From the Department for Companion Animals and Horses of the University of Veterinary Medicine Vienna, Austria

LAPAROSCOPIC OVARIECTOMY IN FEMALE DOGS: A COOPERATION BETWEEN VUW AND THE UNIVERSITY OF SAMSUN

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Acknowledgment

First I want to thank Prof. Dr. Gilles Dupré for the opportunity to develop this diploma thesis and for his qualified support.

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# Contents

1 Introduction ........................................................................................................... - 5 -

2 Literature survey – current contraception methods in the bitch ....................... - 6 -
   2.1 Anatomy of the female reproductive tract ......................................................... - 6 -
   2.2 Surgical techniques of contraception ............................................................... - 8 -
      2.2.1 OHE versus OVE – advantages and disadvantages ...................................... - 8 -
      2.2.2 Comparison of Laparoscopic OVE and traditional midline OVE .......... - 8 -
         2.2.2.1 General and specific benefits of Laparoscopic OVE ......................... - 8 -
         2.2.2.2 Laparoscopic procedure – overview of different methods .......... - 10 -

3 Scheduling of the project ..................................................................................... - 14 -

4 Material & Methods ............................................................................................. - 18 -
   4.1 Materials ........................................................................................................ - 18 -
      4.1.1 Patients ..................................................................................................... - 18 -
      4.1.2 Equipment .............................................................................................. - 20 -
         4.1.2.1 Endoscopic tower ............................................................................. - 20 -
         4.1.2.2 Laparoscopic equipment ................................................................. - 20 -
   4.2 Methods ......................................................................................................... - 21 -
      4.2.1 Anaesthesia ............................................................................................. - 21 -
      4.2.2 Laparoscopic surgery ............................................................................. - 22 -
         4.2.2.1 Preparation ....................................................................................... - 22 -
         4.2.2.2 Surgery ............................................................................................ - 22 -
      4.2.3 Statistical analysis ................................................................................... - 25 -
         4.2.3.1 Unpaired t-test .................................................................................. - 25 -
         4.2.3.2 Chi2 test ............................................................................................ - 25 -
         4.2.3.3 Pearson Correlation Coefficient ......................................................... - 25 -

5 Results .................................................................................................................. - 26 -
   5.1 Signalment ..................................................................................................... - 26 -
      5.1.1 Weight distribution .................................................................................. - 26 -
      5.1.2 Body condition score .............................................................................. - 27 -
   5.2 One-hole LapOVE versus Two-hole LapOVE ................................................ - 28 -
      5.2.1 Surgical time ........................................................................................... - 28 -
      5.2.2 Surgical complications ............................................................................ - 28 -
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2.3 Surgeons</td>
<td>28</td>
</tr>
<tr>
<td>6 Discussion</td>
<td>29</td>
</tr>
<tr>
<td>6.1 Minimally invasive technique</td>
<td>29</td>
</tr>
<tr>
<td>6.2 Pedicle haemostasis</td>
<td>30</td>
</tr>
<tr>
<td>6.3 Surgical time</td>
<td>31</td>
</tr>
<tr>
<td>6.4 Complications</td>
<td>32</td>
</tr>
<tr>
<td>6.5 Scheduling of the project</td>
<td>33</td>
</tr>
<tr>
<td>7 Summary</td>
<td>34</td>
</tr>
<tr>
<td>8 Annex</td>
<td>38</td>
</tr>
<tr>
<td>8.1 List of figures</td>
<td>38</td>
</tr>
<tr>
<td>8.2 List of tables</td>
<td>38</td>
</tr>
<tr>
<td>8.3 List of abbreviations</td>
<td>38</td>
</tr>
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<td>9 References</td>
<td>39</td>
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Laparoscopic ovariectomy in female dogs

1 Introduction

Because of its numerous advantages such as decreased duration of hospitalization, faster recovery time, decreased stress and pain, and improved visualization of abdominal organs minimal invasive surgery has become more widespread in veterinary medicine (TWEDT and MONNET, 2005).

The first endoscopic experiments were performed by Hippocrates (460 – 375 B.C.), who described an instrument for retroscopy, which could be compared with ours nowadays. At the beginning the major problem was the insufficient light source and so Philipp Bozzini analyzed the problem and developed a fiber optic to advance the endoscopic examination. 1901 the first laparoscopic surgery in dogs was done by G. Kelling who produced an insufflation technique for a better visualization. Independent from Kelling, Jacobeus established and performed the minimal invasive technique in humane medicine in 1913 (NAUNDORF, 2003).

Minimally invasive techniques have been applied in many different fields in veterinary medicine. It can be used for OHE, OVE, cryptorchidism, gastropexy, cystopecty, portocaval shunts, partial or total lobectomy, pericardectomy, PRAA, PDA and thoracic duct ligation (DUPRE, 2007, personal communication).

Laparoscopic ovariectomy has shown to be efficient for spaying in female dogs and is currently practiced at VUW. It allows for small incisions, time-effective surgery and early release. However because of the need of a high number of patients in a small period of time a collaboration with the University of Samsun was decided.

Because of these reasons the aim of this diploma was

- the organisation of a project, where a team of VUW goes to Turkey to perform laparoscopic ovariectomies on stray bitches in association with the University of Samsun
- to describe the pros and cons of one-hole and two-hole laparoscopic ovariectomy with LigaSure (vessel-sealing device).
2 Literature survey – current contraception methods in the bitch

2.1 Anatomy of the female reproductive tract

The female tract of the bitches consists of the ovaries, oviduct, uterus, vagina, vulva, and mammary glands (FOSSUM and HEDLUND, 2007).

