

Diagnosed primary causes of death in domestic sheep of all ages in the Intermountain West

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Introduction

The 5.2 million domestic sheep in the U.S. resulted in \$360 million in sales during 2016. Causes of sheep death were last summarized 25 years ago. The objective of this descriptive case series study was to summarize the diagnoses at necropsy of primary cause of death in 246 sheep including aborted fetuses from the Intermountain West over a 7-year period.

Materials and Methods

Domestic sheep necropsied from 2009 through 2016 at the Utah Veterinary Diagnostic Laboratory were studied. For sheep with no age provided, age was estimated from body weight: 4 week lamb 1-28 d old, < 8 kg; young lamb 29-180 d old, 8-35 kg; older lamb 181-365 d old, 35.1 - 54 kg; adult >365 d, > 54 kg. Lung, rumen, abomasum and fluid, liver, heart, kidney, spleen, thymus, adrenal glands, thyroid, brain and placenta (if submitted) were collected from fetuses. Additional samples collected from adults were trachea, reticulum, omasum, intestine (multiple levels), pancreas, skeletal muscle, urinary bladder, ovaries and uterus or testes, and lymph nodes. Tissue staining and additional sample collection were on a case-by-case basis according to history and gross findings at necropsy. Bacterial culture and parasite detection (fecal flotation or direct observation) were by standard methods. Copper and selenium were quantified using inductively coupled plasma-mass spectroscopy. Primary cause of death was defined as disease that caused pathology in critical organs or tissues leading directly to death.

Results

Sheep carcasses (n = 246) were submitted in groups of 1 - 7 (209 submissions) from farms or range flocks in Utah (93%), Idaho (6%) or Wyoming (< 1%). Of 111 (45%) sheep with an age provided, 100 (90%) matched with the body weight-based estimates. Breed was reported or could be identified in 72 (29%) of sheep. Suffolk (18%) and Rambouillet (4%) were the most common identified breeds. Of 228

cases (93%) where cause of death was diagnosed, 6 diseases accounted for 60% of deaths: abortion 50 (22%), parasitism 29 (13%), pneumonia 19 (8%; 18 bacterial), enteritis/enterotoxemia 17 (7%), bloat 13 (6%), and selenium deficiency 8 (4%). Primary causes of death by age group: Fetus (n = 54) non-chlamydial abortion 29 (54%) mainly *Campylobacter jejuni* and *Campylobacter fetus*, idiopathic abortion 12 (22%), *Chlamydia abortus* 8 (15%); 4 week lamb (n = 21) pneumonia 4 (19%), parasitism 3 (14%), dystocia 2 (10%), and single cases of disease including polioencephalomalacia, selenium deficiency, and spider lamb syndrome (hereditary chondrodysplasia); Young lamb (29 - 180 d, n = 69) parasitism 15 (22%) mainly *Haemonchus contortus*, pneumonia 10 (15%) mainly *Mannheimia haemolytica* and *Pseudomonas aeruginosa*, enteritis 7 (10%), bloat 6 (9%; 5 frothy) and 31 other cases including selenium deficiency, surgical sequelae, clostridial enterotoxemia and polioencephalomalacia; Older lamb (6 - 12 mo, n = 28) parasitism 7 (25%) all *H. contortus* or *Fasciola hepatica*, bacterial pneumonia 3 (11%), clostridial enterotoxemia 3 (11%), frothy bloat 2 (7%), selenium deficiency 2 (7%), and single cases of disease including copper toxicity, post-surgical jejunal entrapment and pregnancy toxemia; Adult sheep (> 1 yr, n = 74) bloat 5 (7%), *H. contortus* 4 (5%), peritonitis 4 (5%), pneumonia 4 (5%), urolithiasis 4 (5%), mastitis 3 (4%), metritis 3 (4%) and 47 other cases including copper toxicity, polioencephalomalacia, selenium deficiency, pituitary (acidophil) adenoma, listerial encephalitis, pyrrolizidine alkaloid toxicity, and rectal perforation.

Significance

Most of the common causes of death in domestic sheep of all ages were infectious, parasitic, or related to dietary imbalance. Control measures include vaccination and clean lambing environment to reduce infectious abortions and enterotoxemia, control of parasite infestation, prevention and treatment of bloat and pneumonia, and adequate mineral supplementation, particularly for copper and selenium levels and prevention of urolithiasis.