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SURGICAL MANAGEMENT OF UNILATERAL ECTOPIC HYDROURETER AND HYDRONEPHROSIS IN A JUVENILE ALPACA

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ABSTRACT

An unusual case of an ectopic ureter and hydronephrosis in a 9 month female alpaca with persistent complain of incontinence is reported. Hydronephrosis and hydroureter was evident on ultrasonographic examination. An intravenous pyelogram and excretory urogram was performed to assess kidney function, as well as document the possibility of an ectopic ureter. The right kidney function and ureter were determined normal. Unilateral left nephrectomy and ureterectomy was performed through a caudal ventral midline celiotomy. The alpaca began feeding soon after recovery and had no significant difficulties over the course of the recovery period. On follow-up a year after surgery, the owner reported that the alpaca was well and had normal growth. No episodes of incontinence were observed.

Key words : Alpaca, ectopic, hydronephosis, hydroureter, nephrectomy, ureterectomy, ureter

A 9-month 25 Kg female alpaca was admitted to the Washington State University Veterinary Teaching Hospital (WSU-VTH) for evaluation and treatment of urinary incontinence that had persisted since birth. The incontinence was characterised by persistent dribbling of urine from the vulva, as well as urine scalding at the perineal area and medial aspect of the hind limbs. The alpaca could urinate normally, did not appear to suffer from any signs of tenesmus, and was otherwise in good physical condition. The alpaca had been previously evaluated for the incontinence, and a surgery was performed in an attempt to reduce the diameter of the urethral opening, without a successful outcome.

Results of a serum chemistry and complete blood count revealed a mild decrease in the serum protein, 4.3g/dl (normal range 5.1-7.8 g/dl), characterized by a mild hypoalbuminemia of 2.5g/dl (normal range 3.1-5.2 g/dl). No other abnormalities were noted from the CBC or chemistry profile. At this time, a tentative diagnosis of ectopic ureter was pursued, with the possibility of associated cystitis or subclinical pyelonephritis as secondary conditions.

The alpaca was sedated with 5mg butorphanol[a] IV, and vaginoscopy was performed for evaluation of the vaginal vault as well as possible documentation of ectopic ureters. On visual examination the perineal area and the vulva were normal. The external urethral opening, vestibulum, vagina, and cervix were examined using a flexible pediatric bronchoscope[b] (6 mm outer diameter). The only abnormality found was a dilated external urethral opening with very small (1mm) round scarred tissue on each side of the transverse fold. The vagina was normal. The cervix was normal and completely open and allowed direct visualisation of the uterine cavity. According to history, the attending veterinarian had placed two sutures to reduce the external urethral opening, but the details of this surgical intervention were not available. The scars were presumed to be the results of this surgery.

An ultrasound examination was performed, revealing a distended, fluid-filled left kidney as well as hydroureter (Fig 1). The ureter could be traced to the level of the trigone of the bladder (Figure 2), but could not be identified to be continuing beyond that point. The right kidney and ureter both appeared normal, with the right ureter entering the bladder at the level of the trigone. The remainder of the abdominal cavity appeared normal.

The following day, the alpaca was sedated with a combination of butorphanol, ketamine[c], and xylazine[d] IV, and an intravenous pyelogram and

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excretory urogram was performed to assess kidney function, as well as to document the possibility of an ectopic ureter. The pyelogram was conducted under fluoroscopic guidance. A Philips Miltidiagnost 3 unit[e] was used to document filtration within the left and right kidney. The right kidney appeared to have normal function, and the right ureter inserted into the urinary bladder in a normal anatomic position. The left kidney could not be identified after the initial injection of contrast material, but subsequently, an accumulation of contrast material was noted in the anatomical area of the left kidney. There was significant dilution of the contrast material in the region of the left kidney, making identification of the left ureter, and its course to the urinary bladder impossible. At this time, left hydroureter and accompanying hydronephrosis of the left kidney was diagnosed with a suspected ectopic left ureter. The right kidney function and ureter were determined normal based on the lack of azotemia and the normal fluoroscopic appearance of the right kidney during the contrast study.

