

Laparoscopy in veterinary practice

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Received: 05/03/2014

Revised: 19/03/2014

Accepted: 21/03/2014

Abstract

Laparoscopic surgery is a keyhole surgery. It is now widely established for evaluation of various abdominal organs like adrenal gland, spleen, kidney, ovaries, gallbladder, bile ducts, liver and intestines. Benefits include reduced postoperative pain, improved cosmetic results and patient satisfaction and reduced hospital stays. The range of surgical techniques is increasing in complexity and now includes cholecystectomy, adrenalectomy, nephrectomy, hernia repair, bowel resection and gynaecological procedures. There is also an increase in the number of emergency operations performed laparoscopically.

Keywords: Abdominal organs, keyhole surgery, laparoscopy surgery.

Introduction

Laparoscopy is a minimally invasive surgical technique for viewing the internal structures of the abdominal cavity by means of a telescope through a small incision made in the abdominal wall (Tam, 1999). It is an endoscopic procedure that bridges the gap between clinical evaluation and surgical exploration. The technique of laparoscopy has been used extensively in human medicine for its simplicity and accuracy. Limited abdominal exploration (keyhole) for laparoscope guided organ examination permits precise and accurate site localization of the various internal organs (Fantinatti *et al.*, 2003; Lew *et al.*, 2003) and excision biopsy is indicated to ascertain a correct diagnosis, specific therapy and accurate prognosis (Tams, 1990). Direct visualization of the organ with a token invasive method also helps the clinicians to imply an assiduous control over the technique without invasive exploratory surgery and proves its superiority over other non invasive diagnostic techniques like X - ray, ultrasound, MRI etc. Moreover, laparoscopy requires minor surgical intervention; it provides one of the only available practical means of making repeated direct examination of abdominal viscera (Twedt, 1999).

Principles of Laparoscopy

There are many important principles and techniques that facilitate performing minimally invasive procedures. Patient positioning, tower positioning, surgical team positions, and instrument table position all have to be considered and planned

out before each procedure. Patient positioning not only includes the recumbency (dorsal, sternal, lateral, or lateral oblique) the animal will be in but also whether the head will be tilted down (Trendelenburg position) or tilted up (reverse Trendelenburg position). One important tip of performing laparoscopy is to always be using gravity to your benefit. For example, for performing a laparoscopic cystostomy or abdominal cryptorchid, the head of the animal should be tilted down allowing gravity to pull the abdominal viscera towards the diaphragm. Gravity is one of the best assistants for laparoscopic procedure.

The position of the tower is also very important in making the procedure quick and smooth. The tower, and therefore the monitor, should always be in a straight line with surgeon body and the angle of the telescope. If the tower is too lateral or if it is behind surgeon, it makes instrument operation difficult, similar to operating in front of a mirror. Because, it is necessary to operate on both sides of the patient in advanced procedures, it is helpful to have an assistant available to move the tower and monitor as surgeon move. The ideal option is to have two or more monitors available in the operating room. Positioning of the surgical team and the operating instrument table is an acquired skill that is perfected over time. Ideal team positioning will be different with every procedure.

Laparoscopic procedure

Preparation of the animal for laparoscopy should include a period of fasting for 12 to 24 hours, with fresh water available except during the 3 hour

period immediately prior to the procedure. The urinary bladder, colon, and stomach should be empty.

Anaesthetic protocol

For performing laparoscopy procedure general anaesthesia is required. In dogs use Atropine sulphate at 0.02 mg/kg. SC as a premedication follows that 2.5 % Thiopentone Na at 15-30 mg/kg. IV up to the effect. or Diazepam – Ketamine at 0.5 mg/ kg + 10 mg/kg IV, respectively or as per the surgeon choice.

Types of laparoscopy

Laparoscopy can be divided into two types.

