Dairy Split Session III

New Approaches to Old Problems

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Theory and Management of the Downer Cow

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Sick animals of all quadruped species often become recumbent, but the recumbency of the downer cow seems to have some unique features. While a well accepted definition of the downer cow is not available, commonly recognized downer syndromes do not occur in other species. Factors which characterize the downer cow are:

1. Sternal recumbency whereas dying cows are usually in lateral recumbency.

2. The paradoxical nature of the condition. The downer cow looks as if it should be able to stand but can't. This subjective appearance is, in part, the result of a diagnostic problem. If a specific diagnosis such as a fracture can be made, the quesiton of whether the cow should still be called a downer is moot, however.

3. Most cases begin during the periparturient period. Since milk fever and calving paralysis also commonly occur during this period, the relative contributions of each may be difficult to ascertain.

4. Most downers can stand on the forelimbs when lifted with hip clamps but the hindlimbs are useless. This is especially true in the early stages of the condition but may require some stimulation of the fore feet with an electric prod to demonstrate. Occasional downers will spontaneously demonstrate forelimb function by dog sitting for brief periods.

Several additional terms are used in the literature to describe certain downer cows. The term creeper is used for the downer cow which moves considerably but is unable to stand.[5] The non-alert downer is a cow in sternal recumbency that appears to suffer from a toxic or metabolic condition which causes prolonged severe depression.[4] While creepers are more common, some degree of depression is not uncommon.

The observation above can be explained by a progression from primary recumbency due to a variety of causes to secondary recumbency due to pressure damage.[2] Unsuccessful struggling to rise may lead to terminal recumbency due to luxations and/or torn muscles. The key to elucidation of this progression was observation of a hindlimb predilection in most cases. If the problem is only systemic (metabolic or toxic) it should affect all four limbs equally. In normal recumbency and milk fever recumbency cattle lie with one hind leg under the body where it is compressed by the body. The forelimbs, however, are never placed under the body and are protected from pressure damage by the well developed bovine sternum which bears most of the forequarters' weight during sternal recumbency. While there are many causes of primary recumbency, all down animals suffer from pressure damage. Pressure damage, then, is a factor common to all down cows.

Pressure damage is more of a chronic problem in human medicine than it is in veterinary medicine because people who cannot stand or walk are kept alive indefinitely but such is rarely the case with animals. Pressure sores are a major problem in the management of bed ridden human patients. In a 1979 study of human pressure sores the cost to the health care system was found to be $14,000 for each lesion.[8] When the downer cow is considered as a bovine para- or quadriplegic, some interesting similarities with human cases can be seen. In the bedridden human the 2 most common sites of pressure sores are over the tuber ischii and greater trochanter. The same sites of pressure sores are observed in downer cows.

The common occurrence of both acute and chronic pressure damage lesions in human beings has spawned a considerable body of research and literature on the subject. Acute pressure damage mainly affects muscle and nerve tissue, whereas chronic pressure mainly results in skin lesions. Two terms must be defined to understand this literature. First, compartment syndrome refers to pressure damage due to the encasement of vulnerable soft tissue within an osteofascial compartment. The inelasticity of the compartment causes an increase of pressure within the compartment whenever external compressure or internal swelling occurs.[6] One of the most effective treatments for the condition is surgical decompression by incision of the fascial

wall. Compartment syndrome is a local problem, but the term crush syndrome refers to the systemic effects resulting from compartmental pressure damage.[6] These include factors such as myoglobinuria, renal failure, hyperkalemia and cardiac arrythmias resulting from hyperkalemia. Because cells contain abundant potassium, this ion is released into the blood after muscle damage. I have not found hyperkalemia in downer cows even when there is evidence of massive muscle destruction. In both humans and cattle massive muscle destruction is followed by myoglobinuria and greatly elevated creatine kinase (CK, formally CPK) levels in the blood. Why hyperkalemia occurs in humans but not in cattle is unknown. The bovine kidneys may be more efficient in eliminating potassium or the rumen may act as a "sink" for potassium.