Surgical procedure

Food was withheld for 24 hours preceding surgery and water was withheld for 12 hours immediately preceding surgery. Ceftiofur[f], 270mg IV, was initiated and continued every 12 hours. General anesthesia was induced using guafenisin[g] and propofol[h] IV and maintained throughout the procedure using isoflurane[i] admixed in 100% oxygen. The abdominal region was shaved from 8 cm cranial to the xiphoid to the pubis and washed to remove gross contamination. The perineal region was

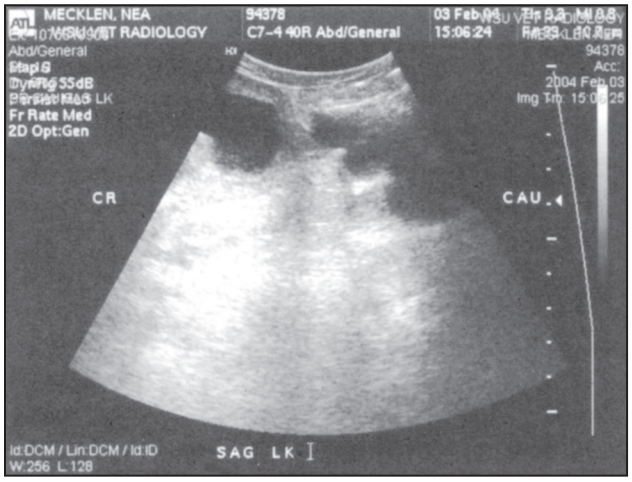

Fig 1. Ultrasound exam performed on 9 month old female alpaca. A sagittal view of the left kidney reveals significant hydronephrosis with indistinct cortico-medullary distinction.

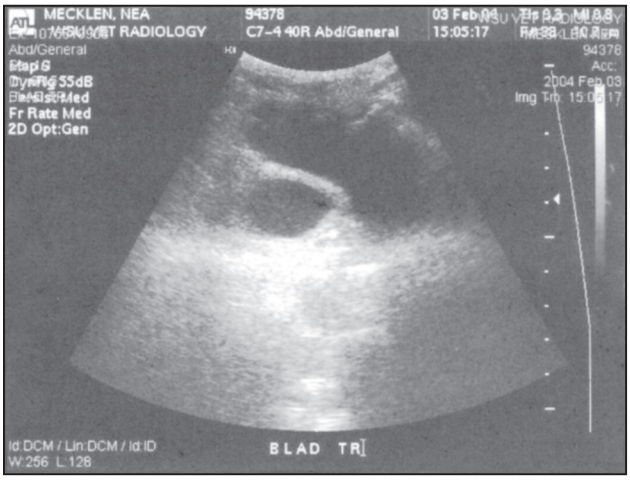

Fig 2. Ultrasound examination of the urinary bladder of a 9 month old alpaca with a history of urinary incontinence. The left ureter (closed arrow) is dilated and seen at the area of the trigone of the urinary bladder (arrowhead). The right ureter cannot be visualised in this field. The left ureter could not be identified further caudally.

Fig 3. The left kidney and ureter has been reflected caudally (The patient's head is to the right of the picture). The kidney is notably dilated, with subsequent loss of functional parenchyma. The ureter is also significantly dilated.

Fig 4. Left kidney and ureter removed from the alpaca.

likewise clipped and cleaned for sanitary purposes. A tetanus toxoid booster was administered and 27mg of ceftiofur was given IV. A caudal ventral midline celiotomy was performed to access the abdominal cavity (Fowler, 1998). An incision ranging from 5cm cranial to the umbilicus to the cranial aspect of the mammary glands was performed. Careful dissection of the mammary tissue was performed to minimize hemorrhage and post-operative inflammation. The abdominal cavity was explored with no significant abnormalities apparent aside from the left renal area. The left kidney was hydronephrotic, and the left ureter was distended along the entire length (Fig 3). The kidney was dissected free from the retroperitoneal space with a combination of cautery and blunt dissection. The left ovarian artery and vein were identified and carefully dissected to prevent damage to the ovarian blood supply. The renal artery and vein were isolated, and double ligated with 2-0 silk. Additional hemostasis was obtained using hemoclips[j]; the ureter was dissected free from the retroperitoneal space to the urinary bladder. At the site of the trigone of the bladder, the dissection was discontinued, and the ureter was double ligated with 2-0 silk. The ureter was transected at the level of the trigone of the bladder, and the entire left kidney and ureter were removed (Fig 4).

