

The evolution of down cow management

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Abstract

While improvements have been made in how non-ambulatory cattle cared for over the past 35 years, they remain a challenge to manage on farm. Cows that are down, even for several hours, are at risk of developing secondary complications, further exacerbated by poor management and care, which impacts both their welfare and potential for recovery. Good nursing care results in better recovery rates and ensures compliance with quality assurance programs. Developing standard operating procedures for managing these animals, including euthanasia decision-making, is an essential step towards improving animal welfare on farm.

Key words: non-ambulatory, downer, welfare, nursing care

Background

Approximately 450,000 non-ambulatory cattle are reported annually in the United States, with 70% of American dairy producers reporting at least 1 non-ambulatory cow per year.¹ Although national statistics regarding these cows are not currently available in Canada, a similar trend is likely.² This represents a significant challenge to the dairy industry, causing financial and labour costs, as well as impacting animal health and welfare.

Defining non-ambulatory cows

There have been a range of terms used to classify non-ambulatory or recumbent cattle.² Typically, “down” cows encompass those unable to stand without assistance, regardless of mentation, position or time spent non-ambulatory,^{3,4} while “downer” is more specific and generally precludes animals that are non-ambulatory from an uncomplicated primary cause which would be quickly responsive to treatment. As such, downer has been described as an alert animal unable to rise after a specific time period (e.g., 12 hours,^{5,6} 24 hours⁷). This has been further defined as an animal in sternal recumbency which some authors have differentiated from “dying” cows, those which are dull and in lateral recumbency.^{7,8,9} “Downer cow syndrome” has also been used to more specifically identify animals that “appear” to be able to rise but can’t,⁸ cows which are unresponsive to calcium treatment,^{2,10} and cattle with secondary damage following recumbency from any primary cause.⁷ Further defining animals with secondary damage is an important concept, as prevention and treatment for these conditions is likely very different from dealing with the initial cause of recumbency. Unless the primary cause of recumbency is identified and treated quickly, such that the cow can again stand, there is a risk of progression to continued recumbency which can be as a result of pressure damage simply from being down,^{7,8,11,12} additional damage from unsuccessful attempts to rise,^{7,8} and additional damage caused by poor care and management.¹³

The problem of downer cows

Compartment syndrome

This condition is an ischemic myonecrosis which can be due to direct pressure, or inflammation within an osteofacial compartment occurring at a rate higher than the additional fluid can be resorbed, which then causes additional pressure within the compartment leading to damaged capillaries causing anoxic injury.¹⁴ Even when blood flow is restored, transudation from these damaged vessels occurs, further increasing pressure within the compartment. In cattle, the hamstring group is typically most at risk.⁸ When laying normally, the sternum bears most of the forequarter’s weight, relieving the front limbs, which are also not typically under the body. Conversely, the hindquarters weight is typically borne by the one hind leg placed under the body. The hamstring group also has a very thick fascial boundary which increases risk. However, any muscle group is at risk when either subject to injury and/or pressure, such as the forelimbs in animals unable to right themselves from lateral recumbency. As well, additional neuropathies can also develop when the region of pressure includes major nerves (e.g., sciatic).

Positioning of the cow is very important, as body position changes like lateral pelvic tilt can dramatically increase intramuscular pressure.¹⁵ This highlights the difference between cows that can reposition themselves and those that cannot; normally, cattle exert pressure on a hind limb while laying, but are able to do this and stand without issue when they have control over their movement and position and are able to reposition frequently. Cox⁸ showed that the downer syndrome can be induced by as little as 6 hours in sternal recumbency under halothane anesthesia. Lesions produced by these experiments varied, from cows that could rise but had transient hindlimb ataxia, to those unable to rise with marked ischemic necrosis of the thigh, inflammation of the sciatic nerve, or peroneal damage.⁸ Slight differences in positioning were thought to relate to these variable outcomes.