![Anatomy of the reproductive female tract](source: Ira M. Gourely und Clare R. Gregory (1993), Atlas der Weichteiloperationen bei Hund und Katze, S. 20.2)

**Fig. 1 Anatomy of the reproductive female tract**

The ovaries are located just caudal to the pole of each kidney. The right and the left ovaries are not in the same position because the right ovary lies further cranially than the left one. The exact location of the right ovary is dorsal to the descending duodenum, and the left one is dorsal to the descending colon and lateral to the spleen. Each ovary is connected to the uterine horn by the proper ligament, and via the suspensory ligament to the transversalis fascia medial to the last one or two ribs. Further important structures are the mesovarium, which includes the
Laparoscopic ovariectomy in female dogs

suspensory ligament with its artery and vein, ovarian artery and vein, and variable amounts of fat and connective tissue. The origin of the ovarian arteries is the aorta and ovarian vessels take a tortuous path within the pedicle. The left ovarian vein drains into the left renal vein, while the right ovarian vein empties into the vena cava caudalis. The uterus is suspended by the broad ligament (mesometrium), this is the peritoneal fold. The ligamentum teres uteri runs in the free edge of the mesometrium from the ovary through the inguinal canal with the vaginal process. Uterine body and horns are provided with blood by the uterine arteries and veins. (FOSSUM et al., 2007).
2.2 Surgical techniques of contraception

2.2.1 OHE versus OVE – advantages and disadvantages

Routine gonadectomy is one of the most common surgical techniques in veterinary medicine to control pet population. Surgical contraception can be performed by ovariectomy and ovariohysterectomy (VAN GOETHEM et al., 2006). Several techniques as traditional midline OVE/OHE, lateral flank OVE/OHE and laparoscopic OVE/OHE have been described (HOWE, 2006). The application is very controversial and for this study and as for several studies ovariectomy was considered as the method of choice for female neutering.

2.2.2 Comparison of Laparoscopic OVE and traditional midline OVE

2.2.2.1 General and specific benefits of Laparoscopic OVE

Laparoscopy is a minimally invasive technique which provides a high visibility of internal structures of the abdominal cavity. The advantages of this technique compared with conventional open surgical exploration are:

- improved patient recovery
- less postoperative pain and stress
- lower postoperative morbidity
- decreased infection rate
- shorter hospitalization and convalescence time (TWEDT and MONNET, 2005, NICKEL et al., 2007).

Open ovariectomy has received more widespread attention in veterinary medicine compared with laparoscopic methods. This is, in part, due to the difficulty in handling laparoscopic techniques, the complexity of the equipment, and the duration of the laparoscopic procedures (DEVITT et al., 2005).

Increased duration of surgical time is reported as a negative factor in laparoscopic surgery. But surgical time depends on surgeon experience, instrument availability and the kind of procedure (ovariectomy or ovariohysterectomy). The duration of
Laparoscopic ovariectomy in female dogs

Laparoscopic surgery can be reduced by using a multiple function instrument including grasping, cauterization and transection, which avoid repeated instrumental exchanges. Laparoscopic assisted technique can also minimize the surgical time. This technique applies a transabdominal suspension suture to maintain exposure of the ovarian pedicle and eliminates the use of an additional trocar and a surgical assistant (DEVITT et al., 2005).

A recent report from Mayhew and Brown (2007) has shown that surgical time is associated with different methods used for pedicle hemostasis. In this study three techniques (clips, suture, vessel-sealing device) for pedicle hemostasis were compared. Due to numerous instrument exchanges time increased considerable in the suture and clip group compared with the vessel-sealing device (MAYHEW and BROWN, 2007).

Pain control is also an important factor in veterinary medicine because uncontrolled pain results in cardiovascular stress, immunosuppression and anorexia. (HANCOCK et al., 2005). Less pain is provided with laparoscopy due to small incisional size, decreased muscular trauma and the relatively atraumatic nature of cauterization and transection of the ovarian pedicle compared with digital disruption of suspensory ligament and organ manipulation during traditional midline ovariectomy (DEVITT et al., 2005).

A further benefit of laparoscopic surgery is the superior visibility of internal structures compared with open procedures. Small incisions are often performed during traditional midline OVE or OHE, which decrease visualization of the reproductive tract. This can result in a high risk of incomplete tissue resection, which cause ovarian remnant syndrome (AUSTIN et al., 2003).

Another advantages of laparoscopy associated with less surgical tissue trauma are less risk of dehiscence and haemorrhage and less postoperative wound complications (DAVIDSON et al., 2004).
2.2.2.2 Laparoscopic procedure – overview of different methods

The basic steps in mini invasive surgery are the same for traditional midline ovariectomy, such as access, exploration, dissection, hemostasis, tissue removal and closure (KOLATA and FREEMAN, 1999).

Laparoscopic ovariectomy is mostly performed on medium and large size dogs, but can also be performed on small dogs. Restrictions are reported by the patient’s size, since the abdominal cavity of small dogs makes the technical procedure more difficult. Dorsal recumbency is most commonly performed by ovariectomy, because both ovarian pedicles can be visualized without moving the patient. Alternative possibility is the Trendelenburg position, thus the patient is tilted 30 degrees with the head down. The advantage of this position is to shift the abdominal organs into the cranial abdomen and facilitate exploration of reproductive tract. The table can also be tilted from side to side to help manipulation and visualization. Mechanical ventilation is suggested because of the intra-abdominal insufflation pressure and the weight of the organs on the diaphragma (TWEDT and MONNET, 2005).

As a precondition for laparoscopic surgery the insufflation of the abdominal cavity must be performed. Pneumoperitoneum can be obtained with CO₂, N₂O, air, nitrogen, helium, xenon or argon. CO₂ is the most commonly applied insufflation gas. There are three methods for establishing pneumoperitoneum:

- the closed technique with the Veress needle
- the open technique for placing a Hasson trocar
- optical trocar (KOLATA and FREEMAN, 1999).

For the closed method, the Veress needle is inserted subumbilical and directed to the pelvis. Therefore a small skin incision is made and the abdominal wall is lifted up during insertion. To avoid intraabdominal injury, encountered in blind puncture, the open technique was developed in 1974. For trocar placement an incision through all layers is performed, which are fixed by placing a suture on each side of the incision. An alternative to both methods is the optical trocar. This type of trocar
Laparoscopic ovariectomy in female dogs

has a hollow obturator with a lens inside, in which the laparoscope can be inserted. This technique allows controlled entry, because the tissue layers can be visualized on the video monitor during trocar insertion. That cannula, which is made by open method or by optical trocar for insufflation, serves as the primary port. For the closed technique the first port has to be provided by trocar insertion to the umbilicus. An acceptable optical cavity is created with 10 to 12 mmHg because a higher intra-abdominal pressure results in mild haemodynamic changes (KOLATA and FREEMAN, 1999).

