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PARAINGUINAL CRYPTORCHIDECTOMY UNDER GENERAL ANAESTHESIA IN A BACTRIAN CAMEL (*Camelus bactrianus*)

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ABSTRACT

The present paper describes general anesthesia technique and surgical parainguinal approach to remove an abdominal testis in a 2 year old Bactrian camel. The testis was located by transbdominal ultrasonography in an area adjacent to the inguinal ring. General anesthesia was induced by Guaifenesin 5% (200 milliliters IV) followed by a bolus of ketamine (1050mg, IV) and maintained with Isoflorane in oxygen. The parainguinal approach to cryptorchidectomy as described was performed without complications, with a smooth uneventful recovery.

Key words : Anaesthesia, bactrian camel, cryptorchidectomy, parainguinal

Cryptorchidism has been described in all camelids but is generally considered uncommon or rare condition and should be distinguished from ectopic testicles. Ectopic testicles are commonly found in the subcutaneous tissue of the inguinal region or on either side of the penis and are easily removed surgically.

Cryptorchidism is relatively better studied in South American camelids than in Old world camelids. In alpacas, an abattoir study found an incidence of 3% unilateral cryptorchidism (58.3% left and 41.7% right) in 792 animals (Sumar, 1983). The incidence of ectopic testicles was reported to be 1.9% in the same study with the left testicle being affected 73.3% of the time. Bilateral cryptorchidism has been described in a Sry-negative XX, sex reversal case in a llama with multiple congenital abnormalities (Drew *et al*, 1999). Monorchism, true absence of one testicle, has also been reported in a few alpacas and is accompanied by absence of the ipsilateral kidney (Sumar, 1989). Methods of diagnosis include history, clinical evaluation and testosterone response after hCG injection (Perkins *et al*, 1996). Similarly to other species, cryptorchidism is suspected to be hereditary in South American camelids. Three cases of cryptorchidism were described in closely related males from a herd of captive vicunas (Rietschel, 1990).

Cryptorchidectomy is the management methods of choice. In South American camelids removal of the retained testis can be accomplished using a variety of techniques including laparoscopy, flank, ventral midline and parainguinal approaches (Parker and Semevolos, 2002; Tibary 2004; Tibary *et al*, 2001a; Tibary *et al*, 2001b).

The incidence of cryptorchidism in Old World camelids is largely unknown. An abattoir study reported an incidence 1.3% in 153 camels (El-Wishy 1993), 2 in 132 camels (Tibary and Anouassi, 2004) and 1 amongst 210 births in Bikaner (Kohli and Verma, 1981; Vyas *et al*, 1996). Isolated cases of unilateral (El Hariri and Deeb, 1979) and bilateral (Kohli and Verma, 1981; Vyas *et al*, 1996) cryptor-chidism have been reported in the dromedary camels. In one case, an interstitial cell tumor was diagnosed in the affected testicle (El Hariri and Deeb, 1979). Only one case of cryptor-chidism in *Camelus bactrianus* was available in the literature (Kuntze, 1984).

The objective of the present paper is to describe the diagnosis and surgical management under general anesthesia using a parainguinal approach in a bactrian (*Camelus bactrianus*) camel using a technique similar to that described recently in alpacas (Parker *et al*, 2002).

History and Physical Examination

A 2-year-old male bactrian camel was presented to the Veterinary Teaching Hospital at Washington State University for an elective orchidectomy. Physical

