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Laparoscopically Assisted Cryptorchidectomy Using LigaSure® Electrocoagulation

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Abstract

This study presents first two cases of laparoscopically assisted cryptorchidectomy using the LigaSure® device performed on clinical patients at our department; namely, a four-year-old German shepherd and a thirteen-year-old Maltese dog. The cryptorchid testis was laparoscopically localized and grasped and by sequential grasping of the spermatic funicle using the LigaSure® device, a. et v. testicularis, ductus deferens as well as a. et v. ductus deferentis were successively coagulated and transected. The testis was removed from the abdominal cavity through a slightly enlarged incision for the instrument port. The testis positioned in the scrotum was in both cases removed using prescrotal castration with ligature of the spermatic funicle and a. et v. testicularis, ductus deferens as well as a. et v. ductus deferentis. Both patients were released into home care on the second day after the procedure without the need to administer further analgesics. No complications with anaesthesia, surgical procedure or complications in the postoperative period were recorded. Laparoscopically assisted method of coagulation and transection of the blood vessels and ductus deferens using the LigaSure® device appears as clinically applicable, fast and safe miniinvasive method of cryptorchidectomy in dogs.

Miniinvasive castration, endoscopic, cryptorchism, ductus deferens, a. et v. testicularis

The absence of one or both of the testes in the scrotum may present a clinical problem in dogs. Cryptorchism is considered the most frequent congenital defect of testes in dogs (Wallance and Cox 1980). Under normal situation the testes descend into the scrotum as a result of the shortening of the gubernaculum, or its fibrotization and contraction. This process is directed hormonally by androgens produced by interstitial (Leydig) cells from the 54th day of gestation (Yates et al. 2003). The approximation and passage of the testis through the inguinal ring occurs within 5 days from birth (Kawakami et al. 1993) and the complete descent is finalized at the age of 6–8 weeks. At six months of age a partial closure of the inguinal ring prevents further migration of the testes (Johnston et al. 2001). Failure of the process of the descent of testes leads to cryptorchism.

Frequency of the occurrence of a missing testis in the scrotum is 1–10% with a 2.7 times higher risk in small breeds of dogs, such as the Poodle, Terrier, Dachshund, Chihuahua and Sheltie (White 2005; Pendergrass and Hayes 1975). Yates et al. (2003) found in their study a frequent occurrence of cryptorchism in German shepherds, Staffordshire bullterriers and Boxers. Bilateral cryptorchids are sterile due to the suppression of spermatogenesis caused by the effect of inadequate temperature on the cryptorchid testes, whereas unilateral cryptorchids are usually prolific (Romagnoli 1991). More often only one testis is undescended, mostly the right one (Wallance and Cox 1980; Dunn 1968; Reif et al. 1979; Crane 1990; Yates et al. 2003).

The retained testis may be localized in the prescrotal or inguinal region or in the abdominal cavity. The free position of the retained testis in the abdominal cavity presents a higher risk of its torsion (Wallance and Cox 1980; Pearson and Kelly 1975). Concurrently, undescended testes are 13.6 times more often affected by neoplasia than testes positioned in the scrotum (Hayes and Pendergrass 1976). The connection between cryptorchism

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and the occurrence of tumours of sustentacular (Sertoli) cells and semiomas is well known, however, it appears not to be connected with the incidence of interstitial (Leydig) cell tumours (Reif and Brodey 1969, Reif et al. 1979, Hayes et al. 1985).

Finding the undescended testis may present a certain problem. For example, during examination by palpation, a lymph node or fat may be easily mistaken for a testis in the inguinal region (Miller et al. 2004). Finding an undescended testis in the abdomen by palpation is difficult because unless it is affected (and enlarged) by a tumour, it is usually atrophied and palpable with much difficulty. Using ultrasonographic examination of the abdomen, prescrotal region and inguinal canal may determine a possible presence of the testis (Matoon and Nyland 2002), or even find the incidence of a tumour in the parenchyma (Johnston et al. 1991).

