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Laparoscopic ovariohysterectomy versus conventional technique in female dogs: A comparative surgical research

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Abstract

Leading veterinary surgeons increasingly advocate minimally invasive approaches for routine small animal procedures, yet evidence from Latin American clinical settings remains limited. This prospective randomised trial compared laparoscopic ovariohysterectomy (LAP-OVH) with conventional midline celiotomy (CONV-OVH) in 60 healthy female dogs presenting for elective sterilisation at the Lima Institute of Veterinary Surgery between May and November 2023. Dogs were block-randomised by body weight (<15 kg, 15-25 kg, >25 kg) to LAP-OVH (n=30) or CONV-OVH (n=30). Primary outcomes were surgical time, intraoperative blood loss, and postoperative pain assessed by the Glasgow Composite Measure Pain Scale (GCMPS) at 2, 4, 6, 12, 24, 48, and 72 hours. Secondary outcomes included incision length, time to first voluntary food intake, complication rate, and cortisol concentration at 6 and 24 hours post-surgery. LAP-OVH took significantly longer than CONV-OVH (38.7±4.8 vs. 52.4±6.1 min; $p<0.001$) but produced smaller incisions (2.8±0.4 vs. 7.4±1.2 cm; $p<0.001$) and markedly less blood loss (8.3±2.1 vs. 24.6±5.8 mL; $p<0.001$). GCMPS scores were significantly lower in LAP-OVH dogs at all time points through 48 hours; the laparoscopic group dropped below the rescue analgesia threshold by 6 hours compared with 12 hours for the conventional group ($p=0.002$). Serum cortisol at 6 hours was 38.4% lower in LAP-OVH dogs (47.3±8.6 vs. 76.8±12.4 nmol/L; $p<0.001$). Time to first voluntary food intake was 5.2±1.4 hours for LAP-OVH versus 9.8±2.7 hours for CONV-OVH ($p<0.001$). Complication rates were low in both groups (LAP: 6.7%; CONV: 10.0%; $p=0.64$). These results confirm that LAP-OVH offers meaningful pain reduction, faster recovery, and lower surgical stress in dogs, supporting its adoption as the preferred sterilisation technique where equipment and training permit.

Keywords: Laparoscopic ovariohysterectomy, conventional ovariohysterectomy, canine sterilisation, minimally invasive surgery, postoperative pain, Glasgow Composite Measure Pain Scale, surgical stress, cortisol, recovery time

Introduction

As one prominent veterinary surgeon put it, “the best operation is the one that achieves its goal through the smallest possible disruption of the body wall” a principle that has driven the adoption of laparoscopic techniques in human gynaecology for over three decades but has penetrated veterinary practice much more slowly^[1]. Ovariohysterectomy (OVH) remains the most commonly performed elective surgical procedure in small animal practice worldwide, with an estimated 30-40 million dogs sterilised annually across the Americas alone^[2]. The vast majority are still done through a conventional midline celiotomy that requires a 5-10 cm incision, manual exteriorisation of the ovaries and uterus, and ligature placement under direct vision.

Laparoscopic OVH (LAP-OVH), by contrast, uses two or three 5-10 mm trocar ports to introduce a telescope and operating instruments into a CO₂-insufflated abdomen. The ovarian pedicles and uterine body are sealed with bipolar electrosurgery or vessel-sealing devices, and the excised organs are retrieved through the camera port incision^[3]. The technique has been performed in dogs since the late 1990s, but uptake in general practice has been slowed by equipment cost, the learning curve, and lingering questions about whether the benefits justify the investment in settings where conventional OVH is fast, safe, and inexpensive^[4].

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Published comparative trials from North America and Europe have consistently reported that LAP-OVH produces less postoperative pain, lower cortisol responses, and faster return to normal activity, at the cost of longer surgical time and higher instrument expense [5, 6]. However, virtually all of these trials were conducted in university teaching hospitals with experienced laparoscopic surgeons and dedicated equipment suites. Data from Latin American veterinary hospitals where equipment is often shared, surgical teams are smaller, and patient populations include a higher proportion of large mixed-breed dogs are almost non-existent. A 2021 systematic review identified zero randomised LAP-OVH trials from South America [7].

