Laparoscopy for reproductive surgeries: it’s kinda’ like playing Wii, but different
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Objectives
- To discuss indications for laparoscopic reproductive surgeries in dogs and cats.
- To present different approaches and techniques for sterilization of female dogs.
- To describe the technique for laparoscopic exploratory for cryptorchid male dogs.
- To discuss the approach for canine vasectomy.

Key points
- Laparoscopy is a minimally invasive technique that can be used to sterilize female dogs and remove intra-abdominal testicles in cryptorchid males.
- Laparoscopy provides improved visualization, decreased postoperative pain and morbidity, and a faster return to normal activity.
- The use of laparoscopic vessel-sealing devices allows for improved surgical hemostasis and decreased surgical time.
- When preparing for a laparoscopic procedure, the surgeon always needs to be prepared to convert to an open approach if needed.

Overview
The use of laparoscopy in small animal surgery has increased in popularity in the past several years. However, it has not received widespread attention from veterinarians due to the cost of equipment, the requirement for training to master laparoscopic techniques, and the duration of laparoscopic procedures as compared to open procedures. With practice, the techniques can be easily mastered and surgical time quickly diminished. Relatively simple applications of laparoscopy are sterilization of female dogs and cats, and abdominal cryptorchidectomy in dogs and cats. Laparoscopy allows for excellent examination of the peritoneal cavity and either full laparoscopic surgery or laparoscopy-assisted procedures. Procedures are easier in larger patients, and may be combined with prophylactic gastropexy procedures in these patients which may also be at risk of gastric dilatation-volvulus.

The full laparoscopic techniques are not described in this presentation, only salient features. For full surgical detail, please see articles listed in the selected references section.

Instrumentation
For either laparoscopic sterilization or cryptorchidectomy, the equipment is the same and includes the laparoscope, light source, video imaging system, gas insufflators, and laparoscopic instrumentation (trochars, probes, forceps, etc.). A surgical table that is adjustable and tilts facilitates movement of the patient to improve visualization of the abdomen.

There are many hemostatic devices that have been used and proven effective for laparoscopic surgery. The use of extracorporeal sutures, hemoclips, bipolar/monopolar cautery, laser, and ultrasonic vessel-sealing devices are all available. In 2007, a prospective, randomized clinical trial was published, comparing the use of extracorporeal sutures, laparoscopic clips, and a bipolar vessel-sealing device for ligation of the ovarian pedicle during laparoscopy-assisted ovariohysterectomy (OVH). The bipolar vessel-sealing device was found to be associated with significantly shorter surgery times and a lower incidence of hemorrhage from the ovarian pedicle. It is therefore recommended that practices planning to offer laparoscopic procedures on a regular basis invest in a vessel-sealing device. These instruments are can seal vessels up to 7 mm in diameter, so are useful in all breeds, even large breeds. As an aside, vessel-sealing devices are also very useful in splenectomy procedures.
Laparoscopic ovariohysterectomy and ovariectomy

There has been a long lasting argument regarding whether or not the uterus should be removed during gonadectomy in female patients. In the USA, the preferred method is performance of ovariohysterectomy (OVH) whereas in most European countries, the ovariectomy (OVE) is the preferred method. In the USA, there has been a recent greater push to switch to the OVE procedure; however, much resistance is still present. Based on the evidence that is currently available in the veterinary literature, there is no reported benefit and therefore no indication for removing the uterus during routine neutering of healthy bitches. In a survey of the teaching programs among the veterinary schools in North America, the open OVH procedure is most commonly taught. However, if laparoscopy is performed for gonadectomy, most surgeons will perform OVE. When laparoscopy is performed, OVE is technically easier and quicker to perform. If there is pathology present in the uterus, then hysterectomy also should be performed.

There are a few contraindications for the use of laparoscopic gonadectomy in females. Absolute contraindications include the presence of a diaphragmatic hernia, septic abdomen, obesity, and performance in small patients (<2 kg). Although there are reports of successful pyometra surgery in the literature, rupture of the uterus is a significant risk. An open technique should be considered in these situations, or the surgeon should at least be prepared to switch to an open procedure if a laparoscopic procedure is initiated.

For each laparoscopy-assisted OVH, OVE, or cryptorchidectomy, multiple techniques have been described, using a number of ports (one, two, or three). The more common techniques use either two or three ports to allow placement of the laparoscope and instruments. Three ports are usually used for laparoscopy-assisted and completely laparoscopic OVH, whereas two ports are generally used for laparoscopic OVE. Regardless of the number of ports used, the surgeon should always have the patient clipped and prepared in the event that the procedure needs to be converted to an open laparotomy.