Possibilities of treatment of cryptorchism include hormonal therapy which, however, fails to have the appropriate effect (Wallance and Cox 1980), and orchidopexy (used mainly in humans) which is unethical in dogs, considering the hereditary nature of the disease (Miller et al. 2004; Yates et al. 2003). Thus, the most suitable solution of cryptorchism in dogs appears to be castration (Yates et al. 2003).

There are several methods of performing castration of the cryptorchid testis in the abdomen, ranging from classical laparotomy in the caudal to medial third of the linea alba, allowing the surgeon a good view of the abdominal cavity but at the cost of a larger surgical wound, to performing a small laparotomy wound and using a castration hook to find and remove the testis (Kirby 1980). However, this method entails the risks of unwanted prostatectomy, urethral avulsion and damage to urether, and therefore is no longer used (Bellah et al. 1989; Millis et al. 1992; Schultz et al. 1996).

The aim of this study was to present two cases of laparoscopically assisted cryptorchidectomy without the necessity of using ligature with fibres or special clips and with the use of the LigaSure® device. To our knowledge, the method of laparoscopically assisted cryptorchidectomy using the LigaSure® device has not been described in a clinical case in veterinary medicine. The study presents two clinical cases treated at the Department of Surgery and Orthopaedics of the Small Animal Clinic of the University of Veterinary and Pharmaceutical Sciences Brno in the period from September 2008 to December 2008.

Materials and Methods

Patient characteristic

LigaSure® device was used in two dogs: 4- and 13-year-old abdominal cryptorchids. The first one was a four-year-old German shepherd with the right testis in the scrotum and the left testis in the abdominal cavity. The second dog was a thirteen-year-old Maltese dog with the right cryptorchid testis. The diagnosis was based on the palpation examination of the scrotum, prescrotal and inguinal regions.

Anaesthesia and preoperative preparation

The German shepherd was premedicated using medetomidine (0.02 mg/kg i.v., Cepetor, CP-Pharma, Germany) and butorphanol (0.2 mg/kg i.v., Butomidor, Richter-Pharma, Austria). Anaesthesia was induced by administration of propophol (1 mg/kg, i.v., Propofol 1%, Fresenius Kabi, Sweden) and maintained by inhalation using a mixture of O_2, air and isoflurane. The Maltese dog was premedicated using midazolame (0.1 mg/kg, i.v., Dormicum, Roche, Czech Republic), medetomidine (0.01 mg/kg, i.v., Cepetor, CP-Pharma, Germany) and butorphanol (0.2 mg/kg, i.v., Butomidor, Richter-Pharma, Austria). Anaesthesia was induced by administration of propophol (1 mg/kg, i.v., Propofol 1%, Fresenius Kabi, Sweden) and maintained by inhalation using a mixture of O_2, air and isoflurane. Both patients were artificially ventilated during pneumoperitoneum (IPPV, PEEP).

Generally, the patients were administered antibiotics - amoxicilin clavulanate preoperatively (20 mg/kg, i.v., Augmentin 600 mg, Smith Kline Beecham Pharm., Great Britain) and postoperatively (12.5 mg/kg i.m., Synulox RTU, Pfizer, Italy), further non-steroidal antiinflammatory drugs (meloxicam – 0.1 mg/kg s.c., Metacam, Labiana Life Sciences, Spain, nebo carprofen - 2 mg/kg i.v., Rimadyl, Vericore, Great Britain); the patients were infused (H1/1)for the duration of the procedure.

The patient was placed in dorsal recumbency for the surgery and the operating field was prepared aseptically, extending from cartilago xiphoidea to the scrotum, in a twofold width than the distance between the mammary ridges.

