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# Laparoscopic or traditional bitch spay? A comparison of surgical technique, associated risks and benefits

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ABSTRACT: In the bitch, surgical sterilisation can be achieved by a number of different methods. Ovariohysterectomy via a midline coeliotomy is the method traditionally used in the UK. An alternative to ovariohysterectomy, which is being used more widely, is laparoscopic ovariectomy (LapOVE). Laparoscopic surgery involves the introduction of a camera and specialised instruments into the abdomen through small incisions, and is routinely used in human medicine.

The benefits of laparoscopy include a faster return to normal activity and decreased post-operative pain, as well as a lower risk of haemorrhage and other recognised complications. Some complications, such as gas embolism and increased arterial $CO_2$ levels, are specific to laparoscopy.

Laparoscopy requires specialist equipment which carries a high start-up cost; this can deter many practitioners from offering it to their clients. In addition, significant increases in surgical time are documented with LapOVE.

Due to the risk of complications and the specialist equipment required, it is imperative that veterinary nurses have complete and up-to-date knowledge regarding laparoscopic neutering in order to provide the best possible patient care.

Keywords: neutering; spay; keyhole; minimally invasive surgery; ovariohysterectomy; ovariectomy; gonadectomy; sterilisation; nursing

## Introduction

Neutering of dogs and cats is one of the most frequently performed procedures in veterinary practice. Several surgical techniques are available for use in the bitch, including ovariohysterectomy or ovariectomy via midline coeliotomy, lateral flank ovariohysterectomy, laparoscopic ovariectomy or ovariohysterectomy, where the ovaries/uterus are located, ligated and removed entirely via laparoscopy, and laparoscopy-assisted ovariohysterectomy, where the uterus is visualised and grasped via laparoscopy, and the laparoscopy incision extended to ligate and remove the uterus in the traditional manner, (Howe, 2006; Giraldez & Bowlt, 2013).

Ovariohysterectomy via a midline coeliotomy is traditionally performed in the UK, predominantly for historic reasons (White, 1998). However, the last ten years have seen minimally invasive surgical techniques become increasingly common in veterinary medicine. Routinely used in human medicine over the last 30 years, laparoscopy is now considered the standard for many surgical procedures involving body cavities (Grushka & Ginzburg, 2014).

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The advantages of minimally invasive surgery are documented across human and veterinary medicine, and include reduced surgical trauma, decreased post-operative pain, faster recovery and reduced length of hospitalisation (Jones & Soper, 1994; Culp, Mayhew & Brown, 2009). Several studies have examined post-operative pain levels in dogs undergoing laparoscopic ovariectomy, but limited data is available on post-operative activity levels, with only one published study, performed on small-breed dogs (Culp, Mayhew & Brown, 2009).

This article aims to review current literature in order to assess current thinking on sterilisation methods in the bitch. As OVH is performed in the UK, rather than open ovariectomy, limited evidence comparing ovariectomy to LapOVE is available. Therefore, this article will focus on the two main options available to UK clients - OVH and LapOVE.

## Why neuter?

The British Veterinary Association (BVA) (2014) recommends neutering as a means of population control and to reduce the incidence of genetic deformities. In addition, several welfare benefits are apparent including:

- inhibition of the oestrus cycle and associated conditions, such as pseudopregnancy
- prevention of uterine carcinoma and pyometra
- a reduced risk of mammary carcinoma
- prevention of undesirable behaviour

(BSAVA, 2014)

According to the Royal College of Veterinary Surgeons (RCVS, 2014), a veterinary nurse must make animal health and welfare their utmost priority, and provide honest and impartial advice to clients. It also states that nurses should promote animal welfare and responsible pet ownership (RCVS, 2014).Therefore advising and promoting neutering may feature in the nurse's role and in order to provide honest and relevant advice nurses must have an up-to-date knowledge of the various surgical options available.

## Traditional ovariohysterectomy

### Technique

Traditionally, neutering has been performed either by ovariohysterectomy or ovariectomy. In the UK, ovariohysterectomy is considered the procedure of choice for neutering, largely for historical reasons (White, 1998).

Both procedures are performed via a ventral midline coeliotomy. In an ovariohysterectomy (**Figure 1**) the uterine horns and ovaries are located, exteriorised, ligated and transected at the level of the ovarian pedicle (Danova, Schmiedt & Bjorling, 2005). The uterine body is ligated and transected cranially to the cervix, before the abdomen is closed routinely (Danova et al. 2005).