For obtaining optimal access additionally to the primary port at the umbilicus, one or two secondary ports have to be made. The correct placement of the secondary port is important to avoid paradoxical movements and to allow manipulation of the instruments without interference (KOLATA and FREEMAN, 1999). Commonly used method is the placement of one median port at the umbilicus and two secondary ports paramedian halfway between the umbilicus and pubis (HANCOCK et al., 2005, WENKEL et al., 2005). A further approved technique is the use of two median ports, on at the umbilicus for the optic and the second cranial to the pubis (DEVITT et al., 2005).

In laparoscopic surgery different instrumental methods for haemostasis and dissection of the tissue are available:

- mechanical (ligatures, clips, stapler)
- electrosurgery (mono-, bipolar)
- ultrasonic energy (harmonic scalpel)
- laser (WENKEL et al., 2005).

The selection of the right method depends on instrument availability and the vascularity, friability and extent of fat tissue (HENDRICKSON and FREEMAN, 1999). Ligatures, clips or stapler in combination with electrosurgery are commonly used for vessel sealing (WENKEL et al., 2005). As a precondition for application of ligatures the tissue should withstand stretching. Suture ligation is a safe and reliable method but difficult in handling and more time consuming than other mechanical procedures (MAYHEW and BROWN, 2007).
Laparoscopic ovariectomy in female dogs

Vascular stapler is utilized if the ovarian pedicle is extremely wide. The mode of function based on a mechanical compression of the tissue and vessels, simultaneously densely packed staples are placed and cut between the rows. Staplers are versatiliely applicable but relative cost-intensive (WENKEL et al., 2005).

If the ovarian artery and vein are larger than 3 mm, endoscopic clips can be used. To apply ligating clips it is necessary to isolate the tissue into smaller sections. If the ovarian pedicle includes a lot of fat it makes the procedure much more difficult to prevent haemorrhage. Therefore a combination with other methods is required. In case of friable pedicle with many small vessels ultrasonic or radiofrequency are the methods of choice (HENDRICKSON and FREEMAN, 1999).

To seal vessels with a diameter up to 7 mm a modified high-frequency technology (Ligasure) can be used. Ligasure is a feedback-controlled bipolar vessel-sealing device, which is able to sense the electrical resistance of the tissue grasped between the jaws and deliver an appropriate amount of energy to seal the tissue. Vessel sealing occurs by fusion of tissue elastin and collagen. A scalpel is integrated into the tip of the hand-set, which can be used for transection of the tissue without changing the instruments (RIEGLER and CONSENTINI, 2004; HAND et al., 2002).

Regarding to the easy handling and less-invasive dissection of tissue Ligasure can be compared with ultrasonic energy. The transection occurs via ultrasonic waves, which cause a vibration of the instrumental hand-set. Due to less heating (100°) of the tip, accurate dissection, coagulation and transection of the tissue can be performed. If the vessels are larger than 2-3 mm ultrasonic energy has to be combined with ligatures or other mechanical methods similar to electrosurgery and laser (WENKEL et al., 2005).

Further techniques of electrosurgery used to establish haemostasis are monopolar and bipolar electrocoagulation. The disadvantage of monopolar electrosurgery is the excessive lateral spread of the energy and following the potential for injury to the adjacent tissue. Bipolar electrocoagulation compared with monopolar electro-
Laparoscopic ovariectomy in female dogs

surgery requires less current for hemostatic effect and less damage of surrounding tissue occurs (VAN GOETHEM et al., 2003).

Another technique, which assumes special preventive measures, is the laser (WENKEL et al, 2005). Laser has also been used but has shown an increased duration of surgery compared with bipolar electrocoagulation as described by van NIMWEGEN (2005).

For removal of the tissue the ovary must be grasped and brought to the base of the trocar. The incision can be enlarged if it is necessary. To be sure that no haemorrhage exists, the abdominal cavity must be inspected and therefore the intra-abdominal pressure has to be reduced to 6 mmHg. Rectal fascia, subcutaneous tissue and the skin must be closed to prevent omental herniation (KOLATA and FREEMAN, 1999).
3 Scheduling of the project

The whole organizational process was managed by the persons in charge from Vienna. From the beginning of the project there was a close collaboration with the University of Samsun and the involved companies. The preferred means of communication were e-mail and telephone.

The fundamental idea of this project was the comparison of two different methods of laparoscopic ovariectomy in female dogs, which started in October 2007. Prof. Dr. Selim Aslan from the University of Ankara (Department of Obstetrics and Gynaecology), who has already worked with the Department of Gynaecology in Vienna, established the contact with Prof. Murat Findik and the members of his team at the University of Samsun, which was the beginning of this cooperation.

Prof. Murat Findik accepted to provide 30 to 40 female dogs and two operating theatres at the Department of Obstetrics and Gynaecology. These facilities were used for the preparation of the patients and the surgeries.

As a result of the great number of cases planned to be provided by the University of Samsun, a lot of data regarding surgery and anaesthesia could be collected, such as:

- validation of one-hole laparoscopic ovariectomy
- documentation about liver and spleen injury during trocar placement
- comparison of non-ventilated and ventilated patients during surgery.

Another plan for this collaboration was the transfer of technical knowledge about laparoscopic surgery to the team members of the University of Samsun - two surgeons should be inducted into this technique.
The next step was a survey of the status quo and the planning of the missing things. Therefore a list with the open issues was prepared:

- female intact dogs
- localization: preparation and surgical room
  - period
  - finances
  - surgeons
  - anaesthesists
  - equipment for laparoscopic ovariectomy
  - instruments for the anaesthesia

**Period and finances**

In agreement with the University in Turkey the team chose the week from 6th to 12th January 2008. The international relation office of the University of Vienna awarded a financial grant:

- scholarship for the diplomate: € 482
- costs of accommodation
  - Dr. Dupré € 36.40/night
  - Dr. Rocchi € 31.60/night
- airfare

**Team: surgeons and anaesthesists**

The team of Vienna consisted of two surgeons: Prof. Dr. Dupré, who was responsible for the delegation of the project and for initial contacts with the University of Samsun and the companies, and Dr. Fiorbianco, who prepared the protocols for the surgical studies in Turkey. The anaesthesia study was done by Dr. Attilio Rocchi and therefore all organizational things were prepared in advance. The diplomate was responsible for further correspondence with the companies and the members of the University of Samsun. Six persons from the Turkish university, two for anaesthesia and four for surgery, were available for this study.
Laparoscopic ovariectomy in female dogs