In human medicine compartment syndrome most often is due to factors which originate within an osteofascial muscle compartment such as hemorrhage due to fracture, vascular trauma or bleeding disorders, burns etc. As excess fluid accumulates in the compartment, pressure builds up if fluid flows into the compartment faster than it is resorbed. External pressure can also cause compartment syndrome because external compression restricts capillary blood flow resulting in anoxic damage of capillaries. After removal of the external compression, blood flow is restored in the capillary bed; but transudation from damaged capillaries occurs.[6] The transudate increases pressure within the compartment and causes compartment syndrome as mentioned above. The most common cause of external pressure in humans is prolonged recumbency due to a drug overdose.[6] Often the forearm may be compressed by the chest or the head. The sites most affected are the forearm and the lower leg (crural region). These are sites where the fascial walls of the compartments are thick and complete so that fluid pressure can't be relieved by compliance or leakage. In the downer cow, however, the pressure damage lesions are primarily in the thigh region. In this region there are not clearly defined compartments as in the crural region. Therefore the lesions are patchy rather than affecting total muscles as in a true compartmental syndrome.

Recently I have been measuring pressure in the hamstring muscles of anesthetized cows in sternal recumbency.[3] To do this a 16 gauge teflon catherter is placed in the semitendinosus muscle with the aid of a stylet which allows it to be pushed through the skin and into the muscle like an ordinary hypodermic needle. After removal of the stylet, the catheter is connected to a pressure resistent saline-filled tube which in turn is connected to a pressure transducer that is monitored with a chart recorder. The intramuscular pressure measured in this manner varies from normal (0-5mmHg) to 60-100 mmHg. The pressure changes as body position changes. The greatest pressure is recorded when the pelvis is tilted slightly laterally. Irreversible ischemic lesions in humans occur after several hours of over 40 mmHg intratissue pressure.[7] These observations correlate with my previous work which demonstrated that downers can be produced by 6 hours of sternal recumbency under the influence of halothane anesthesia. In this work 8 of 16 cows in sternal recumbency for 6, 9 or 12 hours became downers after recovery from anesthesia.[1] While the others made uncomplicated recoveries, all showed transient hindlimb ataxia and weakness and one displayed a dog sitting posture. The variability between animals was probably due to subtle position differences. If the region of greatest tissue pressure and hence most damage included the sciatic nerve, the effect on hindlimb function will be considerably greater than if the region of maximum pressure does not contain any major nerves.

Recent trends in the treatment of downer cows have demonstrated the importance of pressure damage in downer cow pathogenesis. Several devices to lift cows have given encouraging results in clinical use. The most popular devices are the livestock wheel chair (Cow Bouy) and the full body sling (Munk's sling). While not therapeutic in the usual sense, these devices can stop the progressive development of pressure damage lesions and allow healing to take place. While therapy is of utmost importance to the client, for the veterinarian the most useful aspect of a lifting device is as a diagnostic tool. When a cow is recumbent clinical evaluation of function is very limited but after lifting the assessment is more feasible. After a brief period of suspension the cow should be lowered slowly to observe signs of partial weight bearing. Any slackness of the supporting cable(s) is a sign of partial weight bearing by the patient. The Cow Bouy is far more advantageous than ordinary hip clamps because the animal can walk with the aid of the device. When this is attempted with a fixed hip clamp, the animal is abruptly pulled back and the benefit of "physical therapy" is lost. While hip clamps are less injurious when used as part of a livestock "wheelchair", they inflict more damage than the Munk's sling. Therefore more total hours of support are possible with the Munk's sling, but use of this device can be limited by the development of inguinal region pressure sores.

More important than lifting is the need to get the animal off concrete and on to a softer surface such as dirt or sand. Three distinct advantages of a sand surface are: 1. reduction in contact pressure by spreading out the body supporting area due to better conformity to body shape, 2. excellent footing, 3. good hygiene. While straw and shavings absorb and hold excrements, urine rapidly percolates through sand and manure is easily removed with a shovel. Experimental work at the University of Minnesota and clinical trials at the University of Illinois have demonstrated the value of a sand-filled stall for downer cows. A base of corrugated plastic drain pipe and pea gravel under sand provides good drainage in the Illinois clinic.

In conclusion, the time honored veterinary prescription of good management and nursing care will aid the healing process. The downer cow should be considered an emergency case due to the possibility of rapid development of muscle and nerve pressure damage lesions. The sooner aggresive management is instituted, the better the results will be.

References

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Questions & Answers:

Question: I take it then that, when you have a downer cow with nerve damage, there is no point in resting her before trying to lift her?

Answer: I think that as long as they are down they are going to be getting a lot more myopathy and possibly neuropathy. The real art of it is how much to lift, how often and what to do in between. It is even more important than lifting is to take them off the concrete on to dirt or sand. Then lifting is quite important.

Question: Have you any comments on clinical chemistry as an aid to prognosis?

Answer: I do not know enough about clinical chemistry to say, but we have seen at least one case of hypokalemia. Do the clinical chemistry but get on with these other things at the same time — get them off the concrete.