

Two- or three-port laparoscopic-assisted ovariohysterectomy for the treatment of pyometra in the dog



Introduction and aim of the study: In the dog, minimally invasive laparoscopic-assisted ovariohysterectomy has been associated with reduction of both pain and postoperative complications and with a subsequent prompt recovery. In this paper we describe laparoscopic-assisted ovariohysterectomy using a 2- or 3-port technique and the intra- and post-surgical complications in dogs diagnosed with pyometra.

Materials and methods: With the owners' consent, 17 dogs with pyometra underwent laparoscopic-assisted ovariohysterectomy with a 2- or 3-port technique. The first cannula, 5 millimetres in diameter, was placed about 1 centimetre cranial to the umbilicus for the optical system; the second cannula was inserted 3 to 5 centimetres cranial to the pubis and used as a service port. A third cannula, when needed, was inserted between the two ports.

Results: Ten dogs underwent laparoscopic-assisted ovariohysterectomy using 2 ports and seven with 3 ports, one of which was converted to a traditional celiotomy technique because of poor visualization of the left ovarian pedicle. No major complications were observed intra-surgically and postoperatively; the mean operative time was 32 minutes.

Discussion: In this study, laparoscopic-assisted ovariohysterectomy proved to be a safe surgical treatment for canine pyometra with uterine diameter up to 5.1 cm and no major complications were reported.

Moreover, the operative time was reduced compared to what reported in previous papers on laparoscopic techniques.

Conclusion: Laparoscopic-assisted ovariohysterectomy with a 2- or 3-port technique is a safe surgical procedure with rapid postoperative recovery in dogs with pyometra.

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INTRODUCTION

Laparoscopic-assisted ovariohysterectomy (LAO) is a minimally invasive surgical technique that produces less tissue trauma, a marked reduction in post-operative pain and reduced incidence of post-operative

complications with a significant decrease in infections, dehiscence and formation of hernias and adhesions compared to the traditional celiotomy technique, while significantly reducing postoperative recovery time.^{1,2,3,4} The use of cameras that allow magnification and the induction of pneumoperitoneum make it possible to better visualize anatomical structures and isolate the ovarian pedicle, reducing the risk of intraop-

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erative bleeding.^{1,2} Ovariohysterectomy is the treatment of choice in patients with pyometra. In the dog, the use of minimally-invasive techniques for the resolution of pyometra has already been described by several Authors using different techniques and with encouraging results in terms of both operative time and complications.^{4,5,6,7} The complications reported in the literature were: modest bleeding from the ovarian pedicle, loss of the pneumoperitoneum, haemorrhage of a uterine artery during uterine externalization, minimal splenic lesions with self-limiting bleeding and rupture of the uterus.^{4,5,6,7}

Aim of this work is to describe the 2- or 3-port LAO technique in dogs diagnosed with pyometra and to evaluate the operative time and perioperative complications.

LAO reduces the risk of bleeding and is a safe technique also in dogs with Von Willebrand's disease or factor VII deficiency.

MATERIALS AND METHODS

With the owners' consent, 17 dogs diagnosed with pyometra presented to the Veterinary Hospital Città di Bergamo from January 2016 to November 2018 were selected for ovariohysterectomy using a 2- or 3-port laparoscopic-assisted technique.

The diagnosis of pyometra was based on the clinical history, physical examination, laboratory tests and ultrasound findings of increased uterus size with anechogenic content, compatible with purulent material. The presence of pus was confirmed by the postoperative incision of the uterine horns.

Preoperative diagnostic and evaluation procedures included a complete physical examination, blood count, biochemical profile, coagulation assay and abdominal ultrasound. Ultrasonography of the ovaries and uterus revealed the larger diameter of the uterus.

The presence of severe heart disease, diaphragmatic hernia, peritonitis, poor clinical conditions and ovarian or uterine neoplasms were criteria for exclusion from the study.