The following equipment was required in Turkey:

- endoscopic tower
- laparoscopic instruments
- ligasure generator, ligasure clamps
- anaesthesia device, ventilator
- tilting tables
- sterilization for Ligasure and the laparoscopic instruments
- suture material, camera plastic covers

Due to the fact, that no laparoscopic equipment was available at the University in Turkey, a contact with the companies Storz and Tyco was made. Both companies agreed to provide the laparoscopic instruments and bring them to Turkey. The premises of the Turkish University included two anaesthesia devices and ventilation. For the suture material and the camera plastic covers the companies Vetoquinol and Hartmann were involved. Fritz Sommer, business manager of the company Pannomed, was contacted to provide tilting tables for the laparoscopic surgery. The rest of the equipment was brought from the University of Vienna.
Laparoscopic ovariectomy in female dogs

Project – laparoscopic ovariectomy
6.1. – 12.1.2008

VUW - team members:
• surgeons: Dr. Dupre
  Dr. Fiorbianco
• anesthesiist: Dr. Rocchi
• student

University Samsun – team members:
• Prof. Dr. Murat Findik
• Dr. Nilgün Gültiken
• students and assistants

Storz – contacts:
• Dr. Christopher Chamness
• Dr. Reglind Hühn (Germany)
• Ing. Andreas Hütter (Austria)
• Emine Dogan (Gentek/Turkey)

Tyco healthcare – contacts:
• Adrien Bramoule
• Mathonnet Olivier
• Gokhan Adiguzel (Covidien/Istanbul)

Vetoquinol – contact:
Dr. Sebastian Leibetseder (Austria)

Hartmann – contact:
Mag. Reinhard Nessel

equipment:
- small animal laparoscopy set
- Storz tower
- Aida vet recording system

equipment:
- Ligasure generator
- Ligasure clamp
- Covidien:CN724

equipment:
- camera plastic covers

Fig. 2 Involved people and companies
4 Material & Methods

4.1 Materials

4.1.1 Patients

For this project only stray dogs were used and consequential no exact patient profile existed. A number of 45 female intact dogs were brought up by the members of the University in Samsun and were collected from the street in Turkey. All dogs were mixed breeds with an average weight of 18 kg. A physical examination and a minimum database (standard preoperative blood parameters) were performed and also an ultrasound of the abdomen took place. Before and during the surgery blood gas analysis was conducted. All dogs, which were found to be healthy after clinical examination, underwent laparoscopic surgery. The animals were randomized and divided into two groups:

- Group 1: one-hole technique (20 dogs)
- Group 2: two-hole technique (22 dogs).

The hospitalization time for all patients was not longer than 24 hours. All surgical procedures were performed by the same surgeons. Anaesthesia protocol and surgical time, as well as any complications were documented.
Laparoscopic ovariectomy in female dogs

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<td>11.01.2008</td>
<td>42</td>
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<td>28</td>
<td>underweight</td>
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Tab. 1 Patients included in the study
4.1.2 Equipment

4.1.2.1 Endoscopic tower

For implementation of the laparoscopic surgery an endoscopy tower from the company Karl Storz GmbH & Co KG Tuttlingen was used, which consisted of

- monitor (Sony®)
- camera system
- light source
- CO2- insufflator
- recording system (Aida vet system)
- suction device

4.1.2.2 Laparoscopic equipment

<table>
<thead>
<tr>
<th>one-hole technique</th>
<th>two-hole technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hopkins 0° 10 mm (Karl Storz GmbH &amp; CO KG Tuttlingen)</td>
<td>Hopkins II straight forward telescope 0°, diameter 5 mm, 29 cm (Karl Storz GmbH &amp; CO KG Tuttlingen)</td>
</tr>
<tr>
<td>Endopath Xcel Trocar Ethicon Endo-Surgery Inc 12 mm</td>
<td>Endopath Xcel Trocar Ethicon Endo-Surgery Inc 12 mm + 5 mm</td>
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<tr>
<td>Click line Babcock grasping forceps 5mm, 36 cm (Karl Storz GmbH &amp; Co KG Tuttlingen)</td>
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</tr>
<tr>
<td>Veress Pneumoperitoneum Needle, 10 cm (Karl Storz GmbH &amp; Co KG Tuttlingen)</td>
<td></td>
</tr>
<tr>
<td>Suture material Covidien: monosof CN 724 (Vetoquinol)</td>
<td></td>
</tr>
<tr>
<td>Ligasure generator (Tyco healthcare)</td>
<td></td>
</tr>
<tr>
<td>Ligasure clamps V 5mm and atlas 10 mm</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 2 Equipment
4.2 Methods

4.2.1 Anaesthesia

At one leg an intravenous catheter was placed in the V. cephalica in all patients and the dogs were sedated with Acepromazin (20µg/kg i.v.) for pre-medication and 20 minutes later the dogs were induced with Propofol i.v.(dosage depends on effect). Tracheal intubation was performed for general anaesthesia, which was maintained with isoflurane.

For epidural anaesthesia the dogs were placed in sternal recumbency with the hind legs flexed forward. The lumbosacral area was clipped and disinfected for sterile injection. The spinal needle (Quinke type) was inserted in the lumbosacral epidural space (L7 – S1) and the placement was validated by the hanging drop technique. Two different protocols were used for the epidural injection. For one group a dosage of 0.1mg/kg hyperbaric Bupivacain was applied and for the other a volume of 0.2 mg/kg. The dogs were randomized and divided into two groups, a non-ventilated and a ventilated group (AUSTIN et al., 2003).

During the laparoscopic surgery the monitoring occurred via EKG, capnography, pulse oxymeter and a non invasive blood pressure measuring device. The EKG electrodes were stuck on the pads to measure the heart frequency and the electrical heart activity. To observe the pulse frequency and the arterial oxygen saturation a pulse oxymeter was used. For the non invasive blood pressure measurements an inflatable sleeve was applied, which was attached to the distal limb.