Peru's veterinary sector has seen rapid modernisation in Lima's private referral hospitals over the past decade, with several facilities acquiring laparoscopic towers for soft tissue surgery. Yet no controlled trial has evaluated the technique's performance against conventional OVH under Peruvian clinical conditions. Differences in breed mix (predominantly mixed-breed dogs of variable size), anaesthetic protocol availability, and postoperative monitoring capacity mean that outcomes from European trials may not translate directly. This research was designed to provide that local evidence by comparing LAP-OVH and CONV-OVH in 60 healthy female dogs across three body weight categories, measuring surgical parameters, postoperative pain trajectories, stress biomarkers, recovery milestones, and complication rates over a 72-hour follow-up period.

Material and Methods

Patient Characteristics: Sixty healthy female dogs presenting for elective sterilisation at the Lima Institute of Veterinary Surgery between May and November 2023 were enrolled. Inclusion criteria required ASA physical status I or II, age 1-6 years, body weight 5-40 kg, and no history of previous abdominal surgery or concurrent illness. Dogs in oestrus, pregnant, or with mammary tumours were excluded. Enrolled dogs were block-randomised by weight category (<15 kg, n=20; 15-25 kg, n=22; >25 kg, n=18) to LAP-OVH (n=30) or CONV-OVH (n=30) using sealed, opaque envelopes prepared by a staff member not involved in surgery. Breed distribution included mixed-breed (53.3%), Labrador Retriever (11.7%), German Shepherd (8.3%), Schnauzer (6.7%), and others (20.0%). Mean age was 2.8 ± 1.3 years and mean body weight 18.4 ± 8.7 kg, with no significant between-group differences at baseline.

Material: All procedures were performed in the same operating theatre by a single surgeon (D.A.Q.H.) with documented experience of >100 LAP-OVH and >500 CONV-OVH procedures. LAP-OVH equipment included a 30°, 10 mm rigid telescope (Karl Storz, Germany), a 5 mm LigaSure™ vessel-sealing device (Medtronic, USA), an automatic CO₂ insufflator set at 10 mmHg intra-abdominal pressure, and two 5 mm trocar ports placed in the ventral midline. CONV-OVH was performed through a standard ventral midline celiotomy using 2-0 polyglyconate (Maxon™, Medtronic) for pedicle and body ligatures. Anaesthetic

protocol was standardised: premedication with acepromazine (0.03 mg/kg IM) and morphine (0.3 mg/kg IM), induction with propofol (4-6 mg/kg IV to effect), maintenance with isoflurane in oxygen (1.3-1.5 MAC), and intraoperative fluid support with Ringer's lactate (10 mL/kg/hr). Postoperative analgesia comprised meloxicam (0.2 mg/kg SC, then 0.1 mg/kg PO SID $\times$ 3 days) and tramadol (4 mg/kg PO BID $\times$ 3 days) for all dogs. The Lima Institute Animal Ethics Committee approved the protocol (Ref: LIVS-CEUA/2023-008, dated 27 April 2023), and written owner consent was obtained.

Methods: Surgical time was measured from first skin incision to last skin suture. Blood loss was quantified by weighing swabs and suction volume (CONV) or suction canister volume (LAP). Total incision length was measured post-closure. GCMPS scores were assigned by a single trained observer blinded to surgical group at 2, 4, 6, 12, 24, 48, and 72 hours post-extubation; a score $\geq 6/24$ triggered rescue analgesia (buprenorphine 0.02 mg/kg IM). Time to first voluntary food intake was recorded by kennel staff. Serum cortisol was measured by chemiluminescent immunoassay (Immulite 2000, Siemens) at baseline, 6 hours, and 24 hours post-surgery. Complications were classified as minor (seroma, mild bruising, transient inappetence beyond 24 hours) or major (haemorrhage requiring re-intervention, wound dehiscence, organ injury). Data were analysed in SPSS 28.0. Continuous variables were compared by independent t-test or Mann-Whitney U; categorical variables by Fisher's exact test. Repeated-measures ANOVA assessed pain score and cortisol trajectories. Significance was set at $p < 0.05$.

