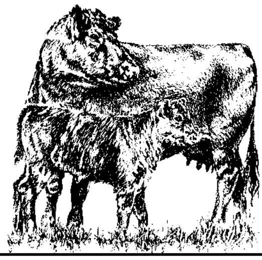

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Animal Health Section 631

Pulmonary Artery Pressure as a Tool for Managing Brisket Disease

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Cause and Incidence

Brisket disease is a common name for pulmonary arterial hypertension in cattle that often results in congestive right heart failure. Ranchers also refer to this disease as high mountain disease or dropsy.

Signs of the disease include pulsating jugular veins and subcutaneous edema in the brisket region. To the rancher, the signs and symptoms seen are lethargy, weakness, bulging eyes, enlarged brisket region, difficult breathing, and often death. Standard treatment is movement to lower altitude.

Brisket disease is caused by hypertrophy (enlargement) of the right ventricle of the heart resulting from pulmonary hypertension (elevated pulmonary blood pressure). Although there is shunting of blood in all animals exposed to low oxygen conditions (hypoxia), cattle are more susceptible to pulmonary hypertension because of the anatomy of the bovine lung including its relatively small size.

Hypoxia is the primary cause of brisket disease, but it is aggravated by respiratory disease, parasite load, chronic cold stress, locoweed, asthma, and high levels of nutrition. The reason brisket disease is pronounced at altitudes above 5,000 feet is due to the fact that the oxygen dissociation curve (relating partial pressure of oxygen and saturation by hemoglobin) is not linear but is "S" shaped. This "S" shape translates to little difference in hemoglobin saturations at low altitude (below 5,000 feet). However, at altitudes above 5,000 feet, hemoglobin saturation drops in a precipitous fashion, and the impact of lower oxygen is magnified.

Data suggest that the incidence in Colorado based on National Animal Health Monitoring System (NAHMS) is about 1 percent in native cattle (Salman et al. 1991a). However, movement of cattle from low altitude (or use of semen from low altitude bulls) would be expected to have higher incidence since the animals are non-adapted. Data from 407,000 feedlot steers in Colorado fed at 5,248 feet where all animals that died were necropsied (1988 animals) showed that 5.8 percent of all deaths were attributed to brisket disease (Jensen et al. 1976).

Brinks et al. (1976) found higher pulmonary artery pressure adversely affected weight and gain of cattle at high altitude. Schimmel et al. (1980) found negative correlations between pulmonary artery pressure and post-weaning gain. At the Colorado State University Beef Improvement Center (BIC) where both home-grown pulmonary artery pressure (PAP) tested sires and artificial insemination (A.I.) sires (not selected for PAP) were used, the incidence of PAP above 50 millimeters mercury (mm Hg) in calves was 3 percent vs. 20 percent for selected and non-selected sires, respectively.

Salman et al. (1991b) found that brisket disease related costs (including both veterinary costs and death loss) ranged from $1.00 to $18.93 per head in a Colorado survey. Brinks and LeValley (1978) speculated that economic loss from brisket disease might exceed the total for all other contagious diseases in cattle populations at high altitude in the intermountain region. The incidence of brisket disease is confounded by the fact that it is aggravated by and may be confused with other respiratory diseases suggesting that often brisket disease is misdiagnosed and simply counted as a part of the respiratory disease complex. This may result in low estimates for brisket disease.

Pulmonary artery hypertension resulting in brisket disease is genetically inherited (Will et al. 1975; LeValley 1978). This genetic relationship helps explain the belief that some breeds are more susceptible to brisket disease than others. Heritability estimates for pulmonary artery pressure have been reported by LeValley et al. (1978) using Hereford, Angus, and Red Angus, and more recently by Enns et al. (1992) using Angus cattle, with

Table 1. Accuracy of measuring PAP to predict pulmonary hypertension at various altitudes.*

Below 5,000 feet	Not valid
5,000 feet	70%
7,000 feet	90%
8,000 feet	95%

*Animals must be exposed to altitude for a minimum of three weeks. Five to six weeks exposure is desirable for accurate measurements.

heritability estimates ranging from 0.42 to 0.46. These relatively high heritability estimates suggest value in selecting breeding animals for low PAP to manage risk of brisket disease. Enns et al. (1992) developed estimated progeny differences (EPDs) as a selection tool and found EPDs for PAP to be effective.