Capnography, which measures the endtidal carbon dioxide, was adjusted to maintain the CO² between 35 – 45 mmHg. During the surgery, pulse, blood pressure, respiration rate, end-tidal CO² and arterial haemoglobin saturation were recorded every 5 minutes. All patients received Caprofen 4mg/kg intravenous after surgery.
4.2.2 Laparoscopic surgery

4.2.2.1 Preparation

The ventral abdomen was clipped from the xyphoid to the pubis and disinfected for laparoscopic castration. The urinary bladder was emptied for a better visualization of the abdominal cavity and to minimize the danger of tapping. At the operating room the patients were positioned in dorsal recumbency.

4.2.2.2 Surgery

For implementation of the Veress-needle, two different methods were used. A distance between the xyphoid and the lateral part of the costal arch was measured and then one third or one half of this distance far away from the xyphoid a skin incision with the scalpel between 11th or 10th intercostal space was done. For the Veress-needle penetration the ribs were lifted up with Backhaus clamps to avoid injuries of organs. The correct placement of Veress-needle was verified by a syringe field with sterile saline. To check for blood or other fluids aspiration of the syringe was performed. A small amount of saline was injected, which should flow freely (KOLATA and FREEMAN, 1999). In case of the right position of the needle the insufflation device was connected and a pneumoperitoneum was built until an abdominal pressure of 12 mmHg was reached.

Two-hole technique

A skin incision, 2 cm caudal of the umbilicus, was performed for the first 12 mm trocar (Endopath Xcel Ethicon Endo-Surgery Inc.). The pneumoperitoneum was reduced to a pressure of 8 mmHg. The Hopkins 5 mm 0° telescopes was positioned through the 12 mm cannula to check the placement of Veress-needle, to visualize the condition of the uterus and existence of any bleeding, and the entrance of the second trocar paramedian. The Veress-needle was removed out of the abdominal cavity and the second port was made in a non-vascular area, paramedian to the midline 1or 2 cm cranial of the umbilicus because of the falciform ligament. A 5 mm trocar (Endopath Xcel Ethicon Endo-Surgery Inc.) was used to penetrate the abdominal wall and place through the skin incision. The laparoscopic telescope was switched from the midline port into the 5 mm cannula. For a better
Laparoscopic ovariectomy in female dogs

visualization, the patient was turned on the right side for the resection of the left ovarian pedicle. A Babcock forceps was inserted into the 12 mm cannula to grasp the right ovary. The ovary was lifted from the surrounding tissue and brought to the abdominal wall, which allowed percutaneous advancement of a transabdominal suspension suture with a round needle (Covidien: CN 724 N°1 polyamid monosof; Vetoquinol) to maintain exposure of the ovarian pedicle. The grasping forceps was removed from the midline port and the 5 mm laparoscopic vessel sealer/divider device (Ligasure V, Tyco Healthcare,) was introduced into the abdominal cavity. The laparoscope was placed that the top of the Ligasure clamp was in the center of the video monitor. With the aid of the modified high-frequency technology (Ligasure generator) the successive sealing and transection of the proper and suspensory ligament, the A./V. ovarica including, occurred. The tissue was grasped, incipient from the ligamentum suspensorium coagulated and dissected in caudal direction. Following transection, the ovary was pulled into the cannula and extracted from the abdomen together with the sling suture. The dog was tilted to the left side to remove the right ovary in the same modality as the resection of the left ovarian pedicle was performed. Complete resection was verified after removal of both ovaries. The trocars and the telescope were withdrawn and the pressure of the abdominal cavity was removed through the port.

The incisions were closed in two layers using 2/0 or 3/0 Vicryl Polyglactin for a single simple interrupted suture.

Fig. 3 Two-hole laparoscopy
One-hole technique
For this technique only one port was necessary and a *Hopkins angled eyepiece* telescope 0° 10 mm diameter was used, which include the working channel. A skin incision 1-2 cm caudal of the umbilicus was performed exposing the linea alba and a 12 mm Trocar (Endopath Xcel Ethicon Endo-Surgery Inc.) was penetrated into the abdominal wall. Development of the pneumoperitoneum and resection of the ovarian pedicles was similarly to the two-hole technique as mentioned above. The single port was closed in two layers using the same suture material as described.

Fig. 4 One-hole laparoscopy
4.2.3 Statistical analysis

The statistical analysis was performed by analytical software SPSS for Windows 14.0. Mean value and standard deviation were calculated.

4.2.3.1 Unpaired t-test

Comparison of total surgical time between one-hole and two-hole laparoscopic ovariectomy, the distribution of weight and the influence and the ovarian pedicle bleeding on the time were measured by t-test. ($\alpha = 0.05$)

4.2.3.2 Chi2 test

Parameters as body condition score, ovarian ligament fat score, ovarian pedicle bleeding were evaluated with Chi$^2$-test.

4.2.3.3 Pearson Correlation Coefficient

With the Pearson Correlation Coefficient the correlation between weight, body condition score, ovarian ligament fat score and the time for each technique were measured.

A p-value of <0.05 was considered statistically significant.
Laparoscopic ovariectomy in female dogs

5 Results

This study represents a part of the collected data. The whole results will be published by Dr. Valentina Fiorbianco.

5.1 Signalment

A total number of 42 stray dogs were available for this study. Three patients were excluded, two due to hyperthermia (>39°) and one was pregnant. Twenty bitches underwent a one-hole laparoscopic ovariectomy and in 22 dogs the two-hole technique was performed. Per day, an average of $8.4 \pm 3.85$ dogs underwent laparoscopic ovariectomy.