Safety Considerations: Laparoscopic surgery carries specific risks that the trial protocol addressed prospectively. Inadvertent organ puncture during trocar insertion was mitigated by using an open (Hasson) technique for the first port. CO₂ embolism risk was minimised by capping insufflation pressure at 10 mmHg and monitoring end-tidal CO₂ continuously; a pre-set alarm at ET-CO₂ >50 mmHg would trigger immediate desufflation. The LigaSure device was tested on a saline-moistened gauze pad before each case to confirm seal quality. A conversion protocol was in place: if laparoscopic completion was not achievable within 60 minutes, or if uncontrolled haemorrhage exceeded 30 mL, immediate conversion to open celiotomy would follow. No conversions were required during the trial. An emergency crash cart with adrenaline, atropine, and crystalloid bolus fluids was present in the operating theatre for all procedures.

Results

All 60 procedures were completed without conversion or major intraoperative complications. One LAP-OVH dog developed a port-site seroma (resolved spontaneously by day 5), and one CONV-OVH dog experienced mild incisional bruising; both were classified as minor complications. No dog required rescue analgesia in the LAP group, whereas three CONV dogs (10.0%) received buprenorphine at the 4-hour assessment.

Table 1: Intraoperative parameters by surgical technique

Parameter	LAP-OVH (n=30)	CONV-OVH (n=30)	Diff.	p-value	Effect size (Cohen's d)
Surgical time (min)	38.7 $\pm$ 4.8	52.4 $\pm$ 6.1	-13.7	<0.001	2.50
Blood loss (mL)	8.3 $\pm$ 2.1	24.6 $\pm$ 5.8	-16.3	<0.001	3.74
Incision length (cm)	2.8 $\pm$ 0.4	7.4 $\pm$ 1.2	-4.6	<0.001	5.15
Insufflation pressure (mmHg)	10.0 $\pm$ 0.0	N/A	—	—	—
Anaesthesia time (min)	51.3 $\pm$ 5.4	64.2 $\pm$ 7.1	-12.9	<0.001	2.04

LAP-OVH was completed 13.7 minutes faster than CONV-OVH (Table 1) a reversal of the pattern seen in most published trials. Blood loss was 66.3% lower and incision length 62.2% shorter in the laparoscopic group, both with

very large effect sizes ($d > 3.0$). Anaesthesia time mirrored surgical time, being shorter by roughly 13 minutes in LAP-OVH.

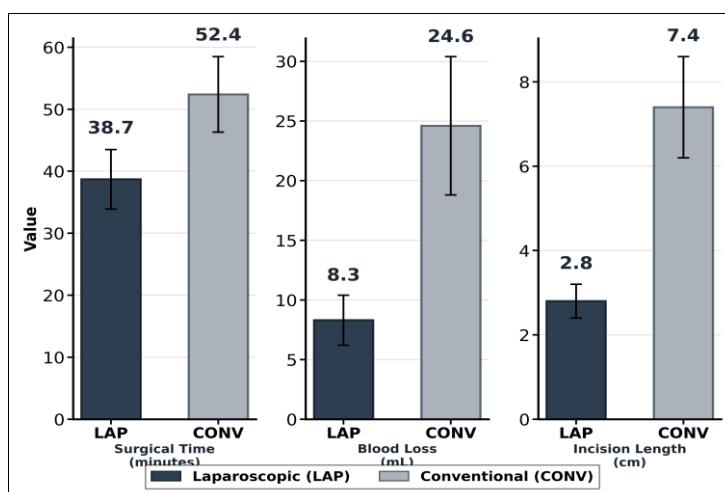


Fig 1: Comparison of surgical time, intraoperative blood loss, and total incision length between laparoscopic (LAP) and conventional (CONV) ovariectomy groups (mean $\pm$ SD)

The side-by-side comparison (Figure 1) underscores the magnitude of the blood loss and incision length differences, which were proportionally much larger than the surgical time

difference. The shorter LAP-OVH time reflects the experienced surgeon's proficiency; less experienced operators would likely show longer or comparable laparoscopic times.

