

Supplementary table: pathology findings in a selection of alpacas necropsied in Sweden 2001-2013

| System affected | Number of cases | Pathology diagnostic observations |
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| Digestive system | | |
| Enteritis | 13 | Four in neonates, 9 in adults (3 euthanased). Parasitic in 7 adults: <i>Eimeria</i> spp., <i>Trichuris</i> sp., <i>Trichostrongyloidea</i> . Severe infiltration of eosinophils in intestines |
| Gastric ulcers | 4 | Considered to be the ultimate cause of death and the cause of months of wasting, colic and behavioural changes. One perforating gastric ulcer was seen in an alpaca with ulcerative stomatitis and oesophagitis, associated to uraemia caused by chronic interstitial nephritis. Two cases had large deep perforating ulcers causing peritonitis and disseminated infection. In one case non-perforating ulceration was associated with severe abscessation in the gastric mucosa |
| Acute mechanical gastrointestinal emergencies | 4 | Small intestinal strangulations (n=2), intussusception in alpaca suffering from a short period of colic and inappetence (n=1), all 3 animals were found dead. Obstipation at stricture site (n=1) in an euthanased animal with relapsing colic.. |
| Hepatitis/ Cholangiohepatitis, liver fluke | 15 | <i>Dicrocoelium dendriticum</i> (n=2); <i>Fasciola hepatica</i> (n=1); remaining cases diagnosed based on bile duct proliferation, fibrosis and multiple calcifications. One alpaca had suppurative granulomatous hepatitis associated with liver fluke (<i>D. dendriticum</i>) as the sole pathology diagnosis. Granulomatous and parasitic or lymphocytic hepatitis were frequent incidental findings. |
| Hepatic lipidosis | 9 | Sole pathology in 7 cases, cause of euthanasia in 1 alpaca. Histologically confirmed in 9% of the necropsies, from neonates to nine-years-old, 50% were under the age of twelve months. Two were females in late pregnancy. Most common clinical signs were wasting and inappetence, less frequently icterus, ascites and general weakness. |
| Cardiovascular system | | |

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| Myocarditis/ endocarditis | 4 | <p>Four young animals (up to 2 years old) with wasting and inappetence.</p> <p>Chronic cases: one alpaca, euthanased, showed dilated heart, discoloured endocardium, the thorax contained 1 liter of fibrinous yellow fluid. One alpaca died of acute circulatory failure</p> <p>Acute cases: one alpaca with fibrinous suppurative endocarditis of the right ventricle, ventricle filled with fibrinous exudate, suppurative myocarditis in apex of the heart, hydropericardium and hydrothorax. Another alpaca with acute purulent myocarditis. <i>E.coli</i> in pulmonary samples in both animals</p> |
| Cardiomyopathy | 2 | <p>One nine-year-old female with secondary left-sided heart failure exhibiting progressively worsening respiratory distress for a month. One uremic cardiomyopathy in an 11-year-old alpaca with severe uremia due to chronic interstitial nephritis. Heart pale and patchy with bilateral ventricle dilation.</p> |
| Myocardial degeneration | 1 | <p>A two-week-old showing signs of staggering and respiratory distress, died. Possible selenium/vitamin E deficiency</p> |
| Cardiac malformation | 1 | <p>4-year old, hind limb paresis, loud heart murmur, was euthanased. Atrial septal defect, chronic stasis in liver and lungs. Thrombosis aortic bifurcation pelvic region, likely cause of limb paresis</p> |
| Respiratory system | | |
| Pneumonia | 4 | <p>An eleven-years-old alpaca, prolonged wasting, coughing, abdominal breathing and harsh respiratory sounds, euthanased. A four-years-old, acutely sick, respiratory distress, progressive neurological signs for 24h before death, <i>C. pseudotuberculosis</i> and suppurative/necrotizing bronchopneumonia. A four-years-old, found dead in pasture, <i>Pasteurella</i> spp. A 1-month-old cria with purulent pneumonia (Fig 4c) had also abscess in the brain.</p> |
| Urinary system | | |
| Urolith | 1 | <p>Nine-months-old male, euthanased, 3 mm calcium carbonate urolith obstructing ureter, dilation of the kidney pelvis, chronic cystitis and interstitial nephritis, anuria</p> |
| Chronic interstitial nephritis | 2 | <p>One alpaca with severe uremia, ulcerative oesophagitis, ulcerative stomatitis and perforating gastric ulcer with subsequent suppurative peritonitis and hepatitis. One alpaca with long term cardiac insufficiency and end-stage kidney disease. Both alpacas were euthanased.</p> |

