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Successful laparoscope-assisted orchiectomy in three cryptorchid sheep

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ABSTRACT

Three adult Corriedale cryptorchid sheep were subjected to laparoscope-assisted orchiectomy of the retained testicles. One (n = 2) or both (n = 1) the testicles were missing in their scrotal sac and inguinal regions. Ultrasonography was used to locate the retained testicles and their distance from the abdominal surface. The animals were restrained in dorsal recumbency and Trendlenburg posture under lumbosacral epidural anaesthesia using 2% lignocaine hydrochloride. Two laparoscopic ports were created in the caudal abdomen adjacent to the retained testicles. They were identified by their ovoid shape, white glistening surface (Tunica albuginea) and typical vasculature. Laparoscope-assisted exteriorization of the testicles after enlarging the ports, ligation of their blood supply and resection of the spermatic cord was performed successfully. The scrotal testes in two rams were then subjected to routine Burdizzoo castration. The laparoscopic port sites healed without complications and all the animals continued to do well subsequently. From this case report, it is concluded that in sheep the laparoscopy; a minimally invasive procedure can confirm abdominal retention of testicle/s and may also be used for their retrieval in a single sitting. Although total laparoscopic procedure is expected to reduce the incision size further but requires advanced laparoscopic instruments and expertise.

1. Introduction

In ruminants the testicles are normally located in the scrotum at birth (Smith, Brown, Barr & Parkinson, 2012) but in cryptorchids one or both are retained along their migration path (Greig, 2000). The condition is therefore detected from the early postnatal life (Veeramachaneni, 2006). Various abnormalities (testicle tumors, altered hormone concentrations and spermatogenesis) noticed in the post-pubertal life in cryptorchid animals are attributed to the exposure of their retained testicles to higher abdominal temperature (Veeramachaneni, 2006). The exclusion of these animals from the breeding stock is therefore inevitable (Smith et al., 2012). The castration abolishes aggressive behaviour, prevents various diseases and the genetic transmission of this condition to the next generation. However, in cryptorchids the procedure is more technically demanding (Coomer, Gorvy & McKane, 2016). The exact location of the undescended testicles using a non- or minimally invasive technique confirms the condition. Consequently the intra- and postoperative complications, surgical time, distress, and the expenditure to the farmers gets reduced (Coomer et al., 2016). Although ultrasonographic (USG) examination can diagnose the condition (Mohmud et al., 2014) but laparoscopy is the "gold standard" method (Sepulveda & Egaña, 2016). The laparoscopic or laparoscope-assisted castration obviates the need for large laparotomy incision and the associated complications (Mayhew, 2009). In farm animal practice, this minimally invasive surgical modality is now gaining popularity. As per the available literature, laparoscopy was used for orchiectomy in one cryptorchid Pygmy goat (Rutherford, 2009) but has till date not been tried in sheep. In this case report the successful laparoscope-assisted cryptorchidectomy in three rams is therefore described.

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2. Case description

Three adult (n = 3) Corriedale rams, aged 1–2 years and weighing 30 ± 5kgs belonging to the university farm were presented with retained testicles. The animals were registered under OPD numbers 0312, 0786 and 1312/2017. All the procedures were conducted after getting ethical clearance from the relevant committee of the hospital. The detailed clinical examination of the animals was followed by meticulous physical examination of their scrotum and inguinal regions. Blood sample (5.0 ml) was collected from all the rams using G-18 hypodermic needle from jugular vein in two vials; one added with anticoagulant for routine haematological evaluation and the second for separation of serum utilized later for biochemical (Total protein, Albumen and Albumen: Globulin ratio) evaluation.

The animals were kept off-feed for 30hours and without water for 12hours. Antibiotic (amoxicillin-dicloxacillin, 5 mg/kg) and analgesic (meloxicam, 0.3 mg/kg) were given intramuscularly (IM) to all the rams 30minutes preoperatively. They were sedated using xylazine (0.05 mg/kg, IM). Lumbo-sacral epidural anaesthesia was then induced using 2% lignocaine hydrochloride (1 ml/7 kg).