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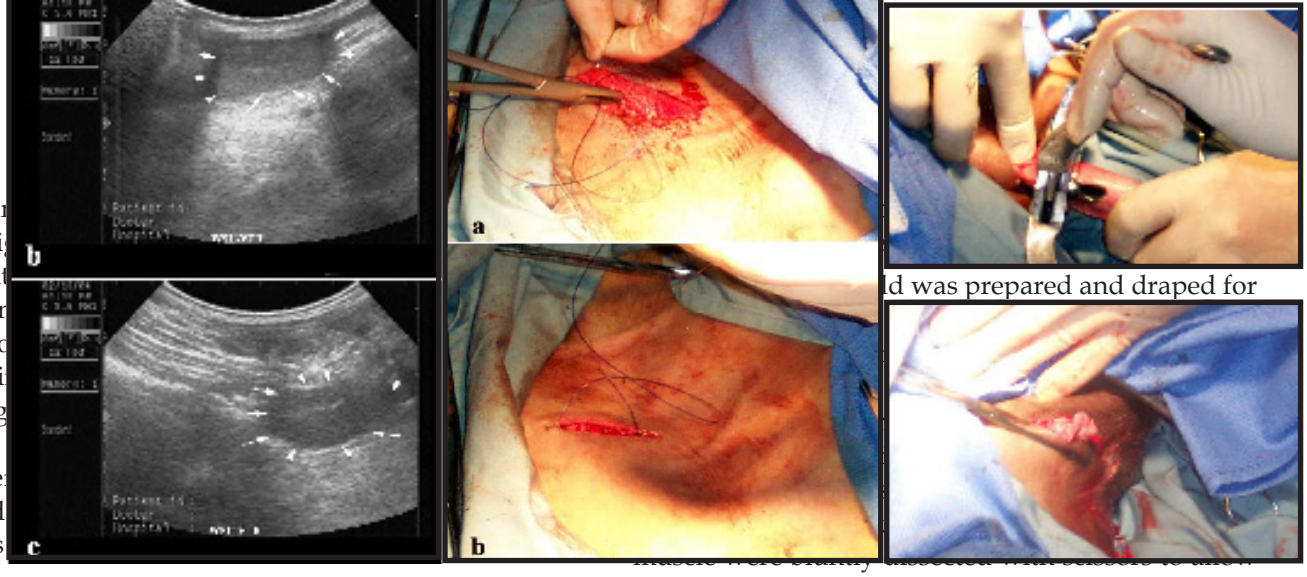

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Anesthesia and surgical procedure

The camel was fasted (food and water) for 24 hours and was given tetanus toxoid and penicillin (22,000U/kg), preoperatively. Packed cell volume (PCV) and total protein (PT) were 26% and 5.8 g/dl, respectively. The patient was sedated with xylazine (70mg IM followed 20 minutes later by 50 mg IV) to allow placement of a jugular vein catheter. General anesthesia was induced by intravenous infusion of 200 ml of 5% guaifenesin solution followed by a bolus of ketamine (1050 mg, IV) when the camel was recumbent. The patient was maintained in sternal recumbency to facilitate intubation. Endotracheal intubation was rather difficult which was expected due to the large soft palate and its tendency to increase in size during the rutting season. Intubation was performed with a 20 mm cuffed endotracheal tube and auxiliary stylet guide (propylene catheter) and a laryngoscope with a 25 cm blade. Lidocaine was sprayed locally on the arytenoids to avoid spasm and facilitate intubation. General anaesthesia was maintained with isoflurane in oxygen (100%) using a large animal rebreathing circuit machine (Dragger- Large Animal Control Centre) and animal was placed on a dorsal recumbency for surgery (Fig 1b). The arterial blood pressure was monitored via a transducer connected to a catheter placed in the cranial tibial artery (Fig 1c). Heart rate and blood gas analysis were also monitored throughout the procedure. Respiratory rate (6 breaths/ min) and volume (4 liters/minute) were controlled by a large animal ventilator (Dragger- Large Animal Control Centre). The animal also received Butorphanol tartrate (10 mg, SC and 5 mg, IV).

Location of the retained testicle and surgery

The camel was placed in dorsal recumbency. The ventral abdomen and inguinal area was clipped from just cranial to the prepuce to just caudal to the scrotum. The testicle was located intrabdominally near the inguinal canal at a depth of approximately 4

visualisation of the peritoneum. The peritoneum was elevated with thumb forceps and incised. The incision of the peritoneum was enlarged by gentle digital manipulation. The size of the incision allowed insertion of 2 fingers into the abdomen. The surgical opening was maintained open by an assistant while the surgeon used a spay hook to locate the testis. The testicle was easily located, hooked and brought to the level of the surgical opening. The testicle, vascular cone and gubernaculum were exteriorised completely (Fig 3a).