Surgical procedure

Pneumoperitoneum was created by CO_2 insufflation using the Verres needle inserted paramedially from the umbilicus. The pressure maintained in the abdominal cavity was 10–12 mm Hg for the duration of the procedure. Using the trocar, an optical port 5 mm in diameter was inserted slightly cranially before the umbilicus in linea alba. Two instrument ports (5 mm in diameter) were inserted in the inguinal region parapreputially according to the principles of optical port triangulation. For "standard" organ revision in the abdominal cavity and both inguinal canals, the retained testis was localized (Plate XX, Fig. 1), grasped by laparoscopy forceps (Plate XX, Fig. 2) and elevated ventrally for opening the optimum place for application of LigaSure®. By sequential grasping and application of LigaSure® to the spermatic funicle, a. et v. testicularis, ductus deferens as well as a. et v. ductus deferentis were transected (Plate XXI, Fig. 3). Following visual control of the complete haemostasis of the stump (Plate XXI, Fig. 4), the separated testis was approximated to the relevant (according to the inserted forceps) working port and after incision enlargement (1.5 or 3 cm) it was removed from the abdominal cavity. Upon CO_2 evacuation from the abdominal cavity and withdrawal of all the instruments, the abdominal wall, hypodermis and skin were closed with individual sutures using monofilament absorbable material (PDS 3 or 2M).

The testis positioned in the scrotum was removed in both cases by prescrotal castration with ligature of the spermatic funicle and a. et v. testicularis as well as a. et v. ductus deferentis.

Results

Postoperative course

Both patients were released into home care on the second day after the procedure without the need to administer further analgesics. In none of the patients complications with anaesthesia, surgical procedure or postoperative period were recorded. Coagulation, blood vessel and ductus deferens separation using the LigaSure® device were fast, complete and reliable regardless of the diameter of coagulated blood vessels.

Discussion

Miniinvasive, laparoscopically assisted approach in the therapy of cryptorchid dogs provides several advantages. Through approximately 0.5 cm long incision it is possible to revise by laparoscope most organs of the abdominal cavity and the inner inguinal ring, so it may be safely determined whether the testis passed through them or not (Miller et al. 2004). In the case of retained testis in the abdomen, it is possible to remove it through a 2–3 cm long incision. Compared to the miniinvasive method described by Kirby (1980), the laparoscopically assisted approach avoids all the above mentioned complications due to visualization of the organs of the abdominal cavity and at the same time provides the advantages of a miniinvasive method (shorter surgery time, lesser trauma for the patient, lower risk of herniation and evisceration after the procedure).

Laparoscopically assisted extraction of the testis from the abdomen has been formerly described by Pena et al. (1998) and Gallagher et al. (1992) who ligated the blood vessels and ductus deferens using special clips or fibres and performed the ligature inside the abdominal cavity. On the other hand, Miller et al. (2004) modified the method in that after the identification and grasping of the retained testis, they first removed it from the abdominal cavity and only subsequently ligated the funicle with blood vessels and separated the testis. The advantage of this approach was avoiding the necessity of special devices and shortening the duration of the procedure. However, our experience with using the LigaSure® device points out rather the advantages of its use, not only in the castration of a cryptorchid testis but also in ovariectomy or splenectomy where it has been shown that manipulation with the device is very fast, easy and safe compared to ligating the vessels with sutures (unpublished data).

During testis removal from the abdomen, loss of capnoperitoneum occurs when using the method of Miller et al. (2004), which requires reinsufflation and sealing of the wound (enlarged for the extraction of the testis) using wet gauze for handling the other testis. This procedure lengthens the duration of the procedure in contrast to the application of the LigaSure® device which allows first separating both testes in the abdomen, checking

for potential haemorrhage, and subsequently removing them both and directly closing the incisions.

For facilitation of the testis extraction from the abdomen, Spinella et al. (2003) have mentioned the possibility of using an extraction pouch into which the separated testis is placed and is removed in it through an enlarged incision through the port. In our case we have not yet had the opportunity to try the extraction pouches and therefore cannot assess their effectiveness objectively but owing to the very good capacity of LigaSure® to coagulate blood vessels not only proximally but even distally from the incision site, we managed to maintain the operating field clean even after the separation of the testis.