The kidney and ureter were submitted for histopathological analysis as well as culture and sensitivity. Routine abdominal closure was performed in three layers. The alpaca received 500 mls of plasma in the immediate post operative period due to the low albumin, as well as fluid therapy and continuation of ceftiofur administered IV overnight. The urinary bladder was catheterised, and urine production was measured through the evening. The alpaca began feeding soon after recovery and had no significant difficulties over the course of the recovery period.

The following day, the urinary catheter was removed, and the alpaca began urinating normally without any dribbling or tenesmus. A chemistry panel was performed on the alpaca to evaluate renal function and albumin. The BUN was within normal limits and creatinine was slightly low (11 and 1.1 respectively [normal range of BUN 9-33, creatinine 1.4-3.2]). A mild increase in creatine kinase was present (166 normal range 8-72) consistent with the recumbency during the surgery. The total protein and albumin remained slightly low (4.1/2.0 respectively) at that time. A subsequent chemistry panel performed three days later showed a continued trend of improving protein and albumin levels. Fluids were continued for an additional 24 hours and were discontinued after noting that the alpaca was drinking well on its own. Enrofloxacin[k] was initiated subcutaneously and continued for an additional 5 days. The culture obtained from the removed kidney and ureter was positive for *E. coli* that was resistant to ceftiofur and sensitive to Enrofloxacin.

Histopathologically the left kidney was hydronephrotic, with a remaining thin rim of cortical tissue amongst significant dilation of the renal pelvis. No other histological abnormalities were noted within the submitted tissues. The alpaca was returned to its herd mates after 3 days and continued to recover uneventfully. The alpaca was discharged 2 weeks later to the owner and continued to do well. On a follow up, a year after surgery, the owner reported a normal growth and no further episodes of incontinence.

Discussion

Hydronephrosis is an uncommon condition often caused by post renal obstruction or congenital defects (Ruiz de Gopegui *et al*, 1999). One case of hydronephrosis in an alpaca has been previously reported in the veterinary literature, involving a young alpaca with concurrent ureteral duplication (Cardwell and Thorne, 1999). Hydronephrosis has been reported to develop secondary to ectopic ureter in one case involving a llama, in which the ectopic ureter was diagnosed with a combination of CT, abdominal ultrasound and vaginoscopy (Van

Footnotes :

a Butorphanol: Torbugesic. Fort Dodge. Fort Dodge, IA. 50501.

b 6 mm Bronchoscope: VB 2000. Pentax. Orangeburg, NY 10962.

c Ketamine: KetasetIII. Fort Dodge. Fort Dodge, IA 50501.

d Xylazine: Tranquived. Vedco. St. Joseph, MO 64507.

e Philips Miltidiagnost 3 Philips medical systems. La Palma, CA. 90623.

f Ceftiofur: Naxel. Pharmacia & Upjohn. Kalamazoo, MI 49001.

g Guafenisin: Guafenisin. Vedco. Phoenix Scientific Inc. St Joseph, MO 64503.

h Propofol: Rapinovet. Shering Plough. Union, NJ 07083.

i Isoflurane: Isoflo® Abbot Laboratories. North Chicago, IL. 60064.

j Hemoclips Weck closure systems. Research triangle, NC. 27711.

k Enrofloxacin: Baytril. Bayer. Shawnee Mission, KS 66201.

Hoogmoed *et al*, 1997). In this case, ultrasonographic and fluoroscopic identification of a normal and abnormal kidney was definitive enough to pursue surgery. To the authors' knowledge, this is the first report of ectopic ureter in an alpaca. The exact course of the left ureter was not completely determined in this patient. Confirmation of intramural tunneling was not possible during fluoroscopy due to the dilutional effect of the contrast material in the hydronephrotic left kidney and ureter. The ultrasound examination did not provide clear evidence of the course of the left ureter once it had reached the level of the trigone of the bladder. The exact termination of the left ureter in the bladder was also not defined in surgery. The left ureter was identified entering the wall of the urinary bladder and ligated at the site of entry. An additional cystotomy to document the ultimate course of the ureter once it entered into the bladder was not deemed necessary. The surgery was completed as described (Rawlings *et al*, 2003), without significant complications aside from a transient period of low mean arterial pressures (55mm Hg) occurring near the end of the surgical procedure, which responded to dobutamine therapy. A likely diagnosis of hydronephrosis secondary to ectopic ureter was reached due to the very caudal position of the ureter as it entered the bladder wall combined with the history of persistent urine dribbling.