The testicular artery and pampiniform plexus were transfixed and ligated using No.0 chromic catgut and the emasculator was applied distal to the ligatures and held in place for few minutes to avoid haemorrhage (Figs 3b and 3c). The stump was cleaned and penicillin G was applied topically then replaced into the abdomen. Closure of peritoneum, oblique abdominal muscle and fascia were obtained with a simple continuous pattern with number 0 catgut. Subcutaneous tissues were approximated with a continuous pattern using 2.0 Polydixon (PDS). Finally, the skin was closed using PDS 1.0 in an intradermal pattern (Figs 4a, b).

The right testicle was removed through a 5 cm incision in the caudal aspect of right scrotum. Vaginal tunica was preserved to perform a closed castration. After exteriorisation, the spermatic cord was transfixed (PDS 1.0) proximal to the pampiniform plexus occluding testicular artery and vein. The emasculator was then placed around the testicular cord and removed after few minutes with no signs of bleeding. The scrotal sac was left open to heal by second intention (Figs 5a, b, c, d).

Recovery from general anesthesia was smooth and uneventful. Flunixin Meglumine (770 mg, IV) and Long acting tetracycline, (LA 200, 3500 mg, IM) were given for post-operative control of pain and to prevent infection. The animal was drinking and eating 2 hours after surgery and was discharged 2 days later.

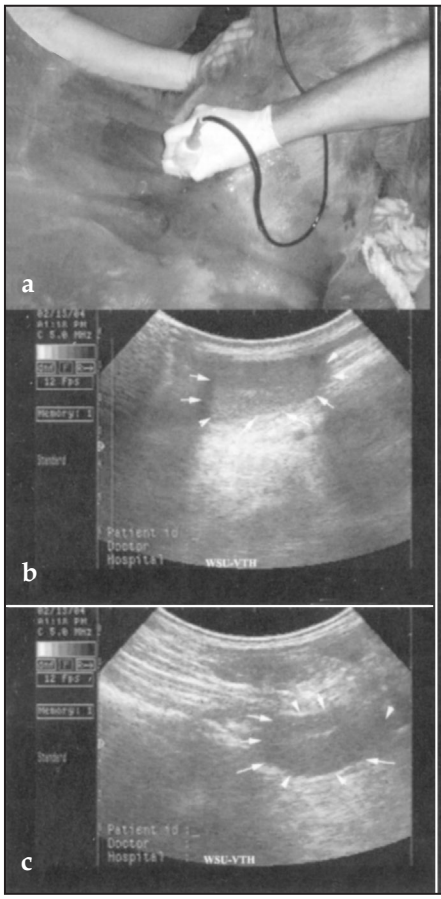

Fig 1. a) Placement of the ultrasound transducer for location of the retained testicle. b) Ultrasonogram of the normal descended testis (right). The arrows outline the edges of testicular tissue. c) Ultrasonogram of the abdominally retained testicle (left). The arrows outline the edges of testicular tissue.

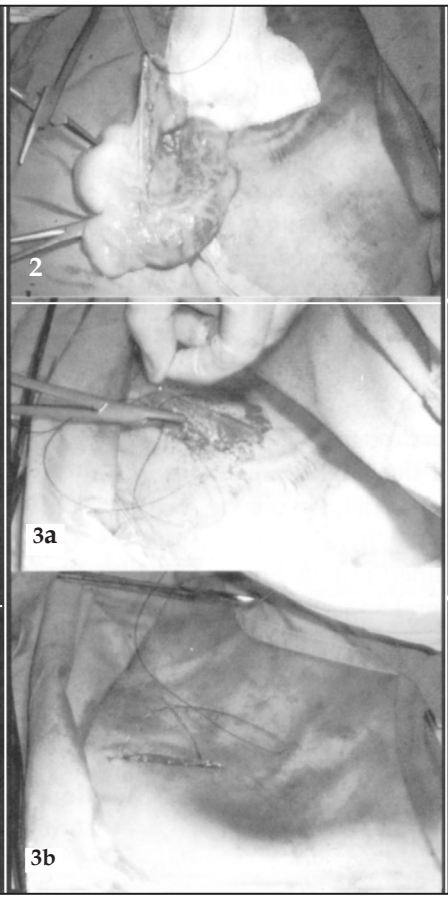

Fig 2. Transfixing suture at the vascular and gubernaculum.