It is recommended during laparoscopically assisted extraction of the cryptorchid testis of the patient to tilt the head lower (approximately by 20°) and slightly to the other side of the retained testis (Miller et al. 2004). In our patients, this tilting was not necessary as in both cases the retained testis was easily and quickly identified in the standard dorsal position of the patient.

Potential complications mentioned in connection with laparoscopy procedures are cardiovascular and pulmonary changes associated with CO_2 insufflation and therefore increased pressure in the abdominal cavity (Patterson et al. 1993; Hurd et al. 1993; Stasberg et al. 1992). Especially the increase of pressure above 20 mm Hg may be dangerous and therefore it is recommended to maintain lower pressure (Seed et al. 1970; Motew et al. 1973; Ivankovich et al. 1974). The insufflator maintained constant pressure of 10–12 mm Hg in our patients which caused no difficulty to the patients. Other possible complications include damage to organs (bladder, spleen, small and large intestines) or to large blood vessels during trocar insertion. We prevented these dangers by primary insufflation using the Verres needle which distances the organs from the umbilicus region, and only then we inserted the port for the camera. Other ports were then inserted under optical control. The risk of subcutaneous emphysema was minimized by checking the correct insertion of the Verres needle through the peritoneum using detection of decompression in the abdominal cavity (Hendrickson 2006). By maintaining the principles of asepsis for the duration of the procedure and by prophylactic intravenous administration of antibiotics we prevented the risk of infection; by thoroughly suturing the incisions using high quality material we prevented the risk of herniation.

The LigaSure® device is already being successfully used in laparoscopically assisted cryptorchidectomy in horses (Hendrickson 2006).

Based on our experience with two patients clinically treated using the above mentioned method, laparoscopically assisted cryptorchidectomy appears as a very efficient and suitable method of castrating the cryptorchid testis of dogs in which one (or both) testis were not found by palpation in the scrotum or the inguinal region. The LigaSure® device effectively facilitates and speeds up this procedure. Theoretically potential complications may be found by prospective further studies.

Laparoskopicky asistovaná kryptorchidektomie s využitím elektrokoagulace LigaSure®

Tento článek popisuje první dva případy laparoskopicky asistované kryptorchidektomie s využitím přístroje LigaSure® provedené na našem pracovišti u klinických pacientů, a to u čtyřletého německého ovčáka a třináctiletého maltézského psíka. Kryptorchidní varle bylo laparoskopicky lokalizováno, uchopeno a postupným přikládáním LigaSure® na semenný provazec byly (postupně) koagulovány a přeťaty a. et v. testicularis, ductus deferens i a. et v. ductus deferentis. Varle bylo vyjmuto z dutiny břišní přes mírně zvětšenou incizi pro nástrojový port. Varle uložené v šourku bylo v obou případech vy-

baveno preskrotální kastrací s ligaturou semenného provazce a a. et v. testicularis, i a. et v. ductus deferentis. Oba pacienti byli propuštěni do domácího ošetřování druhý den po zákroku bez nutnosti podání dalších analgetik. Nebyly zaznamenány žádné komplikace s anestezií, chirurgickým zákrokem, ani komplikace v pooperačním období. Laparoskopicky asistovaná technika koagulace a přetětí cév a ductus deferens přístrojem LigaSure® se jeví jako klinicky využitelná, rychlá a bezpečná miniinvazivní metoda kryptorchidektomie u psů.