The animals were restrained in dorsal recumbency and a wide caudal abdominal area clipped and shaved. After applying copious volume of the gel (Royal Ultrasound gel, Malhotra Surgicals and Chemicals, Delhi, India), USG exploration using a real-time B-mode ultrasound machine (Esoate My lab 40 vet) provided with 3.5 MHz to 12 MHz linear and sector transducers of the abdominal and the pelvic cavities was performed. In addition to the location, echogenicity and dimensions of the retained testicles, their distance from the abdominal wall were also recorded.

The animals were subsequently shifted to a cradle, restrained in dorsal recumbency with all the legs tied apart and tilted to a Trendelenburg (30° to 35°) posture. The shaved area was rescrubbed and isolated using sterile drapes. Laparoscopic equipment and instruments of Karl-Storz, DmbH, Germany were used. Hopkin II straight forward (0° viewing angle of vision) telescope having 5.0 mm diameter and 29.0 cm length was used. The assembly is provided with cold light fountain xenon, with 175 Watt lamp and 4.5 mm fibre optic light cable. One cm longitudinal skin incision was given in the left paramedian area, 3.0 cm lateral to the prepucial orifice. The Veress needle was inserted into the abdominal cavity through the stab and pneumoperitoneum using filtered air established. The Veress needle was replaced by a trocar-cannula (6.0 mm diameter) having pyramid tip. The trocar was then retracted keeping the cannula in place. After connecting the light source and the camera to the laparoscope, it was passed into the peritoneal cavity through the cannula. Exploration of the abdomen in various directions was performed to locate the retained testicle/s (Fig. 1) and additional lesion/s if any. The second port was subsequently created near the retained testicle using a 6.0 mm threaded-cannula unit, three to four centimeters lateral to the linea alba on the contralateral side in level with the primary port. A grasping forceps was passed through this port and the testicle held firmly. The port was subsequently enlarged in sagital/craniocaudal direction; the cannula pulled out and the testicle exteriorized (Fig. 2) with careful traction of the grasping forceps. The vasculature of the exteriorized testicle was ligated at two places 1.0 cm from each other using No-0 (USP) chromic catgut before resection of the spermatic cord in between the two ligatures.

In the bilateral cryptorchid ram, one of the testicles was removed as per the procedure described above. The contralateral testicle was then held by a grasping forceps passed through the already enlarged port. The testicle was then pushed towards and out of the second port. Enlargement of this port for easy retrieval of the testicle, vascular ligation and resection of its spermatic cord was performed as described earlier. The enlarged port sites were closed in two layers; peritoneum and abdominal muscles brought in apposition using No-1(USP) chromic catgut in a simple continuous pattern and the skin sutured using

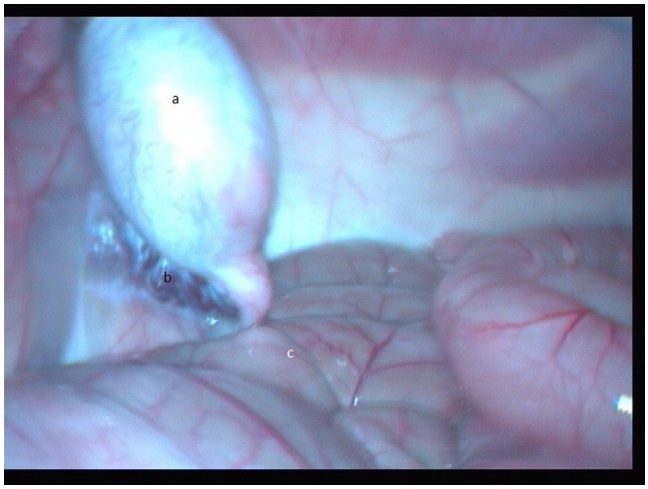

Fig. 1. Laparoscopic view of the abdominal testicle (a), pampniform plexus (b), and large intestines (c) in a ram.

Fig. 2. Exteriorization of an abdominal testicle through enlarged laparoscopic port in a cryptorchid ram.

braided silk No-1(USP) in a horizontal mattress pattern (Fig. 3). The scrotal testicles present in two of the three rams were subjected to the Burdizzoo castration. The animals were housed in a pen away from the flock for 10 postoperative days and monitored for complications if any.