Patients were premedicated with 3 gr/kg of medetomidine and 0.25 mg/kg of methadone intramuscularly. Anaesthesia induction was done with intravenous propofol in doses from 2 to 4 mg/kg. Patients were then intubated and kept under gaseous anaesthesia with isoflurane 1.5-2.5%. All procedures were performed by the same surgical team.

For surgery the patients were placed in dorsal decubitus, the abdomen was shaved and prepared aseptically

and the four limbs were extended and immobilized at the corners of a standard operating table, allowing body rotation during endoscopy. A 5 mm cannula (Versaport™ V2, Covidien Group S.a.r.l., Luxembourg) was introduced 1 cm cranial to the umbilical scar. The abdomen was insufflated with carbon dioxide until achieving an intra-abdominal pressure between 8 and 12 mmHg. A 5 mm, 0°, 27 cm laparoscope (Karl Storz Endoscopia Italia S.r.l., Verona) - connected to a xenon light source (Stryker X-1000 Light Source, Stryker Endoscopy, San Jose, California) and to the camera (Stryker 988 medical video camera, Stryker Italia S.r.l., Formello) - was inserted through the first cannula. In all of the dogs a second cannula, identical to the previous one, was placed under endoscopic guidance 3-5 cm cranial to the pubis, again on the *linea alba*.

The patient was then rotated by approximately 40 degrees on the right flank in order to obtain a better visualization of the uterine horn and of the left ovary. In dogs in which visualization of the first ovarian pedicle was not sufficient the patient was returned to the initial position and a third 5 mm cannula was placed halfway between the two previous ones in order to allow movement of the uterus during the surgical procedure by means of grasping forceps (Figure 1).

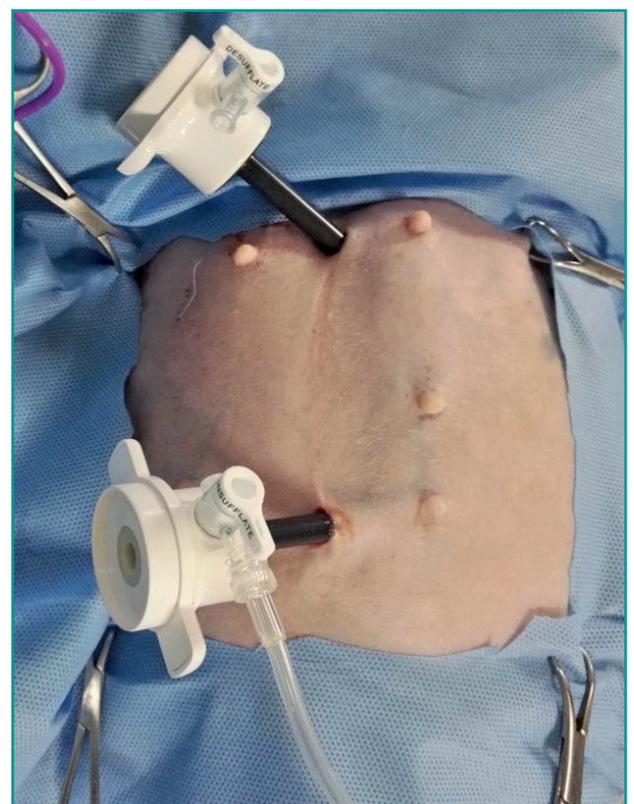


Figure 1 - Pre-pubic and pre-umbilical port positioning in the 2-port LAO technique.

A 5 mm grasping forceps (Endo Clinch™ 2, Covidien, Mansfield, MA) was inserted into the second port under endoscopic vision. The ovarian ligament was first located and then grasped and ligated to the left abdominal wall with a simple trans-abdominal knot. A resorbable polyfilament thread (Polyglactin 910) was used: diameter 0 with a 36-40 mm round needle in medium and large-size dogs; diameter 2-0 with a 26-30 mm round needle in small dogs. With the 3-port technique the ovary was instead supported with the grasping forceps inserted through the third central port (Figure 2) and moved as required in order to facilitate visualization. After this procedure, resection and haemostasis of the ovarian suspensory ligament, the ovarian artery and vein and the broad ligament of the uterus for about two thirds of the length of the uterus were performed, using a 5 mm LigaSure V forceps (Covidien, Inc., Mansfield, MA) inserted through the second port (Figure 3). The ovary was then released from the abdominal wall or from the grasping forceps. The patient was then rotated on the left flank and the same procedures as described above were repeated on the other ovary. At the end, the right ovary was grasped with the grasping forceps inserted through the prepubic port and, after widening of the port with Metzemaum scissors, the ovary and the right uterine horn were externalized up to the cervix (Figure 4). The breach was enlarged caudally and/or cranially, depending on the size of the uterus, in order to allow better exposure of the cervix.