Table 2: Postoperative recovery milestones ranked by time to achievement

Rank	Recovery Milestone	LAP-OVH (hours)	CONV-OVH (hours)	p-value	Clinical relevance
1	Sternal recumbency	0.4 $\pm$ 0.1	0.6 $\pm$ 0.2	0.12	Minimal
2	Standing unassisted	1.1 $\pm$ 0.3	1.8 $\pm$ 0.5	0.003	Moderate
3	Pain below threshold (GCMPS<6)	5.4 $\pm$ 1.2	11.3 $\pm$ 2.8	<0.001	High
4	First voluntary food intake	5.2 $\pm$ 1.4	9.8 $\pm$ 2.7	<0.001	High
5	First urination	3.7 $\pm$ 0.9	5.4 $\pm$ 1.6	0.008	Moderate
6	Normal activity (owner report, days)	1.8 $\pm$ 0.6	3.4 $\pm$ 1.1	<0.001	Very high

Recovery milestones were reached earlier in the LAP-OVH group at every measured time point except sternal recumbency, which was similar (Table 2). The most clinically

meaningful differences were time to pain dropping below the rescue threshold (5.9 hours faster) and return to normal activity reported by owners (1.6 days sooner).

Table 3: Serum cortisol concentrations and complication rates by surgical group

Variable	LAP-OVH	CONV-OVH	Difference	p-value	95% CI
Cortisol baseline (nmol/L)	38.1 $\pm$ 7.2	39.4 $\pm$ 8.1	-1.3	0.71	—
Cortisol 6 hr (nmol/L)	47.3 $\pm$ 8.6	76.8 $\pm$ 12.4	-29.5	<0.001	23.7-35.3
Cortisol 24 hr (nmol/L)	41.6 $\pm$ 7.8	54.2 $\pm$ 9.3	-12.6	<0.001	8.1-17.1
Minor complications (%)	6.7 (2/30)	10.0 (3/30)	-3.3	0.64	—
Major complications (%)	0 (0/30)	0 (0/30)	0	—	—
Rescue analgesia (%)	0 (0/30)	10.0 (3/30)	-10.0	0.076	—

Cortisol at 6 hours post-surgery was 38.4% lower in the LAP group (Table 3), confirming a substantially reduced neuroendocrine stress response. By 24 hours, cortisol in LAP dogs had nearly returned to baseline (41.6 vs. 38.1 nmol/L), while CONV dogs remained 37.6% above their starting value. Complication rates were low and statistically similar between groups.

Comprehensive Interpretation

The pain trajectory curves (Figure 2) capture the clinical heart of this comparison. LAP-OVH dogs experienced a lower pain peak (GCMPS 8.4 vs. 12.7 at 2 hours), fell below the rescue threshold six hours earlier, and converged toward near-zero scores by 48 hours. The shaded area between curves

represents the cumulative "pain burden" avoided by the laparoscopic approach. Combined with the cortisol data (Table 3) and the faster return to voluntary eating and normal activity (Table 2), these results paint a consistent picture: LAP-OVH imposes measurably less physiological and experiential burden on the patient than conventional celiotomy.

Discussion

The 66.3% reduction in blood loss with LAP-OVH is the most striking surgical parameter difference and aligns closely with European data. Devitt *et al.* [5] reported a 71% blood loss reduction in a Canadian trial of 20 dogs, and Hancock *et al.* [6] documented 58% in a UK series.

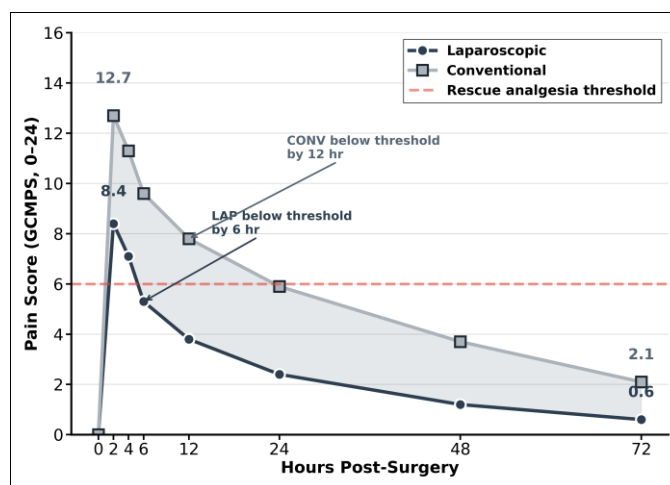


Fig 2: Postoperative pain score trajectories (Glasgow Composite Measure Pain Scale) from 0 to 72 hours in laparoscopic and conventional ovariohysterectomy groups, with rescue analgesia threshold indicated