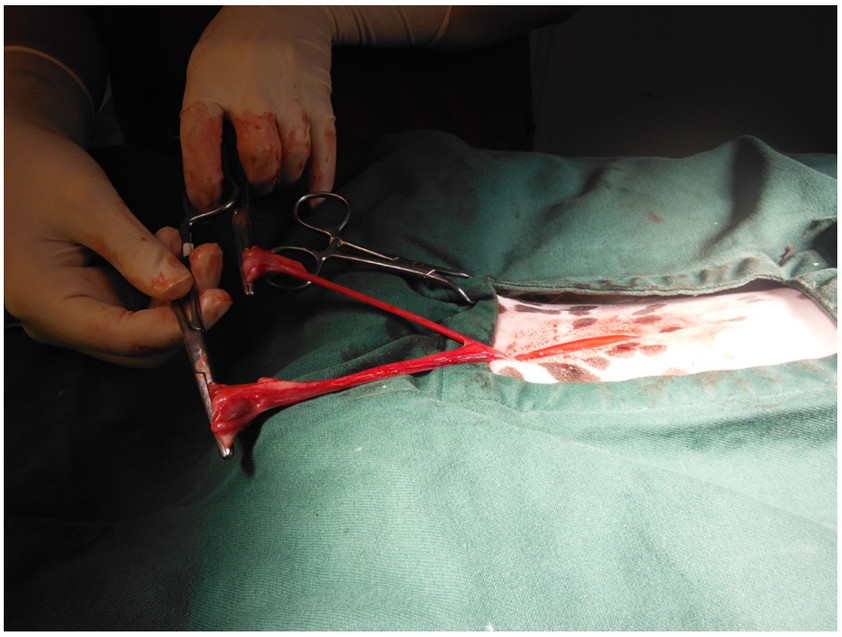

**Figure 1:** Ovariohysterectomy

### Advantages

Ovariohysterectomy requires no specialist equipment, has no expensive start-up costs and requires no additional staff training. It is a significantly shorter procedure; reported surgical times have been up to 51 minutes shorter than LapOVE (Craven, 2012; Davidson, Moll & Payton, 2004).

### Disadvantages

Increased post-operative pain has been widely reported in ovariohysterectomy when compared with LapOVE. A study by Devitt, Cox and Hailey (2005) found significantly higher pain scores (P=0.001) and blood glucose concentrations at 1, 2, 4 and 6 hours (P=0.05) post-operatively in those undergoing traditional ovariohysterectomy. In the ovariohysterectomy group, serum cortisol concentrations were significantly higher than pre-operative levels (P=0.05) at 1 and 2 hours post-extubation, compared with no significant increase in the laparoscopic group. Nine of the ten dogs undergoing traditional ovariohysterectomy required additional post-operative morphine, whereas none in the laparoscopic group required additional analgesia (Devitt et al., 2005).

Recent studies have examined ovariohysterectomy and ovariectomy in order to determine which procedure carries fewer complications. It was concluded that ovariohysterectomy carried higher risk of haemorrhage, distal ureter ligation and stump pyometra/stump granuloma than LapOVE, due to reduced surgical visibility (Van Goethem, Schaefers-Okkens & Kirpensteijn, 2006; Nelissen, 2010).

Davidson, Moll and Payton (2004) compared pain levels, post-operative complications and surgical duration between ovariohysterectomy and LapOVE. Complications reported in those undergoing ovariohysterectomy included haemorrhage (requiring repeat surgery), abdominal-wall dehiscence and seroma formation. Culp et al., (2009) also reported minor peri-operative bleeding in six ovariohysterectomy dogs in their study, compared with three undergoing LapOVE (N = 20 in two groups).

## Laparoscopic neutering

As laparoscopic procedures have become commonplace in human medicine, awareness of their use has increased amongst the general public. Pet owners are now


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**Figure 2:** Laparoscopy tower – top to bottom: $CO_2$ insufflator, camera, light source

**Figure 3:** Veress needle (L) and trocar (R)

expecting these minimally invasive techniques to be an option for their animals, having seen human patients benefit from them (Howe, 2006).

## Technique

Specialised equipment is required for laparoscopic procedures. A tower containing a camera, light source, insufflator unit (used to inflate the abdominal cavity) and screen are required for all procedures. Instruments including trocars (to create a portal through which instruments and the rigid scope are passed) and long instruments (such as forceps, scissors and probes) are used to perform the surgery.