Antibiotic (amoxicillin-dicloxacillin, 5 mg/kg, IM, BD) and analgesic (meloxicam, 0.3 mg/kg, IM, OD) were given for three days and the local antiseptic dressing of the incision site/s continued up to two days following suture removal on day 10.

Fig. 3. Immediate post-laparoscopic view of the sutured enlarged port sites in a bilateral cryptorchid ram.
Fig. 4: Exteriorization of the second retained testicle (a) grasped and pushed by a forceps (b) passed through first port towards the enlarged second port (c), in a bilateral crptorchid ram.

3. Results

Two rams had an abdominal testicle on the right side and in the third animal both the testicles were located in the abdominal cavity. As per the records maintained in the farm, the rams were not related to each other. Their clinical and haemato-biochemical parameters were in normal range.

The USG of the rams revealed ovoid soft tissue mass in the caudal abdomen (Fig. 5Figure 4). They appeared less echogenic than the corresponding scrotal testicles. The mediastinal testes appearing typically as a hyperechogenic line in normal scrotal testicles was less appreciable in the unilaterally retained but completely absent in both the bilaterally retained testicles. The mean length and volume of the retained testicles was 3.7 cm and 1.92 ml respectively. They were located 0.68 cm (mean) from the abdominal surface.

On laparoscopy, the testicles in all the rams were located in the caudal abdomen; 4.0 cm to 5.0 cm right lateral to the linea alba in two and one on either side with similar distance from line alba in the third animal. They were identified by their ovoid shape, white glistening surface (Tunica albuginea) and typical vasculature (Fig. 1). Although all the abdominal testicles were visible on exploration but in two of them the overlying intestines partially covering their surface had to be displaced cranially before grasping them with the forceps. The exteriorization of the testicles, ligation of their blood supply and resection of the spermatic cords was easy.

The evacuation of the abdominal air through the port sites occurred immediately after withdrawal of the cannulas and enlargement of the port/s. Mild subcutaneous emphysema in one animal subsided within three days.