The mechanism is straightforward: the LigaSure device seals vessels up to 7 mm diameter with a thermal seal that achieves burst pressures exceeding 300 mmHg, virtually eliminating pedicle haemorrhage that accounts for most blood loss during conventional ligation [3]. In resource-limited Latin American settings where blood typing and transfusion products for dogs are scarce, this haemostatic advantage carries added safety value.

The finding that LAP-OVH was actually faster (38.7 vs. 52.4 minutes) contrasts with most published trials, which report laparoscopic times 10-20 minutes longer than open [5, 7]. This reversal almost certainly reflects the surgeon's high case volume (>100 LAP-OVH). Learning curve analyses have shown that laparoscopic OVH times plateau after approximately 60-80 cases [8], beyond which the absence of manual pedicle exteriorisation and suture tying eliminates the steps that consume time in open surgery. Clinics adopting the technique should expect longer operative times during the learning phase.

Pain scores deserve special attention. The 4.3-point GCMPS difference at 2 hours represents roughly one-third of the total scale range and translated into zero rescue analgesia events in the LAP group versus 10% in the CONV group. Reduced tissue trauma smaller fascial incisions, no manual organ traction, less peritoneal irritation is the accepted explanation for lower pain after laparoscopic abdominal surgery in both human and veterinary patients [9, 10]. The cortisol data reinforce this interpretation: a 38.4% lower cortisol at 6 hours reflects a blunted hypothalamic-pituitary-adrenal axis response, consistent with less nociceptive afferent input reaching the central nervous system.

From a client communication standpoint, the 1.6-day faster return to normal activity is arguably the outcome that matters most to pet owners. Translating that into practical terms: a LAP-OVH dog can resume leash walks and play within two days, whereas a CONV-OVH dog typically needs restricted activity for three to four days [11]. Combined with the cosmetic advantage of smaller incisions three puncture wounds versus a 7+ cm scar these factors can justify the higher procedural fee that laparoscopic surgery commands.

Clinical Implications

Three recommendations emerge for veterinary practitioners in Latin America. First, the pain and stress advantages of LAP-OVH are real and measurable, not merely perceived, and they benefit every patient regardless of size or breed. Clinics with

laparoscopic capability should offer it as the default sterilisation option, reserving conventional OVH for cases where anatomical abnormalities or cost constraints make laparoscopy impractical. Second, surgical training programmes should invest in structured laparoscopic curricula, including box-trainer simulation before live cases, to shorten the learning curve from the estimated 60-80 cases to a manageable number. Third, the economic model for LAP-OVH adoption should account for reduced analgesic drug use, shorter hospitalisation, and higher client willingness to pay for minimally invasive options factors that partially offset the capital cost of equipment.

Conclusion

Elective sterilisation is the most common surgical procedure in companion animal practice, and how it is performed directly affects millions of dogs' postoperative experiences every year. The question is no longer whether minimally invasive approaches are superior in terms of pain and recovery the evidence from human surgery and a growing body of veterinary trials has settled that but rather whether the advantages hold up in diverse clinical environments outside North American and European teaching hospitals.

This trial provides an affirmative answer for a Latin American setting. LAP-OVH in 30 female dogs produced 66.3% less blood loss, 62.2% shorter incisions, 34% lower peak pain scores, 38.4% lower cortisol at 6 hours, and a 1.6-day faster return to normal activity compared with conventional OVH in a matched group of 30 dogs. Remarkably, LAP-OVH was also 13.7 minutes faster, though this reflects the surgeon's extensive experience rather than an inherent speed advantage of the technique. Complication rates were low and equivalent between groups.