The patient is positioned in the Trendelenburg position (ventro-dorsal recumbency with the pelvis raised by 30°) to allow better visualisation of the uterus (Giraldez & Bowlt, 2013). The fur is clipped and scrubbed as for an ovariohysterectomy but the clip extends further laterally, to allow the spay hook to be placed.

To provide a working space within the abdomen it must be inflated. This is achieved using a mechanical insufflator unit (**Figure 2**) and carbon dioxide ($CO_2$) at a pressure of 10-12mmHg (Giraldez & Bowlt, 2013). Pneumoperitoneum is created by inserting a Veress needle (**Figure 3**) into the abdomen using a blind technique, and attaching the $CO_2$ supply. The blind insertion technique carries a risk of visceral puncture; this is reduced by using the hanging drop technique, where a small drop of sterile fluid is placed over the top of the veress needle. When the needle enters the abdominal cavity, the fluid drop is automatically sucked into the abdomen (Giraldez & Bowlt, 2013).

A number of portals are then created by the insertion of trocars (**Figure 3**) into the abdomen. The first is inserted at, or cranial to, the umbilicus and the second between the pubis and umbilicus (Giraldez & Bowlt, 2013). In some laparoscopic techniques a third portal is placed cranial to the umbilicus. The $CO_2$ supply is then moved to the central trochar and the Veress needle is removed. The laparoscope is introduced through the central trochar (**Figure 4**).

The uterine horn and ovary are visualised and secured using grasping forceps (**Figure 5**). The ovary is manoeuvred towards the abdominal wall, where it is secured percutaneously using a spay hook (**Figure 5**). The suspensory and proper ligaments are sealed using

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**Figure 4:** LapOVE. The laparoscope enters the abdomen via the caudal trocar in this case. A spay hook secures the right ovary whilst it is transected using bipolar electrocautery and cutting forceps (cranial trocar)

**Figure 5:** Spay hook (top), grasping forceps (middle) and electrocautery forceps (bottom)

electrocoagulation (**Figure 6**), a harmonic scalpel or suture loops (Giraldez & Bowlt, 2013). The ovary is transected using laparoscopic scissors or a specific sealing and cutting device, before the ovary is removed through one of the ports (Giraldez & Bowlt, 2013). The procedure is repeated for the other ovary before the $CO_2$ is evacuated and each portal incision closed routinely (Giraldez & Bowlt, 2013).

## Advantages

Craven (2012) found that LapOVE produced a significantly shorter recovery time (mean 32.25 minutes), when compared with traditional ovariohysterectomy (mean 79.44 minutes). Significantly lower subjective and objective pain scores (examining posture, facial expression, heart rate, respiratory rate, pupil size, salivation and reaction to palpation) have been reported in small breeds undergoing laparoscopic-assisted ovariohysterectomy, compared with traditional ovariohysterectomy (Davidson et al., 2004).

Significantly lower pain scores, plasma cortisol levels, plasma glucose levels and plasma creatine phosphokinase levels have been reported in medium-breed dogs undergoing LapOVE (Hancock, Hanz, Waldron, Duncan, Broadstone & Hendrix, 2005). Pain scores were significantly lower (P=0.0001) at 2, 6, 12, 48 and 72 hours post operatively in those individuals undergoing LapOVE. In addition, the LapOVE group tolerated significantly greater pressure being placed on the abdomen during palpation (measured using a sphygmomanometer) than the ovariohysterectomy group at 2, 6, 12 and 48 hours post-operatively (P=0.0002) (Hancock et al., 2005).

A higher level of post-operative activity level has been reported in small dogs undergoing LapOVE. Culp et al., (2009) reported a 25% decrease in activity level with LapOVE (confidence interval 95%, range 11–38%), compared with a 62% decrease in activity level with open ovariectomy (confidence interval 95%, range 48–75%) (**Figure 7**).

## Disadvantages

Specialist equipment is required for laparoscopic procedures. The initial cost of this is high, which can deter many practitioners from offering LapOVE to their clients (Giraldez & Bowlt, 2013). The surgical technique can take time to master; the learning curve associated with laparoscopic techniques is steep (Giraldez & Bowlt, 2013).