The recovered testicles weighed 24.06 g (mean) and the abdominal

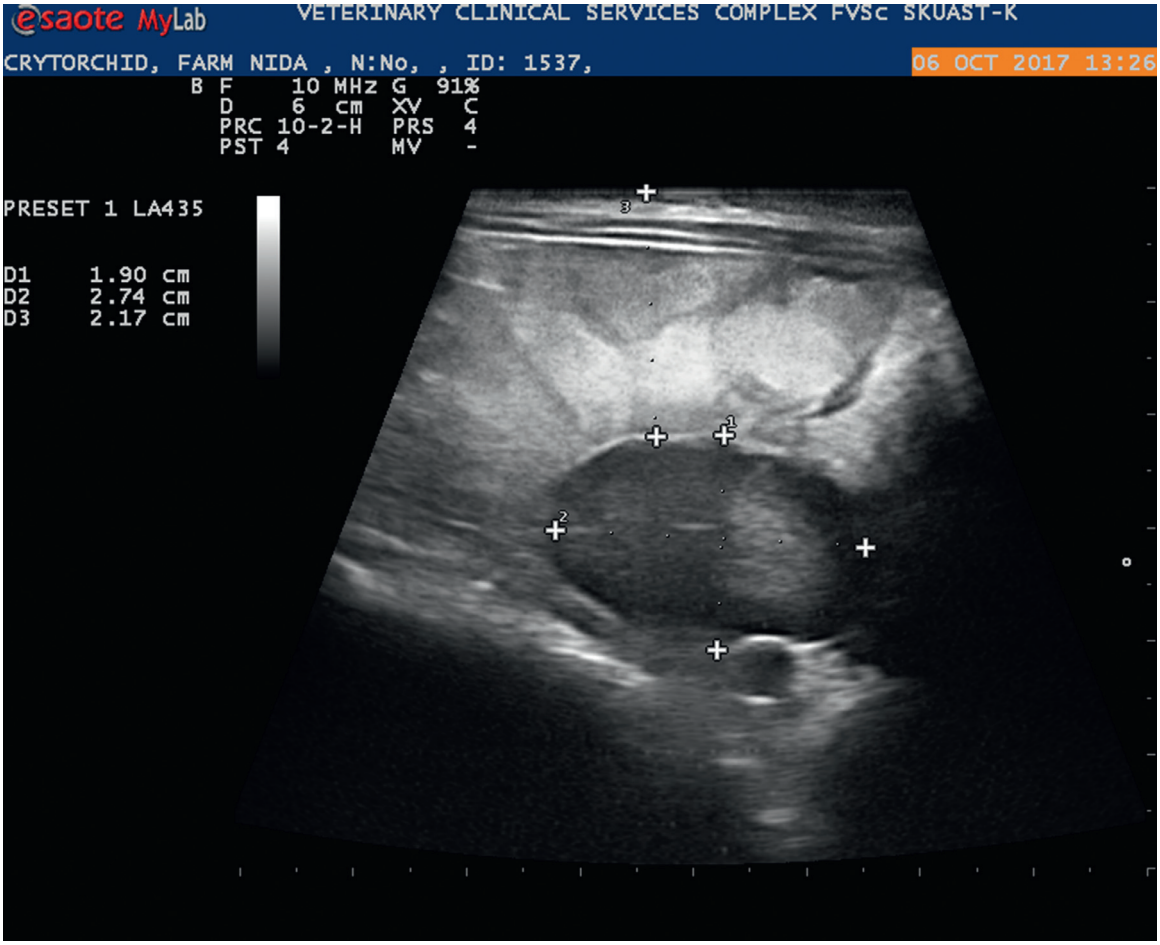

Fig. 5. USG view of abdominal testicle in a ram.

incision length to retrieve them was 4.6 cm (mean). The incision sites healed uneventfully in all the rams.

4. Discussion

The cryptorchid rams included in this study were all Corriedale. The condition is rare in ruminants (Edmondson, Roberts, Baird, Bychawski & Pugh, 2012) with an overall incidence 0.5% to 0.6% in sheep (Greig, 2000). Prevalence 2.4% to 18.0% has been reported in the North Ronaldsay breed (Smith, Brown, Morris & Parkinson, 2007).

As per the records maintained in the university farm, the animals included in this case report were not related to each other. However, in rams, cryptorchidism is attributed to autosomal recessive mode of inheritance or to a dominant gene with the incomplete penetrance (Foster, 2007).

In both the unilateral cryptorchids, the right testicles were retained. In sheep unilateral cryptorchidism is common (62%) and the right testicle is more often retained (Amann & Veeramachaneni, 2006 and Smith et al., 2012). Goats also show a predilection for retaining the right testicle but in cattle and horses, the left one is more commonly retained (Gilbert & Fubini, 2004 and Igbokwe, Grema, Ikpo, Mshelbwala & Igbokwe, 2009).

On USG, all the four retained testicles in these three rams were located in their caudal abdomen. The procedure not only differentiates noninvasively the cryptorchids from the castrated animals. It also helps in surgical decision making; whether conventional surgery or laparoscopy should be preferred for retrieval of the testicle/s (Felumlee, Reichle, Hecht & Pennick, 2012).

The rams included in this report were clinically free from any additional congenital or acquired disorder. Their routine hematobiochemical values were in normal range for the species. On preoperative clinical examination, animals with American Society of Anesthesiologists - Physical Status Classification (ASA-PSC) Category I status undergoing elective (cold) surgery require evaluation of the routine hemato-biochemical parameters only (Clarke, Trim & Hall, 2014).

The best choice to control cryptorchidsm in a flock is to perform bilateral castration (Mattos et al., 2000). They may subsequently be retained as food animals but not for breeding purpose (Mohmud et al., 2014).

The animals included in this case report were kept off-feed for 30hours and without water for 12hours. Preoperative fasting is mandatory before any laparoscopic procedure (Boure, 2005). In ruminants 24hours to 48hours of pre-laparoscopy fasting is needed to satisfactorily reduce their gastrointestinal contents (Desrochers, 2017; Fazili et al., 2015).

In this trial, the sedated animals were satisfactorily induced regional lumbosacral epidural anaesthesia. Laparoscope assisted embryo transfer has been conducted under lumbosacral epidural anaesthesia using lignocaine hydrochloride and ropivacaine hydrochloride in goats (Khajuria et al., 2014a,b). Although laparoscopic orchiectomy has been performed in a goat using xylazine-ketamine for induction and isoflurane for maintenance (Rutherford, 2009) but general anaesthesia is not only expensive but also accompanied by several complications particularly in food animals (Clarke et al., 2014).