Surgical laparoscopy

The laparoscopic surgery is a method in which small incisions made on the abdominal wall and inserting the instruments through specially designed ports. The procedure will be visualized with the help of a camera, which will also be introduced through one of these ports. Various laparoscopic procedures likes Pyloromyotomy, Placement of feeding tube, Exploratory laparotomy, Gastropexy, Ovariohysterectomy, Nephrectomy, Cholecystectomy, Colectomy etc. The Laparoscopic Oophorectomy in bitch (Fig 1) was shown.

Insertion of veress needle: The veress needle was checked for its patency before insertion by flushing it with saline. The abdominal muscles were lifted to prevent accidental injury to the underlying visceral organs, as the entry of veress needle is blind. After a stab incision using No. 11 blade, veress needle was placed at the junction of middle and caudal $\frac{1}{3}$ rd distance from umbilicus to pubis. Hanging drop test was performed before attaching the CO₂ insufflator. The gas supply tube was attached to the luer-lock and desired pneumoperitoneum was achieved at a flow rate of approximately 1 liter per minute.

Placement of ports: All the ports were invariably made on the midline. First the umbilical port was introduced just about 1 cm anterior to umbilicus. The trocar and cannula assembly was inserted after stab incision with No. 11 blade and extended into the abdominal cavity using a regular curved artery forceps of appropriate size to hold 10 mm cannula. Once the cannula was inserted into the abdominal cavity, trocar was retracted back and then the cannula was advanced to desired length so as to avoid the trocar injury to any of the underlying visceral organs, especially spleen. A 10 mm telescope attached to the halogen light source by a flexible fiber optic cable and an endocamera was then guided through the umbilical port for the

visualization of abdominal cavity for any injury due to the initial entries. When the auxiliary instrument was required to be used, a 6 mm safety trocar- cannula unit was inserted through an incision made 5-7 cm lateral to the midline incision. Thereafter, the safety trocar was removed and laparoscopic forceps or biopsy instrument was inserted through this second puncture site under the guidance of telescope.

Extraction of ovaries: The wooden table was tilted to the side where the operating surgeon and an assisting were standing. Normally, firstly the right ovary was extracted and the same procedure was followed for the left. Tilting of the wooden table to a 45° angle caused the abdominal viscera to fall against the contra lateral abdominal wall, to facilitated better exposure of ovarian bursae caudal to the respective kidneys in para lumbar region.

Electro- coagulation of ovarian vessels: The ovary was located and lifted using the heavy grasper and the Maryland forceps. The ovarian vessel bed including the middle uterine artery was electro-cauterized using under water 240 W current initially to avoid bleeding during resection. Then the proper and suspensory ligament of the ovary were dissecting using electro-coagulation by Maryland forceps and simultaneously providing traction by heavy grasper at the bursal slit, so as to prolapsed the ovary through it. Once the ovary was exposed, the heavy grasper was used to hold the ovary. The extraction of the ovarian parenchyma was further carried out using laparoscopic scissor or the forceps provided with the cautery attachment for electro-desiccation. A special attention was given to minimize the internal burn to the abdominal wall. Once the ovarian parenchyma was resected completely, it was extracted out of the abdominal cavity by the grasper through the post-umbilical port under vision. The site was checked for any bleeding and the animal tilted in the opposite site for removal of the other ovary. Same procedure was repeated for the other ovary.

Endo-loop ligature of ovarian vessels: The initial procedure for expose of the ovary was similar as described earlier. Then after loop of black breasted silk No. 1-0 was pushed in after application of lubricant for better sliding. The outer end of the loop was kept long enough and was held with a regular needle holder. The loop was inserted through the post-umbilical port by securing it properly in between the serrated margin of the grasper. The loop was placed over the dissected ovarian parenchyma with help of the forceps and the grasper. Once the loop was placed around the ovary, it was held high against the abdominal wall with the

grasper and the knot was slide by means of the forceps. The loop was tighten using the forceps and the pulling the longer strand of the thread held in the needle holder simultaneously. Cautery wire was attached to other scissor and the entire ovarian parenchyma above the loop was snipped off. The knot was tighten and secured, the longer strand of the loop was cut using a scissor inserted through the pre-umbilical port replacing the forceps. The whole ovarian parenchyma was resected free it was extracted out of the adnominal cavity as describe earlier. Same procedure was followed on the other ovary.