Additional members of staff are required for LapOVE, including a surgeon, scrubbed assistant and anaesthetist (Davidson et al., 2004). The author has found that a circulating nurse is also of benefit in laparoscopic procedures, as the large amount of equipment required takes time to set up, and this can have an impact on patient monitoring.

Craven (2012) reports that the length of surgery (including preparation time) is significantly higher for LapOVE, with a mean of 81.2 minutes, compared with 62.8 minutes for traditional ovariohysterectomy. However, no significant differences in the length of surgery excluding preparation time were found (mean 36.25 minutes for LapOVE, compared with 38.95 minutes for ovariohysterectomy) (Craven, 2012). Culp et al., (2009) note median surgical times of 30 minutes for LapOVE, significantly longer than traditional ovariohysterectomy (21 minutes; P=0.05). It is reported that once the technique has been mastered, the duration of surgery can reduce to 15–20 minutes (Giraldez & Bowlt, 2013).

## Complications

Several complications of LapOVE have been reported. The most severe of these is gas embolism, which occurs when $CO_2$ enters the vascular space during surgery. In order to prevent this, the insufflator pressure should be set to a maximum of 12–15mmHg (Giraldez & Bowlt, 2013; Freeman, 2012).


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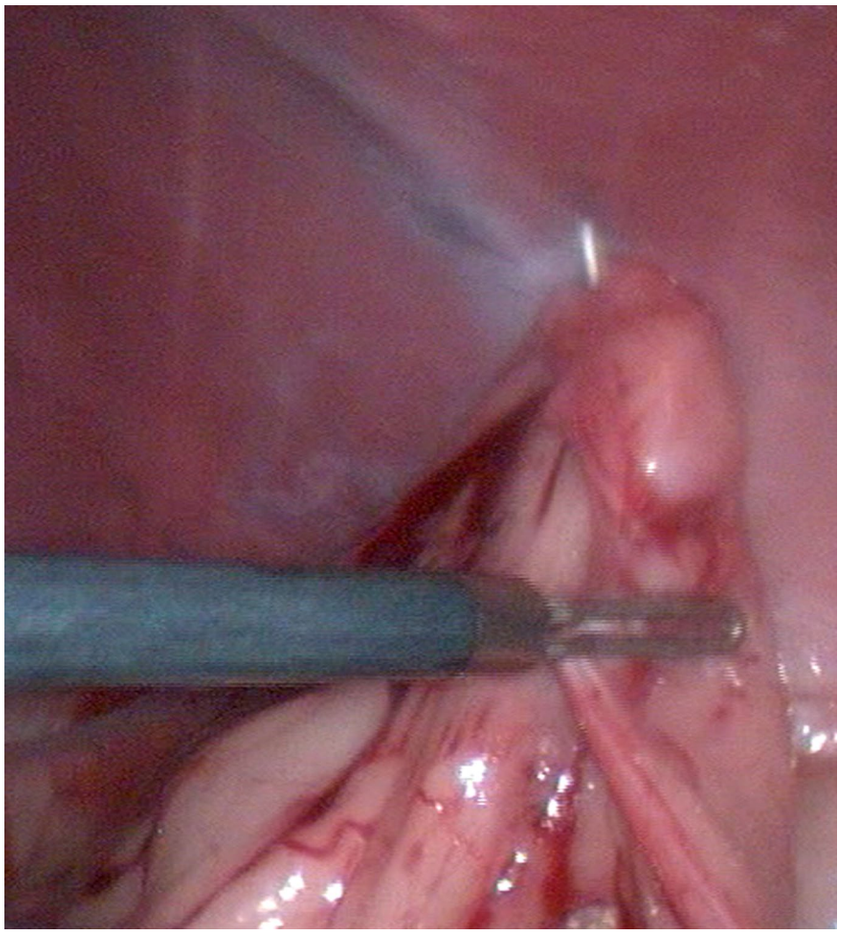