5.1.1 Weight distribution

<table>
<thead>
<tr>
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<th>group 2</th>
</tr>
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<tbody>
<tr>
<td>number</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>weight (kg)</td>
<td>$16.98 \pm 7.04$</td>
<td>$18.95 \pm 6.8$</td>
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</table>

Tab. 3 Number and weight distribution, mean values + standard deviation

![Weight distribution between the groups (kg)](image)

The mean weight of dogs in Group 1 ($16.98 \pm 7.04$, range 7.5 - 33) kg was not significant compared with Group 2 ($18.95 \pm 6.8$, range 9 - 34.5) kg (FIORBIANCO, 2008, personal communication).
5.1.2 Body condition score

<table>
<thead>
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<th>BCS</th>
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<th>Group 2</th>
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<td>thin (BCS 1)</td>
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<td>9</td>
<td>14</td>
</tr>
<tr>
<td>underweight (BCS 2)</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>ideal (BCS 3)</td>
<td>7</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>overweight (BCS 4)</td>
<td>1</td>
<td>1</td>
<td>2</td>
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Tab. 4 Body condition score distribution between the groups

14 dogs were classified as thin, 10 as underweight, 14 patients as ideal and only 2 dogs were evaluated as overweight.
Laparoscopic ovariectomy in female dogs

5.2 One-hole LapOVE versus Two-hole LapOVE

5.2.1 Surgical time

The mean duration of surgery in Group 1 was 21:07 ± 6:15 (range 13:12 – 30:45) minutes and in Group 2 was the median length 19:19 ± 6:16 (range 11:18 – 32:34) minutes. Surgical time was influenced by the body condition score (Group 1 p=0.024 and Group 2 p=0.037), which was related to the amount of fat of the ovarian pedicle in both groups (Group 1 p=0.041 and Group 2 p=0.008). This fact prolonged the duration of surgery (p=0.013) and also the resection of both ovaries independent from the technique (right ovary p=0.034 and left ovary p=0.017).

5.2.2 Surgical complications

In three cases (Group 1) and four cases (Group 2) moderate bleeding occurred during transection of the ligament. There was no need to convert to open surgery due to moderate bleeding, which was self-limiting or controlled by second application of the sealer/divider device.

Spleen injury took place in four cases after trocar insertion. The bleeding was moderate and did not require any treatment. Abnormalities of the ovaries were detected in three patients. Two dogs showed ovarian cysts on the left side and in one dog both ovaries were affected that were emptied percutaneously before resection was performed.

5.2.3 Surgeons

All surgical procedures were performed by the same surgeons. The complete resection of the left ovary was done by an expert surgeon and for the ovariectomy at right side surgeon X or Y was responsible.
6 Discussion

6.1 Minimally invasive technique

Minimally invasive surgery is an inherent part in human medicine since more than 20 years (WENKEL et al., 2005). Because of its numerous advantages laparoscopic procedure has become more widespread in veterinary medicine and laparoscopic ovariectomy is an alternative to traditional midline OVE (AUSTIN et al., 2003).

This study allowed the comparison between one-hole and two-hole ovariectomy using LigaSure (Tyco Healthcare, Valleylab), a vessel sealer/divider device and has shown that one-hole technique is feasible in canine laparoscopic ovariectomy. A variety of methods for laparoscopic neutering with a different number of portals have been described in veterinary medicine (MAYHEW and BROWN, 2007). Previously reported laparoscopic techniques were performed trough 3 or more ports to allow passage of endosurgical instruments. In this study one midline port was used for the one-hole technique, which was already performed by NUDELMANN (1997) and DEVITT et al. (2005). The need for additional portals and surgical assistant could be reduced using the operative laparoscope and a transabdominal suspension suture (DEVITT et al., 2005). The advantage of the operative laparoscope (Hopkins 0° 10 mm) was the working channel, which is integrated in the laparoscope. This eliminated the need of a second trocar for an endosurgical grasper or retractor. An additional grasping forceps was not necessary due to suspension suture, which maintain exposure of the ovarian pedicle. A further benefit was that the transabdominal suspension suture prevented the loss of the ovaries during extraction (DEVITT et al., 2005; FIORBIANCO, 2008, personal communication).

Inadvertent motion could be reduced with the one-hole technique because it is only possible to work in the same plane and direction, which ensures greater control of the instrument. A limited factor compared with the two-hole technique is the restricted degree of motion with the working instrument. Reduction of the number of channels minimizes pain and morbidity and decreases soft tissue trauma and improves cosmetic appearance. Both techniques have been shown to be safe and
Laparoscopic ovariectomy in female dogs

efficient. There was no case, which required conversion to traditional midline ova-
riectomy (FIORBIANCO, 2008, personal communication).

6.2 Pedicle haemostasis

We used the vessel-sealing device (LigaSure) in our study to achieve haemostasis
of the ovarian pedicle and for resection of the ovarian ligaments during laparo-
scopic ovariectomy (HAND et al., 2002). LigaSure is applied in open and minimal
invasive general surgery. It is used for anal, colorectal, hernia repair, esophago-
gastric, antireflux, splenic, hepatic and endocrine surgery in human medicine
(RIEGLER and CONSENTINI, 2004).

This haemostatic system is based on the combination of pressure and bipolar
electrical energy (HEFNI et al., 2005). It is a feedback-controlled bipolar vessel-
sealing device, which sense the electrical resistance of the tissue and delivers an
appropriate amount of energy to seal the vessel. This device is able to seal ves-
sels with a diameter up to 7 mm (HAND et al., 2002; RIEGLER and CONSENTINI,
2004).

The advantage of the vessel-sealing device compared with other haemostatic
techniques is the minimal thermal widespread to surrounding tissue. Due to less
thermal injury at the surgical site postoperative pain can be reduced. Thermal
widespread was recognized within 0.5 to 2 mm of adjacent tissue, which is compa-
rable with ultrasonic device that creates an injury up to 1.5 mm deep. Monopolar
and bipolar electrosurgery causes deeper thermal injury (CHUNG and WU, 2003).
Further benefits are that no remaining foreign material exists and no surgical dis-
section before application is necessary if sealing device is the method of choice
(HAND et al., 2002). Surgical time can be reduced by using LigaSure due to its
multiple function including grasping, cauterization and transection, which avoid
exchange of instruments (DEVITT et al., 2005).

LigaSure is a single-use disposable instrument. To reduce expenses we reused
the instrument after sterilization. Some technical problems were recognized in the
last cases, which could be related to the fact that the instrument was damaged
Laparoscopic ovariectomy in female dogs

during resterilization or during previous use. In the past LigaSure device were resterilized and used several times without any problems (HAND et al., 2002). Minimal smoke was recognized during ovarian pedicle haemostasis but didn’t reduce the visibility of abdominal structures. No further ligating and transection device was necessary to secure haemostasis. Due to the minimal thermal widespread and a quick drop of temperature a few seconds after stopping the energy delivery, LigaSure can be useful if laparoscopic procedures were performed by non-trained surgeons. LigaSure is a quick and safe method to achieve haemostasis during laparoscopic ovariectomy in dogs (FIORBIANCO, 2008, personal communication).

