Case Report

Laparoscopic-Assisted Cryptorchidectomy in an Adult Reindeer (*Rangifer tarandus*)

Romain Pizzi,[1] **Simon Girling,**[1] **Andrew Bell,**[2] **Adam Tjolle,**[3]
Donna Brown,[1] **and Craig Devine**[4]

[1] *Royal Zoological Society of Scotland, Edinburgh Zoo, 134 Corstorphine Road, Edinburgh EH12 6TS, UK*
[2] *Faculty of Veterinary Medicine, University of Glasgow, 464 Bearsden Road, Glasgow G61 1QH, UK*
[3] *Inglis Veterinary Centre, 120 Halbeath Road, Dunfermline, Fife KY11 4LA, UK*
[4] *Borders Veterinary Cardiology, 21 South Back Road, Biggar ML12 6HD, UK*

Correspondence should be addressed to Romain Pizzi, romain@zoologicalmedicine.org

Received 19 January 2011; Accepted 20 March 2011

Academic Editor: Daniel Smeak

A successful laparoscopic-assisted cryptorchidectomy is reported in a novel species, the reindeer (*Rangifer tarandus*). The procedure was performed in an 8-year-old adult positioned in dorsolateral oblique recumbency, with an open approach midline subumbilical placement of the primary 10 mm optical port and carbon dioxide insufflation at 12 mmHg. Three 5 mm instrument ports were inserted under visualization in the left caudal abdomen as the retained testicle was localized to the internal inguinal ring. A 5 mm flexible organ retractor was used to assist in localizing the retained testicle. This procedure provided a less invasive alternative to open laparotomy. The authors are unaware of any published reports of laparoscopy in reindeer, or of laparoscopic assisted cryptorchidectomy in deer species.

1. Case Report

This report describes a successful laparoscopic-assisted cryptorchidectomy in a novel species, the reindeer (*Rangifer tarandus*). An 8-year-old zoo-born adult male reindeer (*Rangifer tarandus*) arrived at a zoological collection with records indicating it was a cryptorchid since birth. The animal had no previous medical problems or interventions recorded. Another adult male reindeer from the same dam and stag but held at another zoological collection had previously had open abdominal surgery performed for a cryptorchid testicle, but the surgeons had been unsuccessful in locating the retained testicle.

Concentrates and hay were withheld for 24 hours before the operation, as recommended for elective anaesthesia in deer [1] and as recommended for laparoscopy in cattle, to reduce rumen fill and increase the potential operating space [2, 3]. Lichen was not withheld, but a reduced amount offered to limit preoperative stress. The reindeer was anaesthetised via blow dart with 0.1 mg/kg medetomidine

(Zalopine, Orion Pharmaceuticals) and 2.5 mg/kg ketamine (Narketan, Vetoquinol UK). After induction, anaesthesia was maintained with isoflurane (Isocare, Animalcare Ltd.) in 100% oxygen via a cuffed 16 mm ET tube. During anaesthesia, arterial blood pressure was monitored directly. Heart rate, electrocardiogram, pulse oximetry, and end-tidal carbon dioxide were also monitored (Kontron Kolormon Plus, Kontron Instruments). Haemoglobin saturation remained above 95% throughout the procedure. Compound sodium lactate (Aquapharm No. 11, Animalcare) was administered intravenously at 10 ml/kg/hr.

On palpation, the right testicle was found to be scrotal. The left testicle could not be palpated. The reindeer was positioned in right dorsolateral oblique recumbency for surgery. Oxytetracycline, 20 mg/kg (Alamycin LA, Norbrook), and meloxicam, 0.5 mg/kg (Metacam, Boehringer-Ingelheim) were administered intramuscularly. Intermittent positive pressure ventilation was instituted to maintain normocapnia during abdominal insufflation of carbon dioxide. Dobutamine, 0.5–2 μg/kg/min intravenously (Dobutamine,
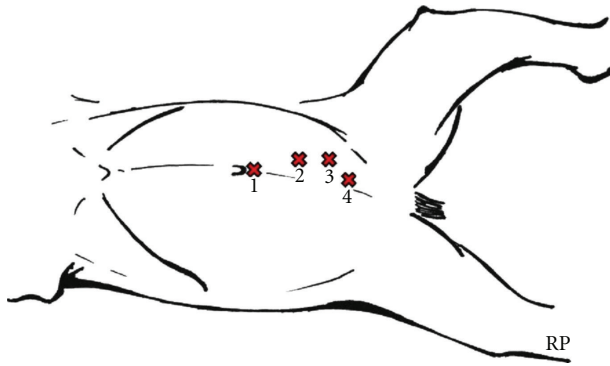
Figure 1: Insertion sites for the open approach midline subumbilical placement of the primary 10 mm optical port (1), 5 mm retractor port, (2) and the two 5 mm instrument ports (3, 4).