Laparoscopy-assisted ovariohysterectomy

A combined laparoscopic and open procedure is used with this technique. Laparoscopy is used to identify and transect the ovarian pedicle. The ovary is identified, grasped and pulled up to the body wall. A suture is passed through the body wall, directed through the proper ligament (not the ovary), and then passed back out of the body. The free ends of the suture are grasped with hemostats to secure the ovary in place. The bipolar vessel-sealing device or laparoscopic hemoclip is used to seal/ligate vasculature and sequentially break down the suspensory ligament, ovarian pedicle, and broad ligament on both sides. Sutures holding the ovaries are released. The ovaries and uterus are then exteriorized through the caudal port, with the incision being extended as needed. Once the ovaries and uterus are exteriorized, the ligation of the uterine arteries and uterine body are performed routinely. Excessive tension on the uterus during this portion of the procedure can result in tearing of the uterus, or hemorrhage. Care must also be taken while exteriorizing the ovary to avoid seeding of ovarian tissue into the peritoneal cavity. Once the caudal incision is closed, the pneumoperitoneum can be re-established and the camera can be re-inserted to evaluate for any hemorrhage from the uterine stump.

Laparoscopic ovariohysterectomy

The suspensory ligaments, ovarian pedicles, and broad ligaments are sealed/ligated as described above, but the uterine arteries and uterus are ligated within the abdomen. The uterine arteries can be individually ligated using a bipolar vessel-sealing device or hemoclips, and the uterine body can be ligated with a pre-tied loop suture or extracorporeal sutures. The bipolar vessel-sealing device can be used on smaller uteri. However, there is little advantage to ligating the uterus within the abdomen, especially in larger dogs, as it is more time consuming, and the caudal incision still has to be enlarged to allow removal of the ovaries and uterus. The laparoscopy-assisted OVH allows more secure ligature placement and is a speedier procedure, especially in large dogs or dogs with enlarged uteri.
Laparoscopic ovariectomy

Once the ovary is identified, the proper ligament is grasped and elevated. The bipolar vessel-sealing device or hemoclip is used to seal/ligate the vascular structures. The proper ligament, mesovarium, and ovarian artery and vein are transected sequentially. Small ovaries can be recovered through the lumen of one of the larger ports. In larger dogs or dogs with ovaries associated with significant adipose tissue, the instrument port may need to be enlarged to allow careful withdrawal of the ovary.

Ovarian remnant syndrome

Laparoscopy is also effective in identifying ovarian remnants from a previous spay procedure. Often the ovarian remnant is small, and located at the end of the ovarian pedicle. Adhesions may have developed at the ovarian pedicle, obscuring the ovarian remnant. The procedure is no different than laparoscopic ovariectomy, but usually only the ovarian pedicle needs to be ligated/sealed further down, closer to the abdominal wall. Tilting the patient to allow the abdominal organs to shift to the opposite side improves visibility of the ovarian pedicle region. Blunt probes may be used to move the duodenum or colon to allow the right and left pedicle, respectively, to be accessed.

Laparoscopic cryptorchidectomy

Cryptorchidism is thought to be a sex-linked autosomal recessive trait in dogs, so neutering and removal of the cryptorchid testicle is recommended. Torsion of the spermatic cord and testicular neoplasia are common pathologies that can develop in cryptorchid animals. One study described a 13.6 fold increase risk of testicular neoplasia in cryptorchid testes. The risk of torsion of the spermatic cord also is increased, with torsion often associated with testicular neoplasia.

The use of laparoscopy for cryptorchid castration allows for easy identification of the testicle within the abdomen with minimal trauma, postoperative patient discomfort, and wound related complications. In cases where localization of the cryptorchid testis is difficult, laparoscopic examination of the caudal abdomen and the openings to the inguinal rings provides excellent visibility. This view can help rule out the diagnosis of abdominal versus inguinal cryptorchidism. This approach may help minimize iatrogenic trauma to tissues attributed in some cases to poor visibility due to small paramedian approaches. Iatrogenic trauma to the ureters and/or urethra and inadvertent prostatectomy have been reported.

Preoperatively the side of the cryptorchid testis should be determined. Under heavy sedation or anesthesia the inguinal regions should be palpated. If a testicle is present within the scrotum, it can be gently manipulated cranially to determine from which side it originates. Cryptorchid testicles are usually abdominal or inguinal, or in rare instances are located within the inguinal canal. Palpation can be challenging in some cases, as often the cryptorchid testis is smaller than normal, and if present within the inguinal canal, then inguinal adipose tissue may make palpation difficult. Ultrasonography of the inguinal region or abdomen can be helpful in some cases to identify the location of the testicle. The patient should always be prepped for full abdominal surgery, in the event that the laparoscopic procedure needs to be converted to an open laparotomy. A two port laparoscopic technique is usually used for a laparoscopy-assisted cryptorchidectomy, whereas a three port technique is used for a complete laparoscopic cryptorchidectomy procedure. Instrument ports usually are introduced through the rectus abdominal musculature lateral to the prepuce.