Diagnosing compartment syndrome has been suggested by Clark et al.¹² with thresholds of CK dependent on time since non-ambulatory (> 12,500 U/L at 24 hours, > 11,000 U/L at 48 hours, and > 9,500 U/L at 72 hours) or an AST above 1,110 U/L, based on a predicted chance of recovery at < 5%. This is not an uncommon condition, with 35% and 28% of cows down for greater than 24 hours meeting the definition in 2 Australian field studies.^{9,13} Similarly, prognosis was poor when this condition was diagnosed, with only 8% of affected cows recovering in the latter study.⁹

Additional secondary damage

Beyond compartment syndrome, cows persistently recumbent are at risk of other kinds of injury. This includes neuropathic damage (which may include the radial nerve, brachial plexus, femoral nerve, sciatic nerve, obturator nerve, or tibial nerve), hip dislocation, muscle tears (which may include obturator

muscles, adductors, or gastrocnemius), fractures and major disease secondary to being recumbent (such as pneumonia, diarrhea, severe bed sores and joint infections).¹³ As a whole, these conditions are common, with 84% of cows down for 24 hours developing some form of secondary damage (including 28% with compartment syndrome and 56% with other types of damage).¹³

Specific risk factors may be linked to the development of this additional damage. “Crawling” or “creeping”, where cows manage to move while being non-ambulatory with lumbar spine hyper-extension is thought to risk damage to the femoral nerve root,^{7,13} while leaving animals in lateral recumbency predisposes to forelimb neuropathies, aspiration pneumonia,⁹ inappropriate moving or hanging by hip lifters can cause muscle damage,¹⁶ as well as muscle tears or hip dislocation from unsuccessful attempts to rise,⁸ and poor hygiene and soiled bedding risk developing mastitis and bed sores.

Prognosis and recovery

General chance of recovery for non-ambulatory cows has been estimated to be 10% for first lactation animals, 18% for lactations 2-4, and 22% for 5+ parity cows.⁴ In an observational field study examining 218 cows down for at least 24 hours, 24% recovered (became ambulatory) in the first 7 days, with an additional 8% recovering after that time period.¹³ Another study with 220 cows from 152 farms, either non-responsive to IV calcium or down for a reason aside from hypocalcemia, had a positive outcome rate of 35%.¹⁰

Biomarkers

The cardiac biomarker troponin (cTnI), using a cut-point of > 0.7 ng/mL, has a 78% specificity and 54% sensitivity at predicting euthanasia within 7 days for downer cows.¹⁰ Neutropenia, and elevated AST and CK have also been shown to be associated with euthanasia risk for downers,¹⁷ similar to that found previously and describe above for compartment syndrome.

Heart rate

Heart rate, which can be a non-specific indicator of pain, has repeatedly been shown to be associated with outcomes in downer cows, with a HR of > 100 bpm having an 85% specificity and 35% sensitivity at predicting euthanasia.¹⁰ Cows with heart rates of over 100 or 120 are associated with 2-3 times the odds of euthanasia.^{10,17} Additionally, inappetence and mentation have also been shown to have associations with negative outcomes.^{10,17}

Flotation therapy

Flotation tank therapy appears to have higher recovery rates, although the admission population may not reflect that of large observational studies done in commercial settings. A field study using flotation tank therapy on 34 cows had a recovery rate of 50%,¹⁶ a retrospective analysis of cows admitted to a referral hospital where flotation therapy was used for some (but not all) cases had a 55% discharge rate,¹⁷ and another analysis of hospital records for non-ambulatory cows using a flotation tank while admitted had a 47% discharge rate.¹⁸ Response to flotation therapy is also associated with recovery, with those unable to walk out of the tank after the first session having approximately 9 times the odds of euthanasia.¹⁸ However, flotation tanks have not been generally adopted on-farm, likely due to practical limitations.^{19,20}

Nursing care

Nursing care has been shown to be strongly predictive of recovery in field studies and is a general term used to encompass many aspects of management, including housing, bedding, feed and water, relocation, repositioning, treatment, hygiene, and general “care”.^{7,16} Downer cows where best practices were implemented either at least 50% of the time, or with 50% effectiveness, were 2.4 times less likely to develop secondary damage compared to those with poorer care,⁷ and recovery rates substantially higher (31-33% vs. 0-8%⁷, (60% vs. 11%¹⁶). Additionally, with very extended time periods, excellent or good nursing care resulted in some recoveries after 7 days, whereas those with poor or very poor nursing care had no animals recover after day 4.⁷

Regulations and quality assurance programs

Until the end of the 1990s, non-ambulatory cows could be shipped for slaughter within the U.S. and Canada. Changes in the early 2000s occurred in both countries, with specific city- and state- wide bans on the shipping of non-ambulatory cattle in the U.S., and increased restrictions in some parts of Canada. For example, in Ontario it was legal to ship non-ambulatory cattle once they were inspected and tagged by a veterinarian to ensure they could be “humanely” transported.²¹ As well, specific end-users also ended purchasing from plants still accepting non-ambulatory cattle. Most of the animals arriving at plants non-ambulatory in this time period originated on-farm (less than 1% of animals arriving non-ambulatory having gone down in transit) and generally led to high condemnation rates.²¹ In the late 2000s, this practice was no longer acceptable in both countries and restricted at a national level, unless the animal was specifically being moved to a veterinary facility for further treatment. Currently, on-farm emergency slaughter exists as an immediate option for animals suffering an acute injury, but who are otherwise healthy, with financial costs usually limiting this practice to truly viable meat animals with very acute injuries such as fractures.