Closure of the ports: Following the laparoscopic examination, the laparoscope was removed and the CO₂ gas was allowed to escape from the abdominal cavity via the cannula. After completion of the laparoscopic examination, each incision site was closed with a single mattress suture using non-absorbable suture material (Patel, 2008).

Diagnostic laparoscopy

Diagnostic laparoscopy is a procedure that allows a health care provider to look directly at the contents of a patient's abdomen or pelvis, including the fallopian tubes, ovaries, uterus, small bowel, large bowel, liver, and gallbladder (Almeida *et al.*, 1995). The purpose of this examination is to actually see if a problem exists that has not been found with noninvasive tests (Boyd and Nord, 2000). Diagnostic laparoscopy is generally carried out for Liver biopsy, pancreatic biopsy, Kidney biopsy, Intestinal biopsy, Adrenal evaluation, splenic evaluation, Reproductive evaluation, Cholecystocentesis etc. Wildt and Lawler (1985) demonstrated that the laparoscopy can be used for directly observing abdominal organs of the cat and dogs. This technique was readily adapted to animals of varied size and age. Results indicate that laparoscopy may be useful diagnostic procedure for clinical veterinary medicine. Maiti *et al.* (2006) studied the use of laparoscopy as a diagnostic tool in canine intraperitoneal disorders and done laparoscopic examination in clinical cases to investigate intestinal torsion, intestinal intussusception, intestinal adhesion, intestinal impaction, intestinal foreign body, mummified fetus, polycystic ovarian and uterine growth, persistent corpus luteum, splenomegaly, splenic abscess, chronic hepatitis, cirrhosis, hepatomegaly, liposarcoma of liver, bridging fibrosis of liver etc. were diagnosed by laparoscopic examination. Biopsy of the diseased organs confirmed different pathological affections.

Laparoscopic biopsy of the internal organs

The exploratory laparoscopic biopsy of affected intraabdominal organs (viz. liver, kidney, intestine or spleen) was conducted through the second port either in the midline or lateral to midline depending upon the organ. After inserting 6 mm trocar and cannula, trocar was removed for passing auxiliary biopsy or grasping forceps under the guidance of 10 mm telescope attached to the light source by a flexible fiber light cable. Thereafter, apprehension forceps with concave and sharp borders was connected to the electrocautery with the aim of collecting biopsy specimens and simultaneously cauterizing the injury produced. The electrocautery was adjusted to cut and clot with the intensity of 45 W of the potency to facilitate hemostasis. The fragments were collected in the 10% formalin solution for further histopathological examination. The animals were evaluated up to 24 hours after surgery either keeping them indoor or counseling their owner through telephone.

Laparoscopy provides excellent visual control and the ability to select samples from multiple sites in the liver. It is the technique of choice when a non-surgical liver disease is suspected. Large liver masses can be examined during laparoscopy, biopsies can be obtained, and decisions can be made about whether the tumor is respectable. If it appears that the tumor can be removed, then the procedure may be converted to an open laparotomy. Laparoscopy is often the preferred biopsy technique in animals with either coagulation or wound healing deficiencies. Animals with coagulation defects often require pretreatment with therapies such as decompressing acetate, plasma transfusion, and vitamin K. (Crantock *et al.*, 1994). McCarthy (2004) reported laparoscopy aided retrieval of a ping pong ball in a 9 month old intact male Labrador retriever. Laparoscopy was performed with a 1 cm umbilical telescope portal and a 1 cm right para costal operative portal 3 cm caudal to the last rib at the lateral margin of the rectus abdominis muscle. The laparoscope and vulsellum forceps were placed into the stomach through the gastrotomy incision. When the ball was located, it was grasped with the forceps and removed. The patient's recovery was rapid and uneventful.