**Figure 6:** Ovariectomy using electrocoagulation forceps

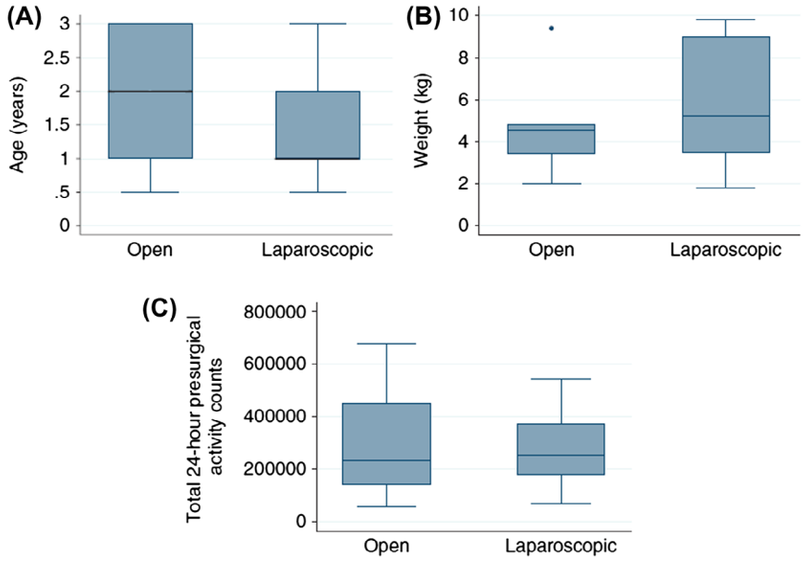


**Figure 7:** A comparison of post-surgical activity levels (Source: Culp et al., 2009)

Increased abdominal pressure (due to inflation) results in reduced tidal volume and increased airway resistance (Freeman, 2012; Giraldez & Bowlt, 2013), and assisted ventilation may be required in these cases. In addition, $CO_2$ is absorbed across the peritoneum, leading to increased arterial $CO_2$ levels (Freeman, 2012). To reduce these risks, careful anaesthetic monitoring is warranted, including:

- pulse oximetry
- capnography
- blood gas analysis
- electrocardiography
- blood-pressure monitoring

(Freeman, 2012: Giraldez &Bowlt, 2013)

## Conclusion

A review of the existing research into laparoscopic neutering would appear to indicate that LapOVE results in lower post-operative pain levels than traditional ovariohysterectomy. However, with the advantage of reduced surgical time and no extra equipment or staff being required, ovariohysterectomy is still a valid option for neutering.

The ultimate decision regarding neutering options will be the owner's to make. This must be an informed decision, made alongside veterinary guidance. In line with the RCVS code of professional conduct, veterinary nurses must provide honest and relevant advice to their clients. As veterinary nurses play a key role in owner education and advice, they must be aware of the various surgical options available in practice.

Nurses in practices that offer laparoscopic neutering must be aware of the different requirements in equipment and patient preparation, as well as additional anaesthetic monitoring and procedure-specific complications, in order to maintain patient wellbeing throughout surgery and in recovery.

As minimally invasive surgery is still fairly new to veterinary medicine, further research into laparoscopic techniques is warranted. Comparing LapOVE and ovariohysterectomy both peri-operatively and post-operatively may provide a better overview of which technique most benefits the patient overall.

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## Multiple Choice Questions

**1. Traditional ovariohysterectomy is normally performed via which of the following incisions?**

(a) Flank laparotomy

(b) Ventral midline coeliotomy

(c) Lateral coeliotomy

(d) Median sternotomy

**2. Which of the following is a disadvantage of routine ovariohysterectomy compared with laparoscopic ovariectomy?**

(a) Higher risk of haemorrhage

(b) Shorter procedure times

(c) No specialist equipment required

(d) Lower pain scores observed post-operatively

**3. Which of the following may be a more likely complication of laparoscopic ovariectomy when compared with traditional ovariohysterectomy?**

(a) Air embolism

(b) Haemorrhage

(c) Reduced surgical visibility

(d) Distal ureter ligation

**4. Laparoscopic ovariectomy is associated with lower pain score postoperatively than routine ovariohysterectomy:**

TRUE or FALSE

**5. Informed consent and the RCVS code of professional conduct means that advice given to owners regarding neutering should be up-to-date and include all surgical options available:**

TRUE or FALSE

**6. Which of the following is a disadvantage of laparoscopic ovariectomy compared with routine ovariohysterectomy?**

(a) Increased surgical visibility

(b) Increased haemorrhage

(c) Longer procedure times

(d) Higher levels of post-operative activity in the patients

**7. The 'Trendelenburg position' is which of the following?**

(a) Ventro-dorsal recumbency

(b) Ventro-dorsal recumbency with the pelvis raised by 30°

(c) Lateral recumbency

(d) Dorsal recumbency

**For the answers to the MCQs, please go to: http://www.bvna.org.uk/publications/veterinary-nursing-journal**



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