Current quality assurance programs also have guidelines and requirements surrounding the care and management of non-ambulatory cattle on dairy farms in Canada and the U.S. These generally include requirements to have a designated area to care for the cattle, define appropriate and inappropriate methods to move cows, as well as to lift cows, as well describing aspects of housing, feed/water, monitoring, and euthanasia decision making. Both FARM 4.0 and proAction have caveats which state that inappropriate methods such as dragging, pulling, or lifting by the limbs or neck, are deemed acceptable for short distances/durations in “extreme situations” where “animal or human safety is a concern”,²² or “animals must be moved a few feet before an appropriate device can be used”.²³ FARM 4.0 also states that even in this situation, “if the procedure cannot be done humanely, then the animal is to be euthanized in place and then moved”, although what constitutes “humane” is not further defined.

On-farm practices

Care and management

Use of pain control for non-ambulatory cows is not well described. Non-steroidal anti-inflammatory drugs were administered to 83% of downer cases in an Australian study.¹³ proAction recommendations for non-ambulatory cattle include provision of pain control though an NSAID “as directed by your veterinarian”.²² While there is concern that the pain associated

with the many secondary conditions these downer animals have may be refractory to treatment,²⁴ this would suggest that these animals should be euthanized as opposed to not given pain control.

In an Australian study, 40/218 cows were deemed to have “poor” or “very poor” nursing care, meaning less than 50% of essential care components were followed (including deep, clean bedding, feed and water, appropriate movement methods, rolling for cows unable to reposition themselves, and appropriate treatment plans), and in some cases, animals were left subject to extreme weather conditions, housed on concrete or gravel, or left in lateral recumbency for extended periods.¹³

A study of 36 downer cows on 27 Canadian farms found 9 deemed to have “poor”-quality nursing care, meaning they only provided 1 or 2 of the following: clean, deep bedding, feed and water offered 3+ times per day and placed within reach, housing with less than 2 other ambulatory cows, relocation method by bucket or pallet/sled, and repositioning 3 or more times per day.¹⁶ Moreover, 4 cows were reported to be dragged by their neck, and one moved using hip clamps, which showed marked abdominal musculature lacerations and myonecrosis.¹⁶ Moving cows using hip lifters and dragging by the neck are methods specifically prohibited by both FARM 4.0 and proAction. Additionally, the use of hip lifters for movement continues to be a reported finding in studies, with 45% of Canadian farmers reporting using these to move cows in 2015,² and 28% of Ontario farmers reporting this method for moving in 2020.²⁰

Euthanasia decision making

In a Canadian study, the majority of farmers cited failure to improve, poor eating and drinking, pain, and dullness as indicators to euthanize cow, but reported duration from identifying an animal who is not improving and euthanasia ranged from 24 hours to 21 days.² Euthanasia decision making appears to be highly variable in many studies of dairy producers, with 6-11% of farmers saying they would “never” euthanize a non-ambulatory cow or calf.²⁵ Bovine veterinarians also appear to have variable agreement on time to euthanize for various conditions,^{26,27} including non-ambulatory cattle, with some reporting they would not recommend euthanasia a non-alert downer left for several days.²⁷

Variation in veterinary recommendations, accompanied to lack of training and ownership of this task and varying levels of veterinary involvement in protocols, likely contribute to a lack of clear action with regards to euthanasia decision making on many farms.^{2,24,25} Additionally, emotions of farmers or farm staff surrounding this task can be quite variable, making this a larger challenge. The caring/killing paradox, compassion fatigue, and experiencing a sense of failure to the cow can all contribute to the emotional strain felt by many farmers and farm staff when tasked with this practice.²⁵

Recommendations

The importance of not only having standard operating procedures for dealing with non-ambulatory cattle, but also farm staff who have ownership and have buy-in on the protocol, cannot be overstated. While there is variation in how farmers and farm staff feel about these tasks,²⁵ there is generally a strong desire to eliminate animal suffering and provide care.^{20,25}