(a)

(b)

Figure 2: (a) Positioning of the reindeer in dorsolateral oblique recumbency. (b) Open approach midline subumbilical placement of the primary optical port and 5 mm instrument ports in left caudal quadrant.

Hameln) was required to maintain mean arterial blood pressure greater than 60 mmHg. Rumenal tympany developed towards the end of the procedure and was relieved via orogastric intubation and percutaneous needle rumenocentesis.

Open subumbilical placement of a 10 mm port (YelloPort, Surgical Innovations) was performed with the aid of a ring retractor (Lonestar retractor, Ark Surgical, UK). A Hassons conical trocar was placed. Initial laparoscopic examination was performed using a 58 cm length 10 mm diameter 0 degree human bariatric laparoscope (Karl Storz Endoscopy, Slough). Insufflation with carbon dioxide was performed at 12 mmHg intraabdominal pressure. A 150-watt Xenon light source provided sufficient illumination, with visualisation via a dedicated camera, processor, and software (Aida, Karl Storz Endoscopy). A 5 mm port was inserted under visualization in the left caudoventral abdomen (Figure 1). After initial retraction of the rumen, bladder, and intestines with a 5 mm flexible retractor (Diamond flex, Surgical Innovations; Figure 2), the left spermatic cord and vessels were visualised entering the internal inguinal ring. A further two 5 mm instrument ports were then inserted under visualisation in the left caudoventral abdomen, caudal to the ports through which the retractor was inserted.

As in other large ruminants, the operating space and visibility was limited, with organ retraction difficult, due to the large rumen and voluminous intestinal tract. A small 2 cm testicle was carefully retracted with two 43 cm length 5 mm diameter atraumatic laparoscopic forceps (Logic, Surgical Innovations; Figure 3), and the gubernaculum testis broken down. The testicle was externalised through one of the caudoventral port incisions (Figure 4), which was enlarged to 1 cm, and the spermatic cord and vessels ligated with 3 metric poliglecaprone 25 (Monocryl, Ethicon). Repeated laparoscopic examination after return of the remnant cord to the abdomen revealed no haemorrhage. The port sites were sutured with a single 4 metric polydioxane (PDS II, Ethicon) cruciate mattress suture in the abdominal musculature and intradermal 3 metric poliglecaprone 25 (Monocryl, Ethicon). Medetomidine was antagonised with 0.5 mg/kg atipamezole (Antisedan, Orion Pharmaceuticals). The reindeer made a rapid recovery, was standing within 5 minutes, and eating within a further 5 minutes.

2. Discussion

Laparoscopy, also referred to as minimally invasive surgery or endosurgery, holds advantages over open abdominal surgery in animals such as small wounds, less postoperative pain, rapid recovery, low rates of postoperative infection, low risk of wound dehiscence, and further provides magnified visualisation of target organs [4–7]. Cryptorchid testicles are recognised in other species to be associated with an increased risk of developing testicular neoplasia [8–10]. There is, however, controversy as to whether neoplasia develops due to the intraabdominal location, or instead due to abnormal maternal androgens in utero, or other causes [11, 12]. While cryptorchid testes have been reported in wild reindeer [13], the authors are unaware of any reports of laparoscopy being used for cryptorchidectomy in any deer species, or of reports of previous laparoscopic approaches in reindeer. Laparoscopic oocyte aspiration, artificial insemination, and tubal ligation have been performed in female white-tailed deer *Odocoileus virginianus* [14, 15], sika deer *Cervus nippon*

FIGURE 3: Careful retraction of the cryptorchid testicle from the internal inguinal ring with 5 mm diameter 43 cm length atraumatic forceps.

FIGURE 4: Grasping the retrieved cryptorchid testis for removal and external ligation via an enlarged 5 mm port site incision.

nippon [16], red deer *Cervus elaphus* [17], and fallow deer *Dama dama* [18].