6.3 Surgical time

In this study no significant difference in total surgical time could be identified between one-hole and two-hole technique. In two surgical phases significant difference could be detected. In the two-hole group duration of the exploration of the abdominal cavity was extended, which is consistent with the required time for second trocar insertion. The second stage with difference between both groups in surgical time was the resection of the right ovary that took almost three minutes more in the one-hole group. This could be related to the fact that three different surgeons with different experience were involved in this phase. The resection of the left ovary was performed by the same surgeon, who had already experience in laparoscopic surgeries (FIORBIANCO, 2008, personal communication).

In both groups duration of surgery didn’t take longer than 33 minutes (from Veress-needle insertion to resection of the second ovary) in all cases. This demonstrates that one-hole and two-hole laparoscopic ovariectomy can be performed in a relative short time without increasing the anaesthetic risk. Both procedures are comparable with other laparoscopic OVE and OHE techniques. In contrast to previously reported studies, which rejected laparoscopic surgery because of its prolonged duration of surgery compared with traditional midline ovariectomy, we observed that surgical time could be compatible (VAN GOETHEM et al., 2003; FIORBIANCO, 2008, personal communication).

The duration of resection of the ovaries, in our study, was influenced by the surgeon and by the body condition score, which was related to the amount of fat of
Laparoscopic ovariectomy in female dogs

The ovarian pedicle in both groups. The study by Van Nimwegen has also described the fat score, which prolonged surgical time during resection. The amount of fat influenced significantly the surgical time because of the thickness of the tissue to grasp and severity to detect the vessels. These facts increased the surgical time and also the resection of both ovaries independent from the technique. Another factor, which influenced the surgical times, was the body weight in both groups. The mean body weight in group 1 was 16.98 kg and ranged from 7 kg to 33 kg. The use of the operative laparoscope for patients with less than 7 kg represents a potential limitation because of its excessive diameter. Therefore the application of the two-hole technique is recommended. If the body weight is more than 33 kg the length of the instrument, that can be inserted through the working channel, could be a limiting factor because it is 37 cm long with a 5 mm working channel.

The results were significantly influenced by the position of the patients and by the vessel sealing device. All dogs were positioned in lateral recumbency, which allowed improved visualization of the ovary. This fact facilitates the work for non-trained surgeons during laparoscopic surgery and has shown that this position could be performed without mechanical tables.

6.4 Complications

Most common complications in laparoscopic surgery are related to pneumoperitoneum, haemorrhage, organ perforation and thermal injuries from cauterization. Majority of these complications occur during the early learning phase of laparoscopy (FREEMAN, 1999).

Increased risk of intra-abdominal injury can be related to blind puncture with Veress-needle. The new method of Veress-needle insertion as mentioned above minimizes the risk of splenic injury. In our study four cases of spleen injury occurred during trocar placement. The bleeding was moderate and did not require any treatment. No conversion to traditional midline OVE was necessary. We recognized moderate bleeding during transection of the ligament at a similar frequency in both groups. The bleeding was self-limiting or controlled by second application of the vessel-sealing device.
Suspension sutures used in laparoscopic assisted technique as described by Devitt et al can bring the transected tissue too close to adjacent structures, which results in collateral injury. To avoid this complication, the tissue must be retracted from the abdominal wall during cauterization (DEVITT et al 2005). Due to minimal thermal widespread of LigaSure as mentioned above this complication could not be recognized in our study. Two dogs showed ovarian cysts on the left side and in one dog both ovaries were affected that were emptied percutaneously before resection was performed.

6.5 Scheduling of the project

This study was supported by the companies Storz, Tyco and Vetoquinol. The surgical equipment such as the endoscopic tower, laparoscopic instruments and the LigaSure generator were sponsored and also the shipping of the equipment to Turkey was provided by the respective companies. The allocation of the equipment at the University of Samsun has enabled to perform the project in Turkey. In general it is very important to get support from special companies to perform such a project and on the other hand the companies obtain a good presentation of their products after publication of these studies.
7 Summary

Minimally invasive surgery has numerous advantages such as less postoperative pain, improved recovery and shorter hospitalization and is an alternative to traditional midline ovariectomy. Many studies have analysed the complications of laparoscopy, duration of surgery and postoperative pain.

A collaboration with the University of Samsun was organized to demonstrate the comparison of one-hole versus two-hole laparoscopic ovariectomy with a vessel sealing device (LigaSure). A number of 42 female intact dogs were included in this project. This study enrolled two non-trained surgical assistants from the Ondokuz Mayis University, who were responsible for the resection of the right ovary. The left side was done by the same experienced surgeon. The dogs were randomized and divided in two groups.

This study has demonstrated that one-hole technique is feasible in canine laparoscopic ovariectomy. Both techniques have shown comparable efficacy. Due to the reduced number of portals in both techniques, especially in the one-hole technique, compared with standard procedures, less surgical trauma of the abdominal wall, as well as improved cosmetic results could be provided. The operating laparoscope, which was used during the one-hole technique, eliminated a second assistant. Inadvertent motion could be reduced with the one-hole technique because it is only possible to work in the same plane and direction. A disadvantage of this technique is the restricted degree of motion with the working instrument compared with the two-hole laparoscopy. There was no case, which required conversion to open procedure or from one-hole to two-hole laparoscopic ovariectomy (FIORBIANCO, 2008, personal communication).

In this study no significant difference in total surgical time and duration was recognized. The duration of abdominal exploration was extended in the two-hole technique, which consistent with the required time for second trocar insertion. Differences between both groups in surgical time were identified during resection of the right ovary in the one-hole group that took almost three minutes more. This could be related to the fact that three different surgeons with different experience were enrolled in this phase. In all cases 33 minutes were required from Veress needle
insertion to the removal of the second ovary from the abdominal cavity, independent from the experience of the surgeon. This demonstrated that one-hole and two-hole technique can be performed in a relative short time without increasing the anaesthetic risk and is comparable with other laparoscopic OVE and OHE techniques (FIORBIANCO, 2008, personal communication).

