on a herd basis.

119 Basics of Transition Cow Disorder Diagnosis – Post-Fresh Period:

120 Evaluation of the cow in the post-fresh period is something all veterinarians should be equipped to do on an
121 individual cow basis. Utilizing the tools we have available to clinically evaluate the post-fresh cow for individual
122 diagnosis we can create herd level thresholds when routinely monitoring the post-fresh group. Similarly to
123 monitoring in the dry period evaluating the post-fresh period allows the veterinarian to pinpoint breakdowns in the
124 transition period and address them before they become a larger issue. In larger herds it is common for employees to
125 screen post-fresh cows routinely up to three weeks post-freshening. Employees then follow a decision tree
126 appropriately treat the animal based on their findings of animal body temperature, presence of malodorous
127 discharge, ketone levels and general appearance. Understanding what this looks like on individual farms is essential
128 for the veterinarian to provide protocol oversight as well as determine if the farm is properly diagnosing and treating
129 specific disorders.

130 The simplest area of intervention is understanding how individual farms are identifying and recording their
131 transition events. In this veterinarian's experience, the most misconstrued disorder classification is retained placenta
132 vs metritis. Some herds will split this out diligently with treatments for each disorder. Other herds will lump both
133 together and treat them the same regardless of the animal's clinical presentation. Understanding how your clients are

134 not only identifying and treating animals but also how they are recording animals is essential to a full understanding
135 when evaluating a transition period crisis.

136 Body condition scoring is again a very useful area to consider when working up transition disorders that is often
137 overlooked by veterinarians and consultants. Animals should target a body condition score of 3.25-3.75 at calving.⁶
138 When evaluating post-fresh we can anticipate that an animal will have dropped her body condition score up to 0.25
139 of a point in the first three weeks through the stress of calving and transitioning into her lactation. Animals that are
140 extremely over conditioned are more likely to experience related to inadequate metabolism, hepatic lipidosis related
141 to ketosis, milk fever and a slow start to lactation during the post-fresh period. Under conditioned animals are more
142 likely to experience issues in the transition period related to inadequate energy, this can present as uterine disorders,
143 ketosis, and milk fever but may not exhibit a slow start to their lactation. Understanding how an animals body
144 condition has changed from her time in the dry period to post-freshening is a strong indicator of the amount of stress
145 that animal as undergone during the transition period. Stress during the transition period can result in any of the
146 transition disorders discussed here.

147 Evaluating animals for ketosis is something that has a very low barrier to entry for young veterinarians as the tools
148 needed for screening are the same tools needed for diagnosing ketosis. Blood Beta-hydroxybutyrate (BHBA)
149 measuring is the most reliable way to diagnose and screen animals and can be done on a routine basis evaluating a
150 subset of animals to identify sub-clinical ketosis prior to a ketosis break in the transition cows. To screen cows for
151 sub-clinical ketosis cows should be evaluated between three and fifteen DIM and approximately 5 hours post
152 feeding. Depending on herd size the number of animals evaluated will vary. For herds where more than twenty
153 animals meet the DIM criteria twenty animals should be sampled on routine basis. By evaluating animals five hours
154 after fresh feed is delivered veterinarians will most accurately capture sub-clinical ketosis as BHBA has been shown
155 to be the highest four to five hours after feed drop.⁵ This can be weekly, bi-weekly or monthly depending on the
156 degree of concern for the herd. When sampling this way, the veterinarian should target less than 15% of the animals
157 demonstrating a BHBA level greater than 12mgL/dL. A level greater than 15% reveals the presence of sub-clinical
158 ketosis and corrective action should be taken under the guidance of the herd nutritionist. Screening in this manner
159 can prevent a clinical ketosis outbreak and prevent future displaced abomasum cows by catching and treating early
160 while taking corrective action for the whole herd.

161 Comparatively NEFAs can also be measured post-fresh. When coupled with pre-fresh NEFA values post-fresh
162 NEFA values can aid in identifying the severity of transition period stress a herd is experiencing. When performed
163 routinely a herd baseline can be established and deviations from normal can be identified early resulting in more
164 timely corrective action. NEFA concentrations $>0.6\text{mEq/L}$ in animals 2-14 days post-partum demonstrates a
165 significantly increased risk of metritis, clinical ketosis and left displaced abomasum later in the post-fresh period.⁴
166 For herd level screening, $>15\%$ of animals with $>0.6\text{mEq/dL}$ indicates that animals are undergoing too much stress
167 during the transition period and corrective action needs to be taken to prevent further issues and losses. Ideally a
168 group of twenty animals would be sampled during the post-fresh period. For small herds this may indicated that all
169 animals between 2-14 DIM are sampled, whereas on larger herds random sampling is needed to limit sampling to
170 twenty animals. Post-Fresh NEFAs are less commonly performed due to the ease and low cost of utilizing blood
171 BHBA which return results cow side without the use of a reference laboratory.

172 Conclusion:

173 Working up transition disorders can be both frustrating and rewarding for the veterinarian. Understanding the
174 clinical animal is important, however, a deeper look at her environment in both the pre and post-fresh pens will aid
175 in identifying the root causes of transition outbreaks. This includes evaluating the body condition score of animals in
176 both groups, changes to the rations, stocking densities, periods without feed and overall stall cleanliness. Deviations
177 from the herd baseline in any of these areas can result in major breakdowns in the transition period. However, in
178 many cases issues are multifactorial and can be influenced by the season as well. By looking at the full picture of
179 what is happening to the animals in this stressful period of life veterinarians can not only correct current issues but
180 can develop a consulting portfolio to identify and prevent further issues in the future.

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