Only reduced quantities of lichen were fed for the 24 hours before surgery, as it was felt the small quantities would not significantly alter rumen fill, but would help reduce preoperative stress. It is unclear if the ruminal tympany that developed at the end of the procedure was related to the lichen feeding, or to a combination of dorsal recumbency with abdominal insufflation with carbon dioxide. While dorsal recumbency for laparoscopy in cattle [19, 20], small zoo hoof stock [21], and deer [15] has been described, this position has been associated with adverse cardiorespiratory effects, hypoxaemia, and ruminal tympany [1, 22–25]. In cattle, laparoscopy may be performed standing under sedation [3], helping create a larger working space. This may be difficult to safely achieve with large captive cervids in a zoological collection. No suitable facilities to allow standing laparoscopic approach were available at the site in this case. The testicle may also have been difficult to access in its inguinal location in this case via a standing laparoscopic approach. Conversely, depending on the abdominal location of a cryptorchid testicle, laparoscopic localisation and removal may not always be possible from this approach. This approach gave relatively poor access to the caudal pole of the

kidney. Due to the retained testicle's location in proximity to a port site, a laparoscopic-assisted cryptorchidectomy was performed. A completely laparoscopic procedure was felt to hold no real advantage and if slower, would simply result in increased anaesthesia time.

Laparoscopic-assisted cryptorchidectomy provided a minimally invasive surgical alternative to open laparotomy for removal of a cryptorchid testicle in this adult reindeer.

Acknowledgments

References

[1] N. Caulkett and J. C. Haigh, "Deer (Cervids)," in *Zoo Animal and Wildlife Immobilization and Anesthesia*, G. West, D. Heard, and N. Caulkett, Eds., pp. 607–612, Blackwell Publishing, Ames, Iowa, USA, 2007.

[2] S. Trostle, "Minimally invasive surgery of the large animal gastrointestinal system," in *Veterinary Endosurgery*, L. J. Freeman, Ed., pp. 164–168, Mosby, St Louis, MO, USA, 1999.

[3] U. Bleul, K. Hollenstein, and W. Kähn, "Laparoscopic ovariectomy in standing cows," *Animal Reproduction Science*, vol. 90, no. 3-4, pp. 193–200, 2005.

[4] R. A. Cook and D. Stoloff, "The application of minimally invasive surgery for the diagnosis and treatment of captive wildlife," in *Zoo & Wild Animal Medicine, Current Therapy*, M. E. Fowler and R. E. Miller, Eds., pp. 30–40, WB Saunders, Philadelphia, Pa, USA, 4th edition, 1999.

[5] J. E. Bailey and L. S. Pablo, "Anaesthetic and physiologic considerations for veterinary endosurgery," in *Veterinary Endosurgery*, L. J. Freeman, Ed., pp. 24–43, Mosby, St Louis, Mo, USA, 1999.

[6] L. J. Freeman, "Introduction," in *Veterinary Endosurgery*, L. J. Freeman, Ed., pp. 15–17, Mosby, St Louis, Mo, USA, 1999.

[7] P. Lhermette and D. Sobel, "An introduction to endoscopy and endosurgery," in *BSAVA Manual of Canine and Feline Endoscopy and Endosurgery*, pp. 1–10, BSAVA, Gloucester, UK, 2008.

[8] A. T. Liao, P. Y. Chu, L. S. Yeh, C. T. Lin, and C. H. Liu, "A 12-year retrospective study of canine testicular tumors," *Journal of Veterinary Medical Science*, vol. 71, no. 7, pp. 919–923, 2009.

[9] S. La Vignera, A. E. Calogero, R. Condorelli et al., "Cryptorchidism and its long-term complications," *European Review for Medical and Pharmacological Sciences*, vol. 13, no. 5, pp. 351–356, 2009.

[10] H. M. Wood and J. S. Elder, "Cryptorchidism and testicular cancer: separating fact from fiction," *Journal of Urology*, vol. 181, no. 2, pp. 452–461, 2009.

[11] D. N. Rao Veeramachaneni, R. M. Sharpe, N. E. Skakkebæk, and J. McLachlan, "Germ cell atypia in undescended testes hinges on the aetiology of cryptorchidism but not the abdominal location per se," *International Journal of Andrology*, vol. 29, no. 1, pp. 235–240, 2006.