Miller *et al.* (2004) Performed laparoscopic assisted localization and removal of retained testes in dogs and cats and concluded that the laparoscopy assisted technique was effective in identifying and removing retained testes and there was less postoperative illness and complications by using laparoscopy. Tumariya (2007) studied on radiographic, ultrasonographic and laparoscopic diagnosis of urogenital disorders in male dogs. He concluded that laparoscopy helps in direct visualization of the size, colour, external texture and peripheral blood circulation of the abdominal and pelvic organs of-



Draping of patient



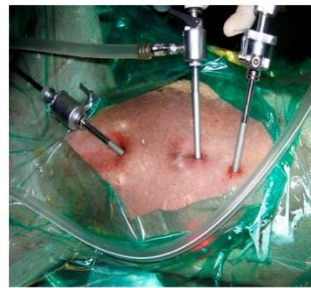
Incision



Placement of veress needle



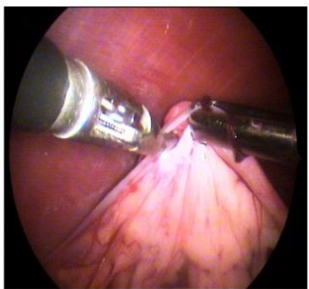
Insertion of trocar



Placement of ports



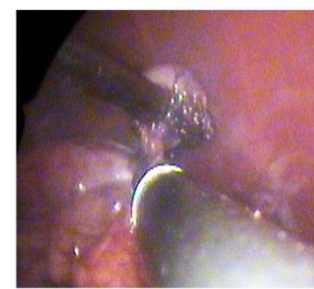
Grasping of ovary



Extension of bursal slit



Grasping of exposed ovary



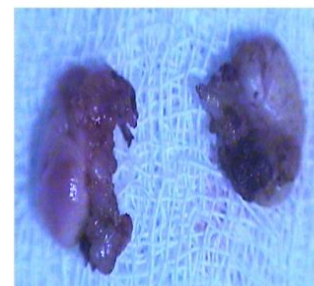
Separation of ovarian parenchyma



Inspection of site



Closure of ports



Dissected ovaries

Fig 1: Laparoscopic Oophorectomy in Bitch

urogenital system but their internal contents cannot be visualized. Moore (2007) told that the principal advantages of endoscopic assisted surgery are twofold: improved visibility of the site of dissection and the avoidance of a large approach through the body wall. The advantage of the improved view during dissection can be useful even if the approach has to be extended subsequently (for example, for organ removal). Minimally invasive surgery has particular advantages for biopsy procedures when a guided biopsy can be taken and the site of biopsy directly observed after collection, with minimal postoperative discomfort.

Contraindications

Contraindications for laparoscopy are relative and include the uncooperative patient, uncorrectable coagulation defects, severe congestive heart failure, respiratory insufficiency, suspected acute, diffuse peritonitis, and the presence of distended bowel. If tense ascites is present, large volume paracentesis can be performed as the preliminary step in the laparoscopy. Previous laparotomy incisions may necessitate alteration of the usual trocar insertion site, or may represent a contraindication to the procedure. Most surgeons would not recommend laparoscopy in those with pre-existing disease conditions. Patients with cardiac diseases and COPD should not be considered a good candidate for laparoscopy. Laparoscopy may also be more difficult in patients who have had previous abdominal surgery. The elderly may also be at increased risk for complications with general anaesthesia combined with pneumoperitoneum. Laparoscopy does add to the surgical risk in patients with a lowered cardiopulmonary reserve with regard to the consequences of the pneumoperitoneum and a longer operative time.