The duration of resection of the ovaries was influenced by the body condition score, which was related to the amount of fat of the ovarian pedicle in both groups. The amount of fat influenced significantly the surgical time because of the thickness of the tissue to grasp and severity to detect the vessels. Another factor, which affected surgical times, was the body weight in both groups. The use of the operative laparoscope for patients with less than 7 kg represents a potential limitation because of its excessive diameter. If the body weight is more than 33 kg the length of the instrument could be a limiting factor as it is 37 cm long with a 5 mm working channel (FIORBIANCO, 2008, personal communication).

To achieve pedicle haemostasis and resection of the ovarian ligaments a vessel-sealing device (LigaSure) was applied. LigaSure is a safe and quick method and is able to seal vessels with a diameter up to 7 mm. Due to the minimal thermal widespread and the reduced risk of tissue burning, LigaSure could be useful if laparoscopic procedures were performed by non-trained surgeon. No severe complication occurred during surgery. Moderate bleeding could be controlled by second application of the vessel-sealing device or was self-limiting. This study demonstrated that one-hole laparoscopy is a valid alternative to conventional laparoscopic ovariectomy in dogs (FIORBIANCO, 2008, personal communication).
Zusammenfassung

Zahlreiche Vorteile, wie geringerer postoperativer Schmerz, raschere Rekonvaleszenz und kürzere Aufenthaltsdauer, werden in der minimal invasiven Chirurgie beschrieben, und stellen somit eine Alternative zur traditionellen Ovariectomie dar. In vielen Studien wurden die Komplikationen der Laparoskopie, die Operationsdauer und der postoperative Schmerz evaluiert.


Die Studie hat keinen signifikanten Unterschied in der Operationsdauer zwischen beiden Gruppen gezeigt. Die Dauer der Bauchhöhlenexploration war in der Zweiloch-Technik verlängert, was mit der Platzierung des zweiten Trokars zusamment-
Laparoscopic ovariektomy in female dogs

8 Annex

8.1 List of figures

Fig. 1 Anatomy of the reproductive female tract .................................................. - 6 -
Fig. 2 Involved people and companies ................................................................. - 17 -
Fig. 3 Two-hole laparoscopy ................................................................. - 23 -
Fig. 4 One-hole laparoscopy ................................................................. - 24 -
Fig. 5 Weight distribution between the groups (kg) ............................................. - 26 -
Fig. 6 Body condition score distribution – group 2 ............................................. - 27 -

8.2 List of tables

Tab. 1 Patients included in the study ................................................................. - 19 -
Tab. 2 Equipment ............................................................................................... - 20 -
Tab. 3 Number and weight distribution, mean values + standard deviation ....... - 26 -
Tab. 4 Body condition score distribution between the groups ........................... - 27 -
Tab. 5 Body condition score distribution – group 1 ............................................. - 27 -

8.3 List of abbreviations

VUW Veterinärmedizinische Universität Wien
OHE ovariohysterectomy
OVE Ovariectomy
CEH cystic endometrial hyperplasia
PDA patent ductus ateriosus
PRRA persistent right aortic arch
9 References


CHAMNESS Ch. J. (2005), Introduction to veterinary endoscopy and endoscopic instrumentation In: McCarthy Timothy C. (Ed.), Veterinary endoscopy for the small animal practitioner, Elsevier Saunders, St. Louis, 1-20


DEVITT Ch. M., COX R. E., HAILEY J. J. (2005), Duration, complications, stress, and pain of open ovariohysterectomy versus a simple method of laparoscopic-assisted ovariohysterectomy in dogs. JAVMA 227:921-927


FOSSUM Th., HEDLUND Ch. (2007), Surgery of the reproductive and genital systems. In: Fossum Th. (Ed.), Small animal surgery, Elsevier Mosby, St. Louis, 702-714
Laparoscopic ovariectionomy in female dogs

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<th>Authors</th>
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<tr>
<td>FREEMAN Lynetta J.</td>
<td>1999</td>
<td>Operating room, setup, equipment, and instrumentation</td>
<td>In: Freeman Lynetta J. (Ed.), Veterinary Endosurgery, Mosby, London, 3-23</td>
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<tr>
<td>HANCOCK R. B., LANZ O. I., WALDRON D. R.</td>
<td>2005</td>
<td>Comparison of post-operative pain following ovariohysterectomy via harmonic scalpel-assisted laparoscopy compared with median celiotomy and ligation in dogs</td>
<td>Vetsurgery 34:273-282</td>
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<tr>
<td>HAND R., RAKESTRAW P., TAYLOR T.</td>
<td>2002</td>
<td>Evaluation of a vessel-sealing device for use in laparoscopic ovariectionomy in mares</td>
<td>Veterinary surgery 31:240-244</td>
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<td>HEFNI M., BHAUMIK J., EL-TOUKHY T., KHO P., WONG I., ABDEL-RAZIK T., DAVIES A.</td>
<td>2005</td>
<td>Safety and efficacy of using the LigaSure vessel sealing system for securing the pedicles in vaginal hysterectomy: randomised controlled trial</td>
<td>BJOG 112:329-333</td>
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<td>HOWE Lisa M.</td>
<td>2006</td>
<td>Surgical methods of contraception and sterilization</td>
<td>Theriogenology 66:500-509</td>
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Laparoscopic ovariectomy in female dogs

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<td>MAYHEW Philipp D., BROWN Dorothy C. (2007)</td>
<td>Comparison of three techniques for ovarian pedicle haemostasis during laparoscopic-assisted ovariohysterectomy</td>
<td>Veterinary surgery</td>
<td>36:541-547</td>
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Laparoscopic ovariectomy in female dogs

**VAN GOETHEM** Bart E., **SCHAEFERS-OKKENS** A., **KIRPENSTEIJN** J. (2006), Making a rational choice between ovariectomy and ovariohysterectomy in the dog: a discussion of the benefits of either technique. Veterinary surgery 35:136-143

**VAN NIMWEGEN** S., **VAN SWOL** Ch., **KIRPENSTEIJN** J. (2005), Neodymium: Yttrium aluminum garnet surgical laser versus bipolar electrocoagulation for laparoscopic ovariectomy in dogs. Veterinary Surgery 34:353-357

**WENKEL** R., **ZIEMANN** U., **THIELEBEIN** J., **PRANGE** H. (2005), Laparoskopische Kastration der Hündin – Darstellung neuer Verfahren zur minimalen invasiven Ovariohysterektomie. Tierärztl. Prax. 33(K):177-88
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