This latter procedure usually resolves the pneumoperitoneum by gas leakage from the enlarged breach. The left uterine horn with the respective ovary was then also externalized through the same breach (Figure 5). Resection of the broad ligaments was completed with LigaSure forceps. The uterine vessels were tied with a simple suture and resorbable polyfilament thread (Polyglactin 910, 2-0 or 3-0). The body of the uterus was then resected at the border with the cervix using a scalpel blade and a Parker-Kerr suture was performed on a clamp using resorbable polyfilament thread (Polyglactin 910, 2-0 or 3-0). As already reported in previous papers,^{5,6} as well as on the basis of our

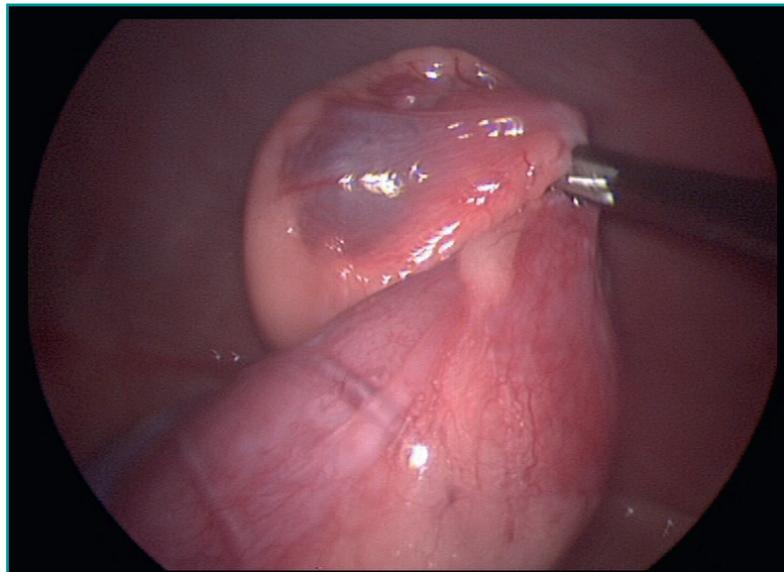


Figure 2 - Suspension of the ovary with grasping forceps. With the 2-port technique the ovary can be attached to the abdominal wall with a transabdominal stitch; with the 3-port technique it can be supported with grasping forceps.

experience that showed no complications with this technique, the cervix was not removed.

The ports were then sutured in 2 layers using resorbable polyfilament thread (Polyglactin 910, 3-0 or 4-0): one layer comprising the peritoneum, muscle fascia and subcutis; the second with an intradermal suture. The total operative time of each surgery was calculated starting from the first cutaneous incision (first port) until application of the last suture stitch.

The postoperative control was scheduled 7-10 days after surgery and comprised a physical examination, wound healing status assessment and the owners' evaluation of postoperative recovery in terms of return to normal. A telephone follow-up was done for those