Fig 3. a) Closure of the abdominal muscle. b) Closure of the skin with intra.

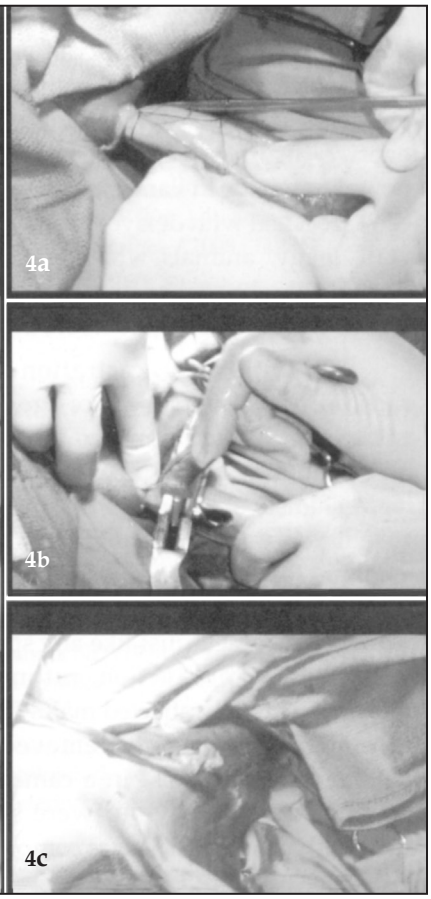

Fig 4. Closed castration of the normal testicle: a) Transfixing the testicular cord, b) Application of the emasculator, c) Scrotal incision after excision of the testicle.

No complications were observed in the 6 months following surgery.

Discussion

Little is known about the embryonic development of the male genitalia and testicular descent in camelidae. In one study on dromedary foetuses, all testicular structures were differentiated and easily identifiable in 8-9 month foetuses. At 9 to 10 months of pregnancy, the foetal testicle offers a histological organisation similar to that of the adult animal with well-differentiated interstitial tissue, seminiferous tubules and rete testis. The tunica albuginea is well differentiated and richly vascularised and projects into the testicular parenchyma to form septae containing the germinal cords (seminiferous tubules) (Fahmy and George, 1967).

The mechanism and chronology of testicular descent remains largely unstudied in camels. In some studies, the testicles lie caudally to the superficial inguinal region at 7 months. According to some authors, testicular descent is not complete until the second or third year of life in the dromedary and bactrian camels (Tibary and Anouassi, 1997). The high variability of onset of puberty reported by different authors could be due to different types of camels and their management (nutrition, genetics, health…). In the llama and alpaca, the testes are already present in the scrotum at birth, but they are usually soft and difficult to palpate. One study on camels reported that testicular descent occurs between 66 and 296 days of life (Bissa *et al*, 1988). In the author's clinical experience, in well managed racing camel herd most calves have testicles already descended in the scrotum and castration is possible

as early as 4 to 8 months of age (Tibary and Anouassi, personal observations). However, the negative health effects of early castration are not known in camels. In llamas, prepuberal castration has been associated with delayed physeal closure resulting in tall "leggy" animals, which may be predisposed to degenerative changes and early onset of osteoarthritis and patellar luxation (Anderson, 2004).