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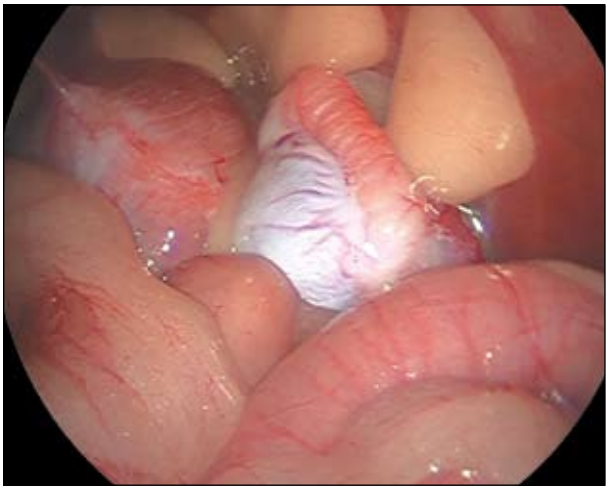

Fig. 1. Cryptorchid testis in the abdominal cavity

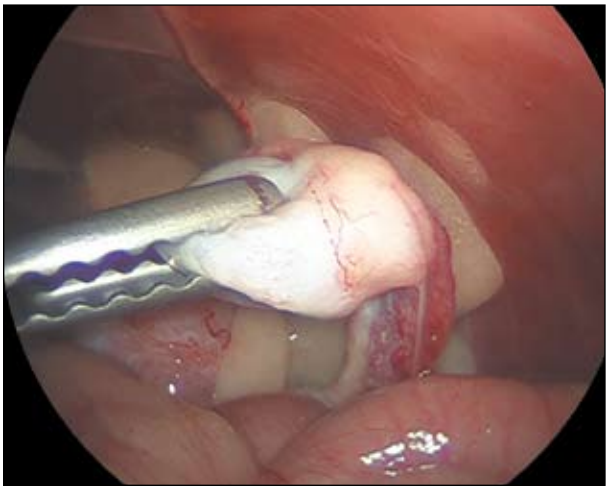

Fig. 2. Cryptorchid testis grasped by laparoscopy forceps

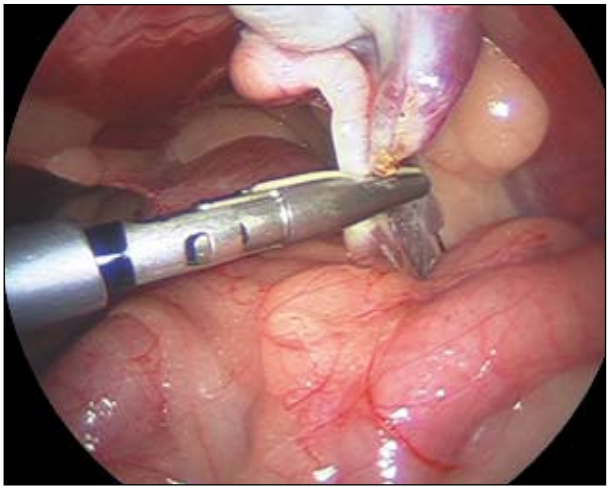

Fig. 3. Sequential grasping, coagulation and transection of the spermatic funicle, a. et v. testicularis, ductus deferens, and a. et v. ductus deferentis using the LigaSure® device

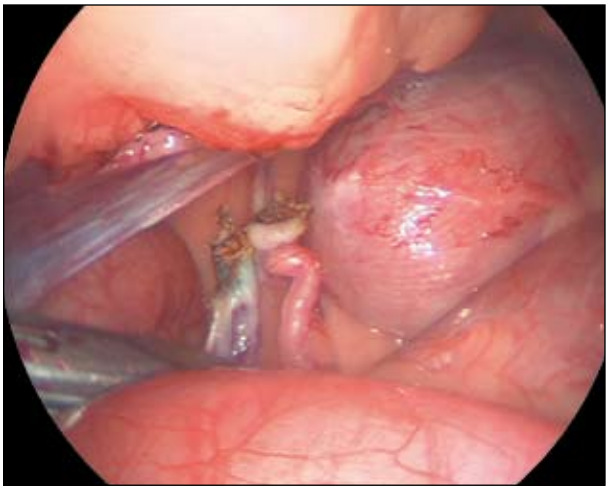

Fig. 4. Visual control of haemostasis at the stump