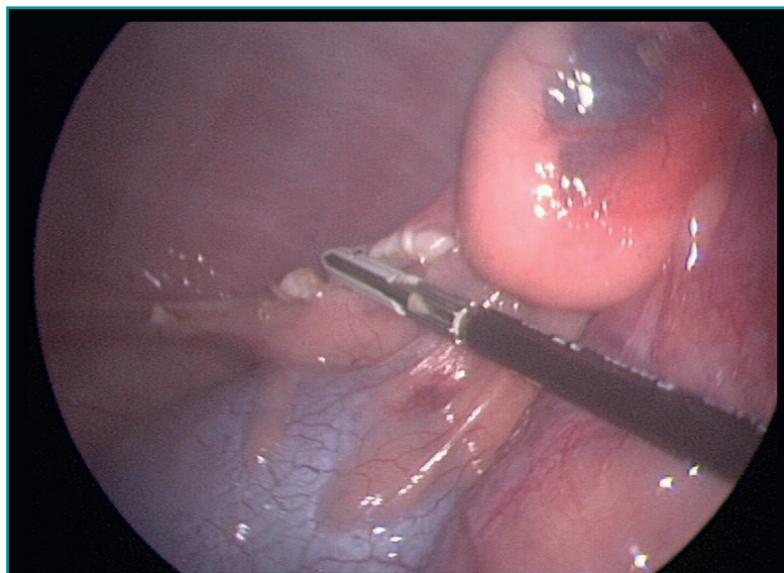


Figure 3 - Resection and haemostasis of the ovarian pedicle with LigaSure forceps.

dogs in which no check-up was possible. Postoperative analgesia was performed with carprofen 2-4 mg/kg for the three days after surgery.

RESULTS

In this study, 17 dogs aged between 58 and 144 months met the inclusion criteria. Their weight was between 3.2 and 36 kg and the breeds included were: 2 Yorkshire terriers, 2 Pomeranians, 2 Poodles, 2 mongrels, 1 Cavalier King Charles Spaniel, 1 Dalmatian, 1 American Staffordshire, 1 Shih Tzu, 1 West Highland White Terrier, 1 Irish Setter, 1 Labrador Retriever, 1 Golden Retriever and 1 German Shepherd.

In our case series pyometra appeared in bitches with a mean age of 8 years and 6 months; according to what reported by the owners, the last oestrus had been observed: 4-8 weeks earlier in 10 bitches, 6 months earlier in 2 bitches, 4 years earlier in 1 bitch and not known in 4 bitches.

The symptoms that led to the physical examination were: lethargy (8), polyuria/polydipsia (8), anorexia/dysorexia (6), vomiting (4). At the physical examination 10 patients had vulvar discharge (7 mucopurulent, 3 hematic-purulent), 6 abdominal distension and 7 hyperthermia.

The main laboratory test abnormalities were: leukocytosis (10), hyperproteinemia (6), increased alkaline phosphatase (5), thrombocytosis (3), hypercholesterolemia (3), thrombocytopenia (2), hyperglycemia (2), hypoalbuminemia (1). In two of the non-thrombocytopenic patients the coagulation test was not performed due to lack of owners' consent.

The uterus with the smaller diameter measured 1.2 cm while the largest measured 5.11 cm. Ten dogs underwent LAO with the 2-port technique and seven with the 3-port technique, one of which was converted to a traditional celiotomy technique.

The following complications were observed: slight bleeding from the ovarian pedicle during suspension with the 2-port technique in 2 dogs; adhesions between the broad uterine ligament, spleen and bladder in a Yorkshire dog of 3.2 kg; kinking with adhesions



Figure 4 - Externalization of the right ovary after extension of the prepubic port.

of the last segment of the uterine horns at the border with the ovary, bilaterally (American Staffordshire Terrier, 22 kg, with maximum uterine diameter of 3 cm), which did not allow visualization of the ovarian pedicle and of the mesovarium in this tract. This latter case was converted to a traditional laparotomic technique. The mean operative time for the 16 patients which completed the laparoscopic surgery was 32