Traditionally, castration in camels is not practiced until 1 or 2 years of age. The chances that testicles will descend after two years are relatively low and the animal should be examined thoroughly for cryptorchidism or ectopic testicles. As described in this present report, ultrasonography is an invaluable technique for the location of the retained testicle but requires heavy sedation or even general anaesthesia. Cryptorchid camels, just like any species, are capable of testosterone production, rutting behaviour and mating. Unilaterally affected males may be fertile if the descended testicle is not removed. In one case of bilateral cryptorchidism in a camel, rutting, mating and ejaculation behaviour were similar to normal camels although the male was completely azoospermic (Vyas *et al*, 1996). Castration of cryptorchid camel is therefore mandatory in order to eliminate rutting behavior and possibility of mating and inducing ovulation without fertilisation.

Several methods used in the equine have also been applied to cryptorchidectomy in llamas and alpacas. Although laparoscopic cryptorchydectomy is very attractive because of their esthetics and safety, it remains a specialised technique requiring special equipment and training and may not be easily manageable in large camelids such as the dromedary and bactrian camel (Tibary *et al*, 2001). In the equine the inguinal approach (incision directly over the inguinal ring) is usually practiced if the testis is inguinal and a modified inguinal approach or parainguinal approach is used if the testicle is not in the inguinal canal (Wilson and Reinertson, 1987).

In our experience the testis in cryptorchid camelids is always intrabdominal. The parainguinal approach is therefore the most logical choice especially if the testicles can be visualised by ultrasonography as in the present case. This technique has been used successfully in 2 alpacas (Parker and Semevolos, 2002). The retained testicle of each alpaca was found on the ventral portion of the abdomen, just caudal to the incision in the first alpaca and at the cranial edge of the incision in the second alpaca. The attachment of the epididymis to the vaginal process was identified only in the larger alpaca. The inguinal approach may not be adequate in all cases because of the inability to exteriorise the vaginal process and allow access to the testis in some cases.

Camelids have a small inguinal ring and canal compared to other large domestic species and especially the equine. Therefore, the inguinal approach commonly used in the equine, which relies on traction on the inguinal extension of the gubernaculums, and exteriorisation of the vaginal process may not be effective in camelids. As stated by Parker and Semevolos (2002) for alpacas a substantial increase of the inguinal rings would be needed to reach the abdominal testicle which would be more traumatic and difficult. Parainguinal approach could be used in camelids with a history of castration and persistent male behaviour and evidence of presence of testicular tissue based on response to hCG stimulation. This technique presents several advantages, including the high likelihood that the testicle is close to the incision, and a small incision with minimal aftercare.

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References

Anderson DE (2004) Castration of llamas and alpacas. Proceedings Camelid Medicine, Surgery and Reproduction Conference. The Ohio State University, Columbus Ohio. pp 203-205.

Bissa UK, Rai AK and Khanna ND (1988) Testicular descent and development of scrotum in camel calves of Bikaneri breed. Indian Journal of Animal Sciences 58:1200-1201.

Drew ML, MeyersWallen VN, Acland GM, Guyer CL and Steinheimer DN (1999). Presumptive Sry-negative XX sex reversal in a llama with multiple congenital anomalies. Journal of the American Veterinary Medical Association 215: 1134-1139.

El Hariri MN and Deeb S (1979) Cryptorchidims with interstitial cell tumour in a case of camel (*Camelus dromedarius*). Journal of the Egyptian Veterinary Medical Association 39: 39-46.

El Wishy AB (1993). Genital abnormalities in camels (*Camelus dromedarius*). Etudes et Syntheses de l'IEMVT, 163-174.

Fahmy MFA and George AN (1967). A study on the development of 8-10 months foetal testis of the camel (*Camelus dromedarius*). Journal of Veterinary Science U.A.R. 4:63-68.

Garmagar M (2001). Personal communication, Kargi, Marsabit, Kenya.

Kohli IS and Verma JK (1981). Note on dicryptorchidism in

a herd of Bikaneri camel. Indian Journal of Animal Science 51:684.

Kuntze A (1984). Zur Kastrationstechnik bei ursiden und kryptorchiden trampeltieren (*Camelus bactrianus*). Verhandlungsbericht des XXIV Internationalen Symposiums uber die Erkrankunge der Zootiere. pp 183-186.

