Congenital caudal vertebral malformations in the alpaca (Lama pacos)

JL VAUGHAN, RA LONSDALE, G JACOBS and DP RYAN

Objective To assess radiologically the caudal vertebrae of a male alpaca with an abnormal tail, and nine of his offspring.

Procedure Right lateral and ventrodorsal radiographs were taken of the caudal vertebrae.

Results The caudal vertebral abnormalities in these alpacas included vertebral subluxation, hemivertebrae, wedge hemivertebrae and block vertebrae.

Conclusion These malformations in offspring of one sire suggest a hereditary basis for congenital caudal vertebral malformations in the alpaca.

A lpacas (Lama pacos) were first imported to Australia from South America in 1858, but all of these and their offspring had died out by the 1940s.1 Importations began again in 1988 from Chile, and in 1997 from Peru, to establish a low-micron, luxury fibre industry. The Australian alpaca population has grown to approximately 20,000 animals (J Rothque, personal communication), with prices for breeding animals averaging more than A$10,000.

Because of the high value of individual animals, and the possibility that South American camelids evolved from a narrow gene pool, organisations in Australia and North America have established guidelines for the importation and pregaurdation of alpacas. These guidelines list disqualifying congenital and heritable traits,2,3 including malformed and absent tails.4 Little information is available on congenital and heritable conditions in South American camelids, but as the Australian alpaca industry develops it will be important that such defects are documented. Congenital caudal vertebral malformation in the alpaca has not been previously reported in the literature.

Limb, spinal and cranial congenital deformities are relatively uncommon in livestock, occurring at approximately one in every 500 births.5 Reported causes of skeletal deformities in ruminants and horses are hypo- or hyperparathyroidism,6 in utero exposure to toxic plants (Astragalus spp, Conium spp, Nicotiana spp and Solanum dimidiatum), exposure to certain viruses (Border disease, Cache Valley and Akabane), copper deficiency, congenital hereditary disorders (spider syndrome of black-faced ruminants and horses are hypo- or hyperparathyroidism,6 in utero exposure to toxic plants (Astragalus spp, Conium spp, Nicotiana spp and Solanum dimidiatum), exposure to certain viruses (Border disease, Cache Valley and Akabane), copper deficiency, congenital hereditary disorders (spider syndrome of black-faced paca (hembra) is also described. Scoliosis and kyphosis in other of his offspring was within normal limits. An unrelated case of cervical vertebral malformation in a 2-month-old female alpaca (hembra) is also described. Scoliosis and kyphosis in alpacas have also been observed by the authors but are not documented here.

History

Western Australian cases

Nine alpaca offspring aged from 12 to 18 months were radiographed. They were conceived on one farm to the same sire, who was approximately 5 years old. This macho had a visibly and palpably normal tail. No dams had visibly or palpably abnormal tails. Two other machos in use at this time had palpably and visibly normal tails. None of their offspring was born with palpably abnormal tails.

Individual pen mating allowed identification of the sire. Dams of animals with tail abnormalities remained on the property until at least 60 days postconception. The majority of the pregnant dams remained on that one property for their entire gestation, although some were taken to other properties within a 50 km radius after pregnancy diagnosis at 60 days gestation. Throughout their pregnancies all animals grazed kikuyu (Pennisetum clandestinum)-based pastures supplemented daily with a commercial camelid ration (lucerne chaff, oat chaff, barley, lupins, vitamins and minerals).

The macho that sired these alpacas was mated to at least 30 hembra over a period of approximately 6 months. Farm records show that of the 30 offspring born, 13 crias (immature alpacas) had visibly and palpably normal tails, five had abnormally short tails, 12 had abnormally deviated tails (wrytail) and none was tailless. There were 7 males and 10 females born with tail abnormalities. In 12 of the crias (11 with abnormal tails, one with a normal tail) 6 had shorter than normal ears and 6 were treated for aural haematomas. One female, with wrytail and normal...
ears, was diagnosed with an ectopic ureter. Six of the females born with abnormal tails have been bred successfully with a normal-tailed macho and produced 4 crias with short tails; three of these crias also had short ears.

In September 1997, 10 alpacas presented at Murdoch University Veterinary Hospital for radiography of their caudal vertebrae. No blood or tissue samples were collected for biochemical analysis or virus testing.

**Victorian case**

In an unrelated case in Victoria a female cria was presented for examination at 1 month of age because it was not thriving. A camelid-specific plasma IgG test showed a failure of passive transfer (IgG 3 g/L) and the cria was given an intravenous plasma transfer. The cria also had a stiff neck at the time of examination and could not drink well. Radiography of the cervical spine was performed, because of continuing illthrift and early signs of paresis at 2 months of age. The patient exhibited a wide-based stance and low neck posture. The cria continued to manifest further paretic dysfunction and was euthanased at 2.5 months of age.

**Materials and methods**

All alpacas received a dose of 0.4 mg/kg xylazine intravenously 5 min before radiographs were taken. Faecal material was removed from the rectum. The equipment used to radiograph tails was a Siemens diagnostic x-ray unit. The x-ray films were used with medium speed intensifying screens and cassettes. The cassettes were positioned directly beneath the animal without the use of a grid, as the thickness of tissue was less than 10 cm. Positioning of the alpacas for radiography included right lateral and ventrodorsal views of the caudal sacrum and caudal vertebrae.

Left lateral and ventrodorsal radiographs were taken of the caudal cervical spine of the Victorian case.