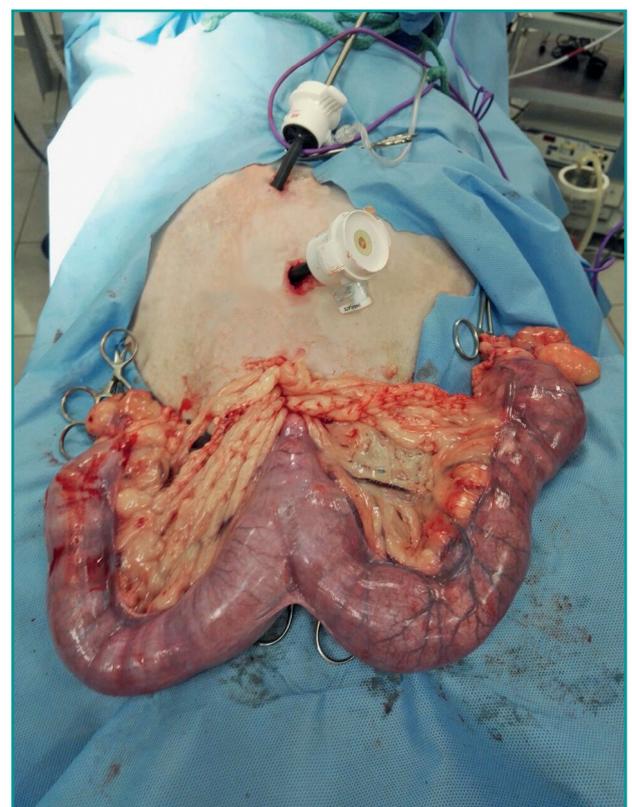


Figure 5 - Final stage after externalization of the uterus and ovaries.

The decreased number of ports and of their size reduces tissue trauma and thus favours postoperative recovery.

minutes, ranging from 14 to 45 minutes; for the patient undergoing the conversion, the total duration of surgery was 60 minutes. Dogs over 21 kg had a longer operative time compared to smaller dogs and all required a third port. In only one small-size dog (West Highland White Terrier, 10.6 kg, maximum uterine diameter 3 cm) was the 3-port technique used.

In no dogs were complications reported during awakening or in the immediate post-operative period.

All the patients were monitored, all underwent peri-operative fluid therapy and were discharged within 24 hours of surgery.

Twelve of the 17 dogs were re-evaluated at the hospital 7-10 days after surgery through a physical examination and the owners' satisfaction assessment regarding recovery; no complications related to the surgery or to wound healing (not even in the patient that underwent surgical conversion) were detected. The owners were generally satisfied with the postoperative recovery and did not notice any abnormalities, even in the 5 dogs that were re-evaluated by phone follow-up only.

Pyometra is a common condition in unsterilized dogs under 10 years of age and ovariohysterectomy is the treatment of choice.

DISCUSSION

In recent years the diffusion and increased awareness of the many advantages of minimally invasive surgery has facilitated the spread of laparoscopy in the veterinary field. In particular, this technique is widely used for ovariectomy in the dog as well as for other less frequent procedures such as: cryptorchid testicle removal, removal of residual ovarian tissue, preventive gastropexy, cholecystectomy, biopsy sampling of organs (liver, pancreas, spleen and kidneys), etc.^{1,8}

The main advantages reported with the use of laparoscopy are: less trauma to the tissues involved, a marked reduction in post-operative pain and duration of hospitalization and, finally, the reduced incidence of post-operative complications accompanied by a significant decrease in infections, dehiscence, bleeding, formation of hernias and adhesions.^{1,2,3,9,10} The main disadvantages are instead the need of a team confident with this methodology, the technical training of the surgeon as well as the cost of the instrumentation.

In the literature, publications on the treatment of pyometra in the dog by minimally invasive surgery are

still limited; this is particularly true with regards to patient selection criteria: patient selection has always been done in an arbitrary way and no defined thresholds have been set on the maximum uterine diameter that can be approached laparoscopically. Some authors have used as reference a maximum uterine body diameter of 5 cm, a restriction based on a threshold reported in human medicine for the laparoscopic removal of intestinal masses.⁶

In two studies the maximum uterine sizes treated with LAO were of 3.9 cm⁶ and 4 cm,⁵ both converted to an 'open' technique due to uterine rupture.