[12] K. A. McGlynn, B. I. Graubard, J. M. Nam, F. Z. Stanczyk, M. P. Longnecker, and M. A. Klebanoff, "Maternal hormone levels and risk of cryptorchism among populations at high and low risk of testicular germ cell tumors," *Cancer Epidemiology Biomarkers and Prevention*, vol. 14, no. 7, pp. 1732–1737, 2005.

[13] N. Leader-Williams, "Abnormal testes in reindeer, Rangifer tarandus," *Journal of Reproduction and Fertility*, vol. 57, no. 1, pp. 127–130, 1979.

[14] R. A. MacLean, N. E. Mathews, D. M. Grove, E. S. Frank, and J. Paul-Murphy, "Surgical technique for tubal ligation in white-tailed deer (Odocoileus virginianus)," *Journal of Zoo and Wildlife Medicine*, vol. 37, no. 3, pp. 354–360, 2006.

[15] L. P. Posner, J. B. Woodie, P. D. Curtis et al., "Acid-base, blood gas, and physiologic parameters during laparoscopy in the head-down position in white-tailed deer (Odocoileus virginianus)," *Journal of Zoo and Wildlife Medicine*, vol. 36, no. 4, pp. 642–647, 2005.

[16] Y. Locatelli, J. C. Vallet, F. P. Huyghe, Y. Cognié, X. Legendre, and P. Mermillod, "Laparoscopic ovum pick-up and in vitro production of sika deer embryos: effect of season and culture conditions," *Theriogenology*, vol. 66, no. 5, pp. 1334–1342, 2006.

[17] D. R. J. Bainbridge, S. L. Catt, G. Evans, and H. N. Jabbour, "Successful in vitro fertilization of in vivo matured oocytes aspirated laparoscopically from red deer hinds (Cervus elaphus)," *Theriogenology*, vol. 51, no. 5, pp. 891–898, 1999.

[18] G. W. Asher, D. C. Kraemer, S. J. Magyar, M. Brunner, R. Moerbe, and M. Giaquinto, "Intrauterine insemination of farmed fallow deer (Dama dama) with frozen-thawed semen via laparoscopy," *Theriogenology*, vol. 34, no. 3, pp. 569–577, 1990.

[19] D. E. Anderson, E. M. Gaughan, and G. St-Jean, "Normal laparoscopic anatomy of the bovine abdomen," *American Journal of Veterinary Research*, vol. 54, no. 7, pp. 1170–1176, 1993.

[20] P. Y. Mulon, M. Babkine, and A. Desrochers, "Ventral laparoscopic abomasopexy in 18 cattle with displaced abomasum," *Veterinary Surgery*, vol. 35, no. 4, pp. 347–355, 2006.

[21] M. Bush, D. E. Wildt, S. Kennedy, and S. W. J. Seager, "Laparoscopy in zoo mammals," in *Animal Laparoscopy*, R. M. Harrison and D. E. Wildt, Eds., pp. 169–182, Williams & Wilkins, Baltimore, Md, USA, 1980.

[22] G. C. G. Watney, "Effects of posture and intraruminal pressure on the bronchial calibre of cattle during xylazine/halothane anaesthesia," *Research in Veterinary Science*, vol. 40, no. 2, pp. 166–172, 1986.

[23] L. Klein and N. Fisher, "Cardiopulmonary effects of restraint in dorsal recumbency on awake cattle," *American Journal of Veterinary Research*, vol. 49, no. 9, pp. 1605–1608, 1988.

[24] A. E. Wagner, W. W. Muir, and B. J. Grospitch, "Cardiopulmonary effects of position in conscious cattle," *American Journal of Veterinary Research*, vol. 51, no. 1, pp. 7–10, 1990.

[25] T. Riebold, "Ruminant anaesthesia," in *Veterinary Anesthesia and Pain Management Secrets*, S. A. Green, Ed., Hanley & Belfus, 2002.

International Journal of
Agronomy

Scientifica

Veterinary Medicine
International

The Scientific
World Journal

International Journal of
Ecology

International Journal of
Microbiology

Journal of
Viruses

Biotechnology
Research International

Psyche

Submit your manuscripts at
http://www.hindawi.com

Hindawi

Journal of
Insects

Journal of
Veterinary Medicine

Case Reports in
Veterinary Medicine

International Journal of
Zoology

International Journal of
Evolutionary Biology

International Journal of
Genomics

International Journal of
Cell Biology

Journal of
Parasitology Research

Journal of
Animals

Applied &
Environmental
Soil Science