Ectopic ureter has previously been diagnosed in human, feline, canine, equine, llama, bovine, and porcine patients (Hammer *et al*, 2000; Houlton *et al*, 1987; Fowler, 1998; Freedman and Rickwood, 1994; Macallister and Persue, 1990; McLaughin and Miller, 1990). Two forms of ectopic ureter (intramural and extramural) are reported, based on the communication of the ureter with the distal aspect of the urinary system. Intramural ectopic ureters enter the bladder at the area of the trigone and continue within the submucosal and mucosal layers to their final termination. Several configurations of intramural ureters have been described (McLoughin *et al*, 2003). Extramural ectopic ureters are less commonly reported and enter the distal aspect of the urinary tract outside of the bladder and have been reported to terminate into the urethra, vagina, and uterus (Hammer *et al*, 2000; Houlton *et al*, 1987; Freedman and Rickwood, 1994; Macallister and Persue, 1990; Leopold *et al*, 1994; McLaughin and Miller, 1990; McLoughin *et al*, 2003). The alpaca described here had clear indication of ureteral termination in the bladder; therefore, an intramural ectopic ureter has been assumed as the final diagnosis.

A positive culture result of *E. coli* from the kidney is believed to be caused from ascending infection from the urinary bladder secondary to urinary incontinence. The overall incidence of urinary tract defects in camelids is low, accounting for only 1.6% of the total congenital defects reported (Leipold *et al*, 1994). Two previous reports of surgery on the urinary bladder have been reported, both involving repair of a ruptured bladder (Dart *et al*, 1997; Andrews *et al*, 1995).

Vaginoscopy and fluoroscopic contrast studies were highly valuable in determining the developmental abnormality in this patient. The right kidney was also evaluated during the process of the intravenous pyelogram to ensure that a left-sided nephrectomy would be tolerated by the patient. It is imperative that renal function of the remaining kidney be assessed before consideration of unilateral nephrectomy. A combination of serum chemistry values as well as a study to determine filtration of the remaining kidney (GFR, IVP/EU) must be pursued to determine surgical risk. No other developmental abnormalities were noted in the urogenital tract in this alpaca. The surgical procedure was well tolerated and provided excellent results.

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BOOK REVIEW

Name of the Book	:	**SELECTED RESEARCH ON CAMELID PHYSIOLOGY AND NUTRITION**
Editor	:	**T.K. Gahlot**
Co-Editors	:	**N Kataria, R Yagil, K Dahlbom, M Bengoumi, TEA Osman, B Faye, M Gauly, Wv Engelhardt, Afaf S Fahmy, A Tibary and GA Alhadrami**
Edition	:	**1st 2004, Soft Cover, pages 864**
ISSN	:	**81-901141-2-3**
Publisher	:	**The Camelid Publishers (see details on the website: www.camelsandcamelids.com)**

This book published in 2004 by The Camelid Publishers, India and edited by T.K. Gahlot is an comprehensive collection of camelid physiology. The authors come from a large number of countries around the world, bound by their interest in the working on the camelids. The topics are varied and cover all the physiological mechanisms which make the camelids special in the animal kingdom. The data concerning camelid adaptation is the basis for the interest in camelids as farm animals even in modern societies. The data confirms that camels are not just "another cow" or a "horse designed by a committee" but have undergone a perfect adaptation to their various environments of cold deserts, hot deserts and the heights of the Andes.

The book is divided into chapters dealing with physiological adaptive mechanisms: "Adaptation, Stress, Dehydration"; "Biochemistry"; "Endocrinology"; "Enzymes"; "Haematology"; "Milk"; "Nutrition, Digestion, Respiration"; "Renal Physiology"; "Reproduction"; Nutrition";" Adipose tissues".

This book is a direct result of the decision taken at the Eilat International Camelid Conference in 1996 that one specific journal should deal with all information concerning camelids because papers related to the camelids which are published every year are not too many. In this way the dilution of knowledge was checked that resulted when camelids papers were published in many scientific journals. The" Journal of Camel Practice and Research" with T.K. Gahlot as its editor was preferred as the journal of choice for camelid papers. This journal has published volumes of information on camelids since then. Since the journal publishes articles by camelid scientists, presenting the latest discoveries in camel research, the present book is the first fruit of this journal.

This present book is not only a scientific one but also readable. It will become a text book and inspiration for future scientists. Every Faculty with a Department of Physiology and every animal scientist should have at least one copy on its bookshelves.

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