**Results**

Right lateral radiographs of affected caudal vertebrae are shown in Figures 1 to 4 from offspring and Figure 5 from their sire. The recorded caudal vertebral abnormalities (Table 1) included subluxation (offspring 2, 3, 5 to 9 and sire), luxation with overriding (offspring 3), hemivertebrae (offspring 5 to 7),...
Scientific

Lumbar or sacral vertebrae may cause functional physical and neurological deficits. Some malformations may be life-threatening, as in the cria in Figure 6. Myelography and/or computed tomography may be indicated to further determine whether there is spinal cord compression in such cases.

In ewes, increased exposure of vulvar skin to sunlight has been associated with vulvar squamous cell carcinoma. It is possible that hembras with abnormally short or deviated tails could suffer similar consequences.

The most suitable method to establish whether the described malformations are inherited would be by test mating suspected carriers of the responsible genes. Because gestation of the alpaca is 11.5 months and artificial breeding is difficult such a program would not be attractive to a commercial breeder. Nevertheless, camelid breeders should be encouraged to reduce the occurrence of caudal vertebral malformations through careful selection of machos and hembras for breeding and careful examination for, and recording of, all abnormalities in crias.

Discussion

The congenital conditions of hemivertebrae in pigs and tail agenesis in cats have both had inheritance confirmed, but it is unconfirmed in camelids. Whilst it is not possible to rule out acquired congenital causes of vertebral malformations, such as viral infection, nutritional imbalance, toxin ingestion or environmental insult to the dam, the high occurrence of caudal vertebral malformations in the offspring of the macho in this study is suggestive of a hereditary basis for the tail abnormalities.

Caudal vertebral abnormalities in this study included hemivertebrae, wedge hemivertebrae, block vertebrae, vertebral subluxation and vertebral luxation. The number of caudal vertebrae in the alpaca varies from 10 to 15. In this study, the exact number of caudal vertebrae could not be determined in all cases as the sacrum was not visible in all radiographs.

It has been proposed that camelid registries use the finding of a crooked tail as grounds for denying registration. Fowler, noting that disfigurement of the tail may be considered unattractive, then poses a question: "What difference does it make if a llama or alpaca has a crooked tail?" We consider that there may be a correlation between malformations of the tail and other vertebrae, and whilst a malformed tail may be no more than unattractive, malformation of cervical, thoracic, lumbar or sacral vertebrae may cause functional physical and neurological deficits. Some malformations may be life-threatening, as in the cria in Figure 6. Myelography and/or computed tomography may be indicated to further determine whether there is spinal cord compression in such cases.

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Table 1. Number and type of vertebral abnormalities in alpacas examined by radiography

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Alpaca Sub- Luxation</th>
<th>Hemi- Vertebra</th>
<th>Wedge Hemivertebra</th>
<th>Block Vertebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Offspring 1</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>–</td>
<td>Offspring 2</td>
<td>1</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Offspring 3</td>
<td>1</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>Offspring 4</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>–</td>
<td>Offspring 5</td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td>–</td>
<td>Offspring 6</td>
<td>3</td>
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<td>2</td>
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<tr>
<td>–</td>
<td>Offspring 7</td>
<td>2</td>
<td>–</td>
<td>2</td>
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<tr>
<td>–</td>
<td>Offspring 8</td>
<td>3</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Offspring 9</td>
<td>4</td>
<td>–</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Sire</td>
<td>3</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Victorian cria</td>
<td>1</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
<td>1</td>
<td>16</td>
</tr>
</tbody>
</table>

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There were no neurological gait deficits, such as dragging toes, hypermetria or knuckling, observed in any of the radiographed animals.

A left lateral radiograph of the caudal cervical spine of the Victorian 2-month-old cria is shown in Figure 6. There was dorsal subluxation resulting in kyphosis at C7/T1 and a hemivertebra at C7. The cria was becoming progressively paralysed at this stage. The tail of this animal was not radiographed and it is not known whether it was palpably normal.

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Acknowledgments

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References

4. Australian Alpaca Association Inc. Application and veterinary report for male certification. Form MC.

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BOOK REVIEW


The authors, who are philosophers, animal scientists and economists, come from developed and developing countries. The 13 chapters are from papers given at the 8th World Conference on Animal Production in Seoul in 1998. Ten of the chapters have the words ethics or ethical in the title and deal with aspects of livestock science and quality of life. Another chapter is titled Animal Welfare and Use and the remaining two are about free trade and consumer expectations. The book is published so that animal scientists may see their work “in the larger perspective of life as a whole”.

The thesis of the book is that animal science has become the servant of market economy capitalism and that meat consumers have become suspicious of this relationship and want cheap food plus guarantees about food safety and animal and environmental welfare. The authors discuss ethical approaches to livestock production. Authors from developed countries write about ethics as a component of quality of life. The authors from the developing world are more concerned about food per se, how to cope with an increasing population and demand for meat. This is an interesting dichotomy and I got the impression that the authors from Asia, South America and Africa tagged on the ethics paragraphs as afterthoughts.

The book is well written and includes good chapters by Rollin on agribusiness and consumer ethics and on African development by Kinoti. The authors from the developed world plead for a return to animal husbandry, rather than animal science, which entails a lower stock unit to human ratio and a move away from intensive farming. The use of grains as stock feed was of concern to the authors from Asia and this plus the increased demand for meat is likely to see an ongoing increase in intensive pig and poultry production systems against the ethics of authors from the wealthy world. This difference in perspective raises concern about a form of imperialism based on the ethical issues involved in livestock production.

This book is not essential reading for veterinarians although those with an interest in livestock production and ethics may find it interesting. It does not address but should stimulate thought about the role of the veterinarian, as animal scientist, in livestock production worldwide.

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