Parker JE, Semevolos SA (2002) Use of a parainguinal approach for cryptorchidectomy in alpacas. Journal of the American Veterinary Association 220:1761-1952.

Perkins NR, Frazer GS and Hull BL (1996). Endocrine diagnosis of cryptorchidism in a llama. Australian Veterinary Journal 74:275-277.

Rietschel W (1990). Cryptorchidism in the vicugna (*Lama vicugna*). Tierärztl. Prax. 18:459-461.

Sumar J (1983). Studies on Reproductive Pathology in Alpacas. MS Thesis, Dept Obstet and Gynaec., College of Vet Med, Swedish University of Agriculture Science, Upsala, Sweden.

Sumar J (1989). Defectos del sistema reproductivo. In Defectos congenitos y hereditarios en la alpaca - Teratologia. Edicion auspociada por el consejo Nacional de Ciencia y Tecnologia. 23-34.

Tibary A (2004). Laparoscopy in lamoids. Proceedings of North American Veterinary Conference, Orlando, Florida, January 17-21, 2004. pp 290-291.

Tibary A and Anouassi A (1997). Reproductive Physiology of the Male. In 'Theriogenology in Camelidae: Anatomy, Physiology, BSE, Pathology and artificial breeding'. (Ed. Tibary A). (Actes Editions, Institut Agronomique et Veterinaire Hassan II). pp 49-74.

Tibary A and Anouassi A (2000). Surgery of Reproductive Tract in Camels. In: Recent Advances in Camelid Reproduction, Skidmore L and Adams GP (Eds.). Ithaca: International Veterinary Information Service A1008:1100.

Tibary A and Anouassi A (2004). Standing castration in camels. Journal of Camel Practice and Research 11(2): 125-127.

Tibary A, Anouassi A and Memon MA (2001a). Approach to diagnosis of infertility in camelids: Retrospective study in alpaca, llamas and camels. Journal of Camel Practice and Research 8:167-179.

Tibary A, Ragle C and Thompson S (2001b). Abdominal endoscopy in clinical camelid theriogenology. Proceedings of Twin Camelid Production and Reproduction Conferences, Reproductive Health Center, Charleston SC, October 13-15th 2001. Paper 11.

Vyas S, Rai AK and Khanna ND (1996). Case report of bilateral cryptorchidism in Bikaneri camel. Indian Veterinary Journal 73:1080-1081.

Wilson DG and Reinertson EL (1987). A modified parainguinal approach for cryptorchidectomy in horses: an evaluation in 107 horses. Veterinary Surgery. pp 16.

Comparative pharmacokinetics of salicylate in camels, sheep and goats

B.H. Ali

This study compared some pharmacokinetic parameters of DL-lysine-acetyl salicylate administered intravenously (i.v.) and intramuscularly (i.m.) at a dose of 20 mg/kg in camels, sheep and goats. The data was analysed using a non-compartmental model. In camels, sheep and goats given the drug i.v., the t½ values were 43.1, 31.2 and 27.3; the clearance (CI) values were 203.7, 261.1 and 280.4 ml/h/kg, while the area under the curve (AUC) were 100.1, 106.9 and 110.5 mg/h/L, respectively. In camels, sheep and goats given the drug by the i.m. route the mean peak plasma concentration (C_{max}) were 0.94, 1.44 and 1.74 mg/ml, and the time to reach C_{max} (t_{max}) were 2.94, 2.57 and 2.43 h, respectively. The t½ values were 48.9, 38.2 and 36.0 min; the clearance (CI) values were 261.3, 297.4 and 306.4 ml/h/kg, while the area under the curve (AUC) were 101.6, 117.3 and 123.7 mg/h/L, respectively. The drug bioavailability (F) in camels, sheep and goats were 71.3, 78.4 and 79.4%, respecively. These findings suggest that the rate of absorption and elimination of the salicylate is slower in camels than in sheep and goats.

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