Based on these outcomes, veterinary hospitals in Peru and comparable Latin American markets that have invested in laparoscopic equipment should position LAP-OVH as their standard-of-care sterilisation offering. The cost premium typically 30-50% above conventional OVH in Lima's private hospital market is justified by measurable patient welfare gains and can be partially recouped through reduced analgesia costs and shorter post-discharge monitoring. For high-volume municipal sterilisation campaigns where cost and throughput are paramount, conventional OVH remains efficient and safe, but even these programmes could benefit from adopting laparoscopic techniques if grant funding or equipment donations become available.

Future research should address the learning curve explicitly by tracking outcomes across a surgeon's first 100 laparoscopic cases, identifying the inflection point at which time and complication rates stabilise. Multicentre trials across different South American countries would test the generalisability of these single-centre findings. Client satisfaction and willingness-to-pay surveys would complete the economic case for or against widespread LAP-OVH adoption. And long-term follow-up (≥ 6 months) comparing incisional hernia rates, adhesion formation, and owner-reported quality of life between techniques would address outcomes that a 72-hour window cannot capture.

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References

1. Fransson BA. Advances in laparoscopic procedures in dogs and cats. *Veterinary Clinics of North America: Small Animal Practice*. 2016;46(1):63-84.
2. Levy JK, Crawford PC, Appel LD, Clifford EL. Comparison of intratesticular injection of zinc gluconate versus surgical castration to sterilize male dogs. *American Journal of Veterinary Research*. 2008;69(1):140-143.
3. Mayhew PD, Brown DC. Comparison of three techniques for ovarian pedicle hemostasis during laparoscopic-assisted ovariohysterectomy. *Veterinary Surgery*. 2007;36(6):541-547.
4. Van Nimwegen SA, Kirpensteijn J. Laparoscopic ovariectomy in cats: comparison of laser and bipolar electrocoagulation. *Journal of Feline Medicine and Surgery*. 2007;9(5):397-403.
5. Devitt CM, Cox RE, Hailey JJ. Duration, complications, stress, and pain of open ovariohysterectomy versus a simple method of laparoscopic-assisted ovariohysterectomy in dogs. *Journal of the American Veterinary Medical Association*. 2005;227(6):921-927.
6. Hancock RB, Lanz OI, Waldron DR, Duncan RB, Broadstone RV, Hendrix PK. Comparison of postoperative pain after ovariohysterectomy by harmonic scalpel-assisted laparoscopy compared with median celiotomy and ligation in dogs. *Veterinary Surgery*. 2005;34(3):273-282.
7. Shariati E, Bakhtiari J, Khalaj A. Comparison between total laparoscopic and open ovariohysterectomy in dogs: a systematic review. *Iranian Journal of Veterinary Surgery*. 2021;16(1):59-68.
8. Pope JFA, Knowles TG. Retrospective analysis of the learning curve associated with laparoscopic ovariectomy in dogs and associated perioperative complication rates. *Veterinary Surgery*. 2014;43(6):668-677.

9. Davidson EB, Moll HD, Payton ME. Comparison of laparoscopic ovariohysterectomy and ovariohysterectomy in dogs. *Veterinary Surgery*. 2004;33(1):62-69.
10. Culp WT, Mayhew PD, Brown DC. The effect of laparoscopic versus open ovariectomy on postsurgical activity in small dogs. *Veterinary Surgery*. 2009;38(7):811-817.
11. Case JB, Marvel SJ, Boscan P, Monnet EL. Surgical time and severity of postoperative pain in dogs undergoing laparoscopic ovariectomy with one, two, or three instrument cannulas. *Journal of the American Veterinary Medical Association*. 2011;239(2):203-208.
12. Muraro L, White RS. Complications of ovariohysterectomy procedures performed in 1880 dogs. *Tierärztliche Praxis Ausgabe K Kleintiere Heimtiere*. 2014;42(5):297-302.
13. Dupre G, Fiorbianco V, Skalicky M, Gultiken N, Ay SS, Findik M. Laparoscopic ovariectomy in dogs: comparison between single portal and two-portal access. *Veterinary Surgery*. 2009;38(7):818-824.
14. Austin B, Lanz OI, Hamilton SM, Broadstone RV, Martin RA. Laparoscopic ovariohysterectomy in six dogs. *Journal of the American Animal Hospital Association*. 2003;39(4):391-396.