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| Interstitial nephritis | 1 | Incidental finding |
| Reproductive system | | |
| Neonatal deaths | 3 | Suffocation by fetal membranes (n=1); Hydrocephalus (n=1); <i>Streptococcus</i> sp. cultured from several organs, intrauterine infection suspected (n=1) |
| Uterine torsion | 1 | Five-year-old in late pregnancy, signs of colic; large fetus, uterine torsion and a 360° torsion of the third stomach compartment, hepatic lipidosis. |
| Necrotising mastitis and endometritis | 1 | Dystocia and retained fetal membranes, seizures just before death. Acute suppurative endometritis and acute necrotizing mastitis with numerous cocci-shaped bacteria. |
| Central Nervous System | | |
| Non-suppurative encephalitis | 2 | One nine-year-old male, suddenly starting to shake, had difficulties in standing and died within 45 minutes. A two-years-old female progressively worsening general condition, blindness in the last few days. Both had perivascular infiltrations of mononuclear cells in grey and white matter (Fig 6). The female had ample deposits of amorphous, eosinophilic, hyaline material around pathogenic organisms (Splendore-Hoepli phenomenon) (Fig 6), suspected immune-related process with a previous infection (parasite, fungi or bacteria) as the trigger. Etiology could not be established in either case. |
| Polioencephalomalacia | 1 | Cerebrocortical necrosis (CCN), supposedly caused by thiamine deficiency, in a two-years-old female in good body condition, treated with antibiotics (penicillin) and B vitamins but died. |
| Suppurative processes in the brain | 4 | In four cases in neonatal alpacas there were suppurative processes in the brain (Fig 4a and 4b), mainly in ventricles. In two cases abscesses had caused pressure atrophy of the brain, and in one also secondary hydrocephalus interna due to obstruction of outflow of cerebrospinal fluid. |
| Muscular system | | |
| | 1 | Acute muscle degeneration in a six-month-old alpaca |
| Infections | | |
| Systemic infections | 7 | In 4 cases secondary to major disease process in digestive (n=2), respiratory (n=1) and reproductive (n=1) systems. Acute petechial bleeding in multiple organs, reactive hepatitis and splenitis. The causative agent was <i>E. coli</i> in four cases, <i>C.</i> |

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| | | <i>pseudotuberculosis</i> in two cases and <i>L. monocytogenes</i> in one case |
| Multiple internal abscesses | 2 | Two alpacas from an outbreak of pseudotuberculosis. A four-year-old male and a seven-year-old female, both had multiple internal abscesses (male in the lungs, female in uterus and liver) caused by <i>C. pseudotuberculosis</i> . The female had aborted |
| Skin conditions | | |
| Chronic dermatitis | 4 | Two males and 2 females, 2-6 years old. Dermatological signs for more than 6 months, all euthanased due to dermatitis. Two in poor body condition. The dermatitis was localised to the dorsal aspect of the body in one case, to the dorsal aspect of the hoofs/in between the hooves and at the corner of the mouth in one case, to the less-furred parts in one case, and spread over the entire body in one case. No specific parasite, bacteria or fungi could be identified in any. |
| Dermatitis as secondary finding | 1 | One 11-years-old female with primary diagnosis of pleuropneumonia showed chronic dermatitis with hyperkeratosis localised to the ears. |
| Chorioptic mange | 2 | Two individuals which died of traumatic injuries had mild to moderate chorioptic mange infestation, localised to the legs. |
| Neoplasia | | |
| Malignant lymphoma (Fig 3c) | 4 | Wide age-range. Wasting in all, anaemia, paresis, dyspnea, salivation, 2 alpacas were euthanased, Severely enlarged lymph nodes in abdomen and thorax, Palpably (superficial) enlarged lymph nodes in only one, a 10-years-old alpaca (Fig 3a, Fig 3b). In one case the only macroscopic findings were swollen liver and spleen. |
| Cholangiocellular carcinoma (Fig 5a) | 1 | 14-year- old female, inappetent one week, cessation of rumination, euthanased. 12 liters ascitic fluid, granulomatous patches on liver. Metastases in lungs (Fig 5b) and lymph nodes. Severe liver fluke infestation |
| Trauma | | |
| Predator attack | 6 | 5 females and one male, between nine months and ten-years old, severe biting injuries (wolf predation), found dead or dying on pasture |

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| Suffocation | 2 | New-born cria suffocated by fetal membranes covering head; 7-year-old female suffocated due to acute severe swelling of the pharynx/larynx area, insect bite or allergic reaction suspected |
| Slipping on ice | 1 | Seven-year-old female fell in the field, extensive muscle damage in pelvic region, bilateral total rupture of the gracilis muscle and extensive blood loss, euthanased. |
| Fighting, haemorrhages | 1 | One-year-old alpaca male died two days after a fight with another male. Showed multiple haemorrhages in musculature, joints and several internal organs, varying from petechial to larger confluent areas. |
| Injuries of unknown cause | 2 | One male three weeks old, infected rib fracture. One three-years-old male, complete spiral fracture involving both radius and ulna, euthanased. |