Pulmonary Artery Pressure

Pulmonary artery pressure is a measurement taken by passing a catheter via the jugular vein through the heart to the pulmonary artery. This procedure requires an experienced veterinarian with appropriate training and equipment. The measurement has been shown to be valuable when assessing the risk of cattle to brisket disease. Since PAP is known to be heritable, it is a valuable selection tool for herds maintained at high altitude.

As shown in Table 1, validity of PAP measurements increases with increasing altitude. It is important that animals be given a minimum of 3 weeks (5 to 6 weeks are preferred) to acclimate to the test environment before measurements are made. Measurements taken at low altitude or failure to provide adequate time for acclimation will result in invalid PAP values.

Pulmonary artery pressure can vary for a variety of reasons including age, nutrition, and normal daily fluctuations. However, Holt (1998) has noted that PAP measurements of 55 ± 5 mm Hg have not been documented to have dropped to an acceptable level during retest. The impact of age on PAP measurements is important when evaluating yearlings. Typically, PAP values will increase 2 mm Hg from yearling to 18 months of age when values tend to stabilize.

Treating Brisket Disease

Cattle with brisket disease will respond to increased oxygen environments. This can be accomplished by moving the affected animal to low altitude or by supplying additional oxygen via a hyperbaric chamber. The former is a potential answer for individual cases but is problematic for large numbers of breeding stock located at a high altitude ranch. Prevention is far more practical than treatment.

Management at High Altitude

The fact that heritability for PAP is high makes selection a viable option for managing the risks associated with brisket disease. Failure to select resistant animals can result in death and/or reduced economic efficiency since post-weaning performance has been recognized as a major economic loss in animals susceptible to brisket disease. Because predisposition to brisket disease is heritable, failure to select for reduced susceptibility will most likely result in continued incidence of brisket disease.

Table 2. Guidelines for PAP measurements when selecting beef cattle for high altitude.*

Altitude	Recommendation
Below 5,000 feet	Altitude is basically not an issue, and PAP values have little value as selection tools.
5,000 to 7,000 feet	PAP <50 mm Hg
7,000 to 9,000 feet	PAP <45 mm Hg
Above 9,000 feet	PAP <41 mm Hg

*Values listed are for animals 18 months of age and older. PAP values will typically be 2 mm Hg lower when measured at 12 months of age.

Various management options are suggested for minimizing risk of both clinical and sub-clinical ramifications of high PAP. Cow-calf producers should purchase PAP tested bulls using guidelines listed in Table 2. Seed stock producers may wish to test both sires and replacement heifers to more effectively reduce PAP. Commercial bull producers may find value in screening animals before placing them on gain tests to reduce losses incurred in developing bulls that test too high after the expense of performance testing.

These options may be valuable in reducing the incidence of brisket disease and improving economic efficiency. Remember that PAP testing of bulls acclimated to low altitude is not a valid test for managing brisket disease.

Ranchers often ask for interpretation of PAP information and guidelines for using PAP data to limit incidence of brisket disease. It must be understood that PAP testing is not definitive. Instead, it is a system that helps "manage risk" against brisket disease. In other words, it is possible for cattle with low PAP values to have brisket disease and animals with high PAP values to not develop brisket disease. Yet data from both selected animals and experience suggest PAP as a good tool to reduce incidence of brisket disease.

Recommended Guidelines

Table 2 provides a guide for use of PAP values in reducing risk of brisket disease of cattle at given altitudes. Values listed should assist cattle producers in evaluating pulmonary artery pressure data when selecting breeding animals.

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