2013 is the centennial anniversary of brisket disease, but we're not done yet...

Joseph M. Neary MA VetMB
Integrated Livestock Management, Colorado State University
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In 1913 in South Park, Colorado a strange disease in beef cattle was investigated by two CSU researchers, George Glover and Isaac Newsom, in response to requests from two producers, Lew Robbins and David Collard. The problem became known as brisket disease or high-altitude disease because it affected cattle at high altitudes and led to fluid accumulation in the tissues under the chest and often led to death. The researchers conducted clinical investigations and determined that the low level of atmospheric oxygen experienced at high altitude was the primary cause of brisket disease.

How can this be?

The pulmonary arteries exit from the right side of the heart and carry deoxygenated blood returning from the body to the lungs for re-oxygenation. The low level of oxygen in the air at high altitude causes these arteries to contract. This contraction in response to low atmospheric oxygen tension is greatest in cattle and pigs and absent in species, such as llamas, that have adapted to living in mountainous environments. Contraction of the pulmonary arteries increases blood pressure, this is known as pulmonary hypertension. Pulmonary hypertension increases resistance to blood flow and forces the heart to work harder until it eventually fails resulting in death from right-sided heart failure. The increased work of the heart results in the characteristic dilation of the right ventricle of the heart, which can be seen on postmortem examination.

Management tools

In the late 1970's a test was developed to measure pulmonary artery pressure (PAP) in the field. Using this test, cattle with high-PAP (> 45-50 mmHg) can be identified and culled from breeding herds. Since PAP has been shown to be moderately heritable the selective breeding of only low PAP bulls in a herd should reduce the occurrence of brisket disease within the calf crop. This selection method is still the only tool available to producers and has largely been successful. However, our findings show that pulmonary hypertension can still be found in high-altitude herds that have bred only low PAP bulls for over 20 years.

A persistent problem

Calves with pulmonary hypertension can show very mild signs of disease. Swelling of the brisket, as seen in classical brisket disease, does not always occur making correct diagnosis of this disease difficult. Many calves with pulmonary hypertension show signs consistent with pneumonia such as a rapid breathing rate, cough and open-mouth breathing. Rectal temperatures can be elevated both in calves with pulmonary hypertension and in calves with pneumonia since the muscular effort involved in rapid breathing raises their temperature. Calves showing signs of 'summer pneumonia' may be suffering from pulmonary hypertension, pneumonia or both! A recent survey that we conducted with the Colorado Cattlemen's Association found that the occurrence of summer pneumonia in pre-weaned beef calves increased significantly with increasing altitude. Producer reports of disease in pre-weaned calves suggest that the appearance of pulmonary hypertension may be somewhat different and subtler now than it was before widespread PAP testing was initiated. Calves with pulmonary hypertension today do not necessarily present with swelling of the brisket and belly as was seen 40 years ago.

Unfortunately, we do not know the true prevalence or geographic extent of pulmonary hypertension but it has been reported in feedlots as low as 3,000 ft in many states on the Great Plains. The disease is not unique to beef cattle. It has been identified in dairy heifers at 5,000ft in Colorado. Therefore, the cost of this disease to the cattle industry is likely to be vast. 'High Mountain Disease' is not unique to the high-altitude environment, but appears to be coming down off the mountain!

Combatting an old problem with new technology

Over the last 100 years since the discovery of brisket disease we have learned a lot but must do more. We do not yet have the solution to this disease and must find a way to decrease the incidence of pulmonary hypertension within the cattle industry. Over recent years we have been studying the physiology and pathology of pre-weaned calves on high-altitude ranches to characterize risk factors for, and progression of, pulmonary hypertension. We are working with colleagues in the Department of Animal Science, Colorado State University and collaborators at the University of Colorado Health Sciences Center, Denver. We are learning more about the complex cellular and genetic changes that occur within the heart and lungs of calves. Pulmonary hypertension affects up to 100 million humans worldwide both as a primary disease and as a consequence of other diseases, such as obesity and parasitism. Because calves are one of the best animal models of pulmonary hypertension in humans, an added benefit to our ongoing collaborative research could be an improvement in treatment of humans for this condition.