Peritonitis of unclear origin

Patients with diffuse peritonitis particularly when the etiology is unclear. It is a rare complication of minimally invasive surgery due to irritation of peritoneum. Carbon dioxide is known to be a peritoneal irritant which produces congestion of the vessels in patients undergoing laparoscopy. An exaggerated response to the irritant may manifest symptoms of weeping peritoneum which is pyrexia, increased heart rate and respiration cramp abdomen, vomiting and if not treated sometimes leads to severe peritonitis

Cardiopulmonary disease

The deep Trendelenburg position and pneumoperitoneum increase the abdominal pressure

and immobilize the diaphragm, making ventilation more difficult. Secondly, the hypercarbia secondary to the ventilation problem and the absorption of carbon dioxide used for pneumoperitoneum can result in cardiac arrhythmias (Gunther and wolfe, 1992).

Advanced pregnancy

Laparoscopic procedure, particularly in the lower abdominal region, are particular difficult in a near- term gravid uterus (Reedy *et al.*, 1997)

Ascites

It is a most complication of minimally invasive surgery due to pre-renal, renal and hepatic disease. In ascites abdominal organ are not possible to properly visibility and difficult to perform laparoscopic procedure due to accumulation of fluid. In ascites large-volume paracentesis can be performed as the preliminary step in laparoscopy (Lewis *et al.*, 1999).

Portal hypertension

Patients with portal hypertension may have excessive abdominal wall bleeding from trocar placement. In addition, they tend to have more bleeding during routine abdominal dissection due to collateral blood vessel, which may be obscure the field of view and make the procedure unsafe (Morino *et al.*, 2000)

Complications

The most significant risks are from trocar injuries to either blood vessels or small or large bowel. The initial trocar is typically inserted blindly. While these injuries are rare, significant complications can occur. Vascular injuries can result in hemorrhage that may be life threatening. Injuries to the bowel can cause a delayed peritonitis. (Wolf and Stoller, 1994). Some patients have sustained electrical burns unseen by surgeons who are working with electrodes that leak current into surrounding tissue. The resulting injuries can result in perforated organs and lead to peritonitis.

Many patients with existing pulmonary disorders may not tolerate pneumoperitoneum (gas in the abdominal cavity), resulting in a need for conversion to open surgery after the initial attempt at laparoscopic approach

Not all of the CO₂ introduced into the abdominal cavity is removed through the incisions during surgery. Gas tends to rise, and when a pocket of CO₂ rises in the abdomen, it pushes against the diaphragm (the muscle that separates the abdominal from the thoracic cavities and facilitates breathing), and can exert pressure on the phrenic nerve (Corcione,

2007). Coagulation disorders and dense adhesions (scar tissue) from previous abdominal surgery may pose added risk for laparoscopic surgery and are considered relative contra-indications for this approach. (Jansen *et al.*, 2001)

Kerwin (1995) stated that the primary contraindication for a liver biopsy is coagulopathy with a tendency to bleed from the biopsy site and also stated that the pressure of the insufflated gas can decrease the minute respiratory volume. Day (2000) revealed that the examination is contraindicated in patients in which the disease can be surgically solved through laparotomy or in animals in danger of life. Expensive instrumentation, longer duration of the procedure and thus higher load to the patient are the disadvantages of this diagnostic approach.

Simforoosh *et al.* (2004) suggested that performing laparoscopy by skilled surgeons is not associated with considerable complications, though at learning stage more complications may occur, which are gradually decreased. Complications are reported to

be about 4 % and mortality rate to be 0.03 %. Laparoscopic complications have several major parts: those which have occurred during inserting veress and inserting trocar and in pneumoperitoneum stage, as well as vascular complications which are developed by applying some surgical instruments and those complications occurred at the stage of trocar extraction which include vascular complications (the most common), gaseous emboli, hypotension, cardiac rhythmic disorders, hypoxia, hypercapnia, acidosis, aspiration, pneumothorax, pneumomediastinum, pneumopericardium, subcutaneous emphysema, visceral injuries, peripheral nerve injuries, intestinal complications and the rise of creatinine. The familiarity with the technique and accurate consideration to preventive measures are the best ways of preventing complications and decreasing them in laparoscopic procedures (as in open surgeries). Even though if any complication occurs, timely diagnosis and treatment would be of great importance.

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