Veress needle was used to insufflate the abdomen with filtered air in the sheep included in this case report. The needle has specifically been designed to prevent inadvertent puncture of the viscera prior to

abdominal insufflation for laparoscopy (Hendrickson, 2012). A blunt teat cannula and carbon dioxide have alternatively been used (Rutherford, 2009). Insufflation of the abdominal cavity improves visualization and facilitates visceral manipulations (Bouré, 2005; Latimer et al., 2003). Carbon dioxide (CO_2) is the most widely used gas for insufflation because it is inexpensive and least likely to cause gaseous emboli compared with nitrous oxide, air, and helium. In humans, room air pneumoperitoneum is safe, cheap, and freely available and could be used in low resource settings (Ikechebelu, Obi, Udigwe & Joe-Ikechebelu, 2009). Use of CO_2 and room air in both laparoscopy and natural orifice transluminal endoscopic surgery has been found acceptable (Trunzo, McGee & Cavazzola, 2010).

The laparoscope (5.0 mm, 0°) employed routinely for assisted reproductive technologies in sheep and goats (Fazili et al., 2015; Khajuria et al., 2014a, b) was satisfactorily used in these animals. Larger (12.0 mm, 35°) laparoscopes were used in a kid (Rutherford, 2009) and cattle (10.0 mm, 0°) for this purpose (Kaneko et al., 2015). Although 6.0 mm diameter laparoscope is sufficient for use in small ruminants but those with larger diameters may also not pose any problem (Tibary, 2004). Use of 0° laparoscopes not only allows satisfactory orientation and easier manipulation of the instruments (Prescott, 1980) but also maximizes the light transmission compared with 35°laparoscopes (Boure, 2005). Light source (175 Watt xenon lamp) used for laparoscopy in our animals provided satisfactory abdominal illumination. However, 300-W xenon light is recommended (Boure, 2005).

All the retained testicles in our three rams were located in the caudal abdominal cavity. In sheep, the abdominal cryptorchids are more common than inguinal (Smith et al., 2012).

Easy localization of the abdominal testicles on laparoscopic exploration was facilitated by restraining the rams in the Trendlenburg posture. This position encourages abdominal organs to slide cranially, exposing most of the caudal field (Vilos, Termanian, Dempster & Laberge, 2007).

The length of the skin incision (mean 4.6 cm) to retract the retained testicles in our animals was less than half of that required for exploratory laparotomy (10.0 cm to 12.0 cm) in sheep and goats (Hartnack & Jones, 2017; Haskell, 2004). The laparoscope-assisted cryptorchiectomy technique followed in our sheep involved careful externalization of the abdominal testicles before their detachment. The total laparoscopic procedures with the advantage of harmless manipulations, sectioning and morcellation of the resected structures generally require comparatively small abdominal incision or port enlargement (Rutherford, 2009; Zhang et al., 2009).

The mean length and weight of the abdominal testicles in our rams was one-third (3.7 cm Vs 12.5 cm) and on-eleventh (24.06 g vs 266.67 g) of the scrotal organ in healthy Polled Dorset-Corriedale rams (Fazili et al., 2009). This finding corroborates well with several earlier reports of small sized undescended testes than those present in the scrotum (Igbokwe et al., 2009; Ozyigit, 2007; Smith et al., 2012).

5. Conclusions

From this case report, it is concluded that in sheep the laparoscopy; a minimally invasive procedure can confirm retention of testicle/s in the abdominal cavity and may also be used to retrieve them in a single sitting. Although total laparoscopic procedure is expected to reduce the abdominal incision size further but requires advanced laparoscopic instruments and expertise.

Ethical statement

The rams having tag numbers 1537, 1545, and 4269 belonging to Mountain Research Centre on Sheep & Goats (MRCSG), SKUAST-Kashmir were registered under numbers 312, 786 and 1312 in the outpatient department (OPD) of Division of Veterinary Clinical Complex (VCC), the university referral veterinary hospital. All the procedures were performed after getting written consent from the Incharge Professor, MRCSG and the ethical approval by the scientists of the clinical disciplines posted in the hospital.

Declaration of Competing Interest

The authors have no conflict of interest.

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