In a subsequent study, the largest uterine diameter removed was of 7 cm, using a 2-port technique and an Alexis retractor; no complications related to the size of the uterus were reported, nor was there an excessive increase in operative time.⁷

In our study we treated uterine diameters of up to 5.11 cm and used a 2-port laparoscopic technique in dogs weighing less than 9.4 kg and a 3-port technique for those weighing more than 10.6 kg. With respect to the size of the uterus, patients in which the 3-door technique was used had a uterine diameter of at least

2 cm. In these patients the 3-port technique was made necessary because the suspension of the first ovarian pedicle with only the trans-abdominal stitch did not allow good visualization of the pedicle. In a 22 kg dog with a 3 cm uterine diameter the conversion to traditional surgery became necessary due to the presence of kinking of the uterine horns and adhesions;

even the addition of a third port did not allow for a safe completion of the laparoscopy.

In the most recent literature the mean reported operative time were 107 minutes (range 82-120 minutes),⁵ 85 minutes (range 40-110)⁶ and 57 minutes (range 48-65 minutes).⁷

In our case series we were able to obtain a reduction in operative time compared to what reported in the literature for minimally invasive procedures. Patients undergoing the 3-port technique had a mean operative time of 38.5 minutes; patients undergoing the 2-port technique had a mean operative time of 28 minutes. In a Yorkshire terrier (3.2 kg) with a maximum uterine diameter of 1.5 cm the time required for the 2-port surgery was 42 minutes, higher than in other patients with the same number of ports, due to the presence of adhesions that made it more difficult to isolate and resect the ligament itself. In these subjects the need for a third port - as well as the greater difficulty in performing haemostasis of the ovarian pedicles and of the broad ligament of the uterus - obviously led to a lengthening of the operative time in our study. Our shorter operative time compared to what reported in

the literature is in our opinion attributable to the greater diffusion of laparoscopy in recent years: as well known, minimally invasive surgery requires a fairly long learning curve but once the technique has been mastered it allows surgical procedures within a time frame comparable to that of traditional surgery, as confirmed by our daily experience. The increased willingness of pet owners to accept this type of surgery has obviously allowed veterinary surgeons to perform more and more minimally invasive surgeries, with the consequent acquisition of greater confidence, speed and reduction of complications when using these techniques.

One of the major complications of LAO is uterine rupture during surgical or pre-surgical procedures.^{5,6} In our case series and in the recent study (2016) by Becher-Deichsel A. *et al.* this complication did not occur despite uterine sizes of up to 7 cm; other complications were also minimal.⁷ According to the authors, obtaining a good visualization of the elements to be resected - which is the criterion for establishing the addition of a third port or whether to convert to an open technique - helps to reduce uterine trauma and therefore the risk of rupture. On the other hand, it is possible that in view of our limited number of cases we may have not encountered uterine diameters that would have led to an excessive reduction in uterine wall resistance or that the exclusion of patients with

signs of peritonitis may have allowed to exclude cases with increased fragility of the uterine wall. Based on our experience and on what found in the literature, the laparoscopically-assisted pyometra technique is probably applicable up to uterine diameters of 7 cm, but larger case series are necessary to confirm this.

One of the limitations of this study is that the data of

The 3-port technique is used in medium-large patients with moderate uterine distension in order to facilitate visualization of the ovarian pedicle.

patients with pyometra who did not meet the inclusion criteria were not recorded; such data would have allowed a better assessment of the applicability of this technique in clinical practice.

In conclusion, we can state that the 2- or 3-port LAO for the treatment of pyometra in the dog and for uterine diameters of up to 5.1 cm can be performed safely and with reduced operative time compared to what previously reported in the literature; the laparoscopic technique allows a quick postoperative recovery and a short hospitalization time.

It is desirable that future studies with a greater number of subjects included may better define the maximum uterine diameter over which the laparoscopic assisted approach is not recommended.

KEY POINTS

- LAO is a minimally invasive surgical technique that significantly reduces the number of perioperative complications and therefore allows a faster and less painful recovery.
- The 2- or 3-port technique varies according to the patient and uterine size and also allows to approach dogs with closed cervix pyometra.
- In this study operative times are significantly reduced compared to what previously described in the scientific literature for the laparoscopic technique.

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