Initially, rapid identification of a down cow and assessment to determine the primary cause are crucial, in order to treat

uncomplicated cases and allow animals to recovery quickly, as well as identifying cows with very poor prognoses to be immediately euthanized.¹⁹ As nursing care is such an important factor for welfare and recovery, if there are concerns that the animal cannot be cared for according to accepted standards, these animals should be euthanized.¹³

A clinical exam protocol for farm staff should be easy to conduct but able to diagnose typical conditions to allow for treatment, including an examination of the hips and legs.^{13,19} In some cases, cows may be able to be treated where they go down, but if unsuccessful or if they go down in an unacceptable location, protocols should include methods for moving cows in ways that avoid secondary damage. This can include tractor buckets that can fit the cow, stone boats, plywood sheets, rubber mats, platforms on forklifts, or full body slings.^{19,22,23} Unacceptable methods include exposed forks, hip lifters, or any methods to drag, pull or lift an animal by their neck or limbs.^{22,23} For animals not immediately responding to primary treatment, an NSAID should be given to help mitigate secondary damage from being recumbent, and to alleviate pain.^{19,22}

Management and care for down cows not immediately recovering following initial treatment should be aimed at preventing secondary myopathy and neuropathy. A designated area for recovery should have deep bedding, or potentially can be on pasture if sheltered from extreme weather and not wet or muddy.^{13,19} Bedding depths of 40-50 cm for straw, and 20-30 cm for sand or sawdust have been recommended.¹³ Sand may be an excellent choice as it provides maximum body conformity, as well as excellent footing and good hygiene.⁸ Ideally this area should not have other ambulatory cows housed in it, which also aids in feed and water provision and prevents further injury,^{13,22} and should include a barrier if cows are at risk of “crawling”, both for the prevention of femoral nerve damage, and to prevent them from leaving the area of suitable bedding.¹⁶ Areas around the cow should be cleaned frequently, to avoid additional risks of both sores and secondary diseases like mastitis. For animals who may leak milk, milking (either in lateral recumbency or while lifted) should be done to prevent udder engorgement and mastitis risk.^{13,19,22}

Cows should not be left in lateral recumbency; bales or other items can be used to assist sitting, to prevent forelimb neuropathy and other complications like bloat.^{13,22} Repositioning is recommended for cows that do not reposition themselves frequently (at least every 3 hours); this is likely a substantial risk for development of compartment syndrome, and rolling off the dependent hind limb should be done several times a day,¹³ likely every 3 hours or more frequently.¹⁹ Periodic manual flexion/extension of the hindlegs when the animal is repositioned can also be done.¹⁹ Similarly, lifting (provided the cow still stand with this assistance) will help reduce risk of secondary damage, provided it is done in an atraumatic way. Multiple wide straps, slings, and harnesses are often more difficult to place than hip lifters, but bear weight over a larger surface. Hip lifters can be used as well, provided cows are not left to “hang” in them if they do not stand. A chest band in addition to hip lifters can be a good option to provide additional support while being easier to place than a multi-strap or harness device. Cows should only be lifted if effective (i.e., if they can bear some weight), and should be supervised and lowered when no longer able to stand,¹³ ideally waiting for as long as possible with the cow standing.¹⁹ While flotation tanks are considered a higher standard in assisting cows to rise, they are generally not well adopted and may have practical limitations.^{19,20} Hobbles (50 cm

apart) are recommended for animals with obturator nerve paralysis, weakness or damage to adductors, and should be thick, wide material to prevent pressure sores on the lower leg.¹⁹

Regular re-assessment of these cows should also be done in order to identify those that are not improving or have acquired secondary damage, to allow for timely euthanasia decision making. Some timelines have been suggested (2 days²², 4 days¹⁹), and likely animal welfare can be improved on many farms simply by having standard protocols to eliminate animals being kept alive despite clear indications for euthanasia and ensure those animals not improving (or becoming worse) are euthanized in a standard timeframe.

Summary

Cows may become non-ambulatory for a variety of reasons, but without quick and appropriate care, they are at risk of developing secondary complications such as compartment syndrome, potentially within hours of the initial event. Regulations surrounding how these animals are managed have changed substantially over the past 35 years, and although improvements in practices have occurred, challenges of how to care for these cows on-farm are still of concern. Development of farm-specific SOPs surrounding identification, treatment, movement, housing, and care for non-ambulatory cows can serve to improve both animal welfare and farmer and farm staff confidence in managing these difficult situations.

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