With either approach, the caudal peritoneal cavity is first explored. Abdominal testes are often seen immediately upon entering the peritoneal cavity with the laparoscope. In cases where the testicle is not immediately visible, the areas of the inguinal rings are evaluated. If the spermatic cord and vascular pedicle are seen entering the ring, then the testicle is outside of the abdomen, likely in the inguinal region. If the gubernaculum is seen entering the inguinal ring, then the testis is within the abdomen, likely hidden by the bladder or other structures. Gentle traction of the gubernaculum will bring the testis into view.
Laparoscopic-assisted cryptorchidectomy

This technique offers a quick way to identify and exteriorize the abdominal testicle, allowing for easy ligation of the vascular pedicle and spermatic cord outside of the abdomen. Once the testicle is identified and grasped, it is extruded through the port. The port may need to be enlarged (separating along the muscle fibers of the rectus abdominal muscle) to allow exteriorization of the testicle. Once the testicle is outside the abdomen, a routine neuter can be done with ligation of the vascular pedicle and spermatic cord. If both testicles are within the abdomen, the opposite testicle can often be extruded from the same port as the first testicle. Alternatively a second port can be created on the opposite side. Once the caudal incision is closed, the pneumoperitoneum can be re-established and the camera can be re-inserted to evaluate for any hemorrhage.

Laparoscopic cryptorchidectomy

When performing the totally laparoscopic cryptorchidectomy, the vascular bundle and spermatic cord are ligated and transected within the peritoneal cavity. Once the testicle is identified, it is elevated towards the body wall. A bipolar vessel-sealing device is inserted through a second instrument port and used to seal and transect the testicular vascular pedicle, spermatic cord, and gubernaculums. In large dogs, the large pampiniform plexus should be either double sealed prior to transaction, or it should be sealed along its narrowest section below the plexus. Alternatively, hemoclips can be used for ligation. Extracorporeal ligatures can also be used, but this is more time consuming. Once the testicle is transected from its attachments, it is removed through one of the ports. The parapreputial port may need to be enlarged by separating along the muscle fibers of the rectus abdominal muscle. However if the subumbilical port along the linea is enlarged for removal of the testicle(s), there is less muscle trauma and pain that occurs as compared to the removal through the parapreputial port.

Laparoscopic cryptorchidectomy for torsion of the spermatic cord or neoplastic testes

Laparoscopy for this condition is more challenging, as often these testes are larger than normal size (as compared to an unaffected cryptorchid testis which is often smaller than normal). If the testis is larger than 8-10 cm, then an open approach should be considered. With laparoscopy a large incision needs to be done to allow exteriorization of the affected testis, so the benefit of a minimal approach is lost. As well, in many of these situations there are adhesions to adjacent structures (bladder, prostate, ureters, intestines, etc.), making laparoscopic removal technically difficult and prolonging surgery. In many situations, the neoplastic cryptorchid testis is small and mobile. Routine laparoscopic cryptorchidectomy can be done as described above, however the neoplastic testicle should be placed in a specimen retrieval bag before it is exteriorized to prevent seeding the port site with neoplastic cells.

Laparoscopic vasectomy

Although there may be an ethical debate as to whether or not vasectomies should be performed in dogs, there may be the rare situation where it makes sense (guard dogs or flock protection dogs, to prevent pregnancies but maintain behaviors). Obviously before performing a vasectomy in a dog, the owner should be counseled about the risks of testicular neoplasia, prostatic disease, perianal tumors, and perineal hernias. If a vasectomy is still indicated, a laparoscopic approach provides excellent visualization of the spermatic cord entering the inguinal ring. The cord is grasped and pulled away from the vascular bundle. It is recommended that a section of spermatic cord be removed. The bipolar vessel sealing device or hemoclips can be used to ligate and then transect a section (1-2cm) of the spermatic cord. This section can be removed via one of the instrument ports.

Postoperative care

With any of the procedures described above, patients need to be monitored for hemorrhage. Pain management is also imperative in these patients, however the duration of administration may be shorter than with open procedures. Owners should monitor incision sites for the usual redness, swelling, or discharge. Most complications following these procedures are associated with the incisions, including
seroma formation and dehiscence. If dehiscence occurs along the body wall, omental or intestinal herniation can occur. Because these patients may have less pain following their procedures and want to be active quickly, the owners should be well educated as to the importance of restricted activity, despite how well the patient feels. This of course is not new information for veterinarians, as we often have the same problem with open OHE procedures in young animals.

**Selected references**


