Postoperative Pain and Recovery Following Ovariohysterectomy and Orchiectomy in Canines and Felines.

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Content

Abstract

This study investigates immediate postoperative recovery in dogs and cats undergoing ovariohysterectomy or orchiectomy, two common procedures in small animal veterinary practice. Clinical and behavioural parameters were assessed during the first hours after surgery, and postoperative signs and complications were evaluated over the following week. A total of 40 animals were included, with the Feline Grimace Scale (FGS) applied to objectively assess pain in cats, while in dogs, behavioural observations and a simplified scoring system based on appetite, mobility, and general demeanour were used to estimate postoperative discomfort.

The results revealed a low overall incidence of postoperative pain (12.5%), with a higher frequency observed in females undergoing ovariohysterectomy, likely due to the procedure's invasiveness. The most frequent clinical signs were lethargy and wound licking, particularly in cats. No infections or serious complications were reported; wound dehiscence was rare (4%), and no association was found between the antiseptic product used at home and local complications.

The findings suggest that the analgesic protocols used were largely effective. A systematic assessment approach—combining clinical observation with validated pain scales—proved essential for early pain detection and treatment. The study provides valuable insights for improving postoperative care and promoting animal welfare in clinical veterinary settings.

1.   Introduction

Ovariohysterectomy (OVH) and orchiectomy are among the most performed surgical procedures in companion animal practice (Adin, 2011). OVH involves a laparotomy followed by removal of the ovaries and uterus (Bencharif *et al*., 2010). Two main surgical approaches are used in females: the ventral midline and the flank approach (Benavides Melo *et al*., 2019). Regarding orchiectomy, the scrotal technique—widely used in cats—is associated with shorter surgical time and greater practicality, although it presents a higher incidence of visible complications such as scrotal hematoma and edema. In dogs, the prescrotal approach is generally preferred due to its lower rate of visible complications and better postoperative tolerance. This technique can be performed using either an open or closed method (Leal *et al*., 2024; Santiago *et al*., 2025)

The benefits of sterilization extend beyond population control and include the prevention and treatment of several reproductive and systemic diseases. Ovariohysterectomy (OVH) in female animals is primarily indicated for the prevention and management of reproductive pathologies such as pyometra, mammary neoplasia, and uterine prolapse. Additionally, OVH may be recommended in cases involving endocrine disorders and dermatological conditions related to hormonal imbalances (Fossum, 2009; Leelakajornkit *et al*., 2024). In males, orchiectomy is performed to treat or prevent prostatic diseases, testicular problems, and cryptorchidism, and it also reduces undesirable behaviors such as urine marking or aggression (Fossum, 2009; Leal *et al*., 2024).

Despite the well-documented preventive and therapeutic benefits of sterilization, appropriate postoperative pain management remains critical. One of the main challenges in veterinary medicine is that animals cannot verbally express pain, requiring the clinician to rely on behavioral and physiological indicators (Hardie *et al*., 1997). To improve pain detection and management, a variety of assessment tools have been developed. These tools integrate behavioral indicators, facial expression analysis, physiological parameters, and biochemical markers, enabling the early identification of pain and facilitating the timely administration of preventive analgesia (Hernandez-Avalos *et al*., 2019). Although changes in heart rate,

respiratory rate, blood pressure, and stress hormones (e.g., epinephrine, norepinephrine, cortisol, and β-endorphins) can be nonspecific and influenced by stress, combining these parameters with behavioral observations and responses to palpation of the surgical site improves the reliability of pain assessment. The correlation between objective indicators and validated pain assessment scales enhances the understanding of postoperative pain dynamics and facilitates the selection of evidence-based analgesic protocols (Evangelista *et al.*, 2014).

Historically, acute pain in animals has been assessed using simple tools such as the simple descriptive scale (SDS), numerical rating scale (NRS), and visual analog scale (VAS). However, these unidimensional tools often fail to capture the complexity of pain and can show high inter-observer variability, making them unreliable for modern analgesic assessment (Morton *et al.*, 2005; Testa *et al.*, 2021).To address this, the Glasgow Composite Measure Pain Scale (CMPS) was developed as a behavior-based and multi-item tool. The short form (CMPS-SF) was later created for practical clinical use and includes six behavioural categories: vocalization, attention to wound, mobility, response to touch, demeanour, and posture/activity. This scale provides a reliable framework to assess post-operative pain in dogs and guide the need for further analgesia (Murrell *et al.*, 2008; Testa *et al.*, 2021). In cats, the Feline Grimace Scale (FGS) is a reliable method for assessing acute pain based on changes in facial expressions. It includes five action units: ear position, orbital tightening, muzzle tension, whiskers change and head position (Monteiro *et al.*, 2023).

Peritoneal healing following abdominal surgery is generally rapid, with mesothelial re-epithelialization typically occurring within 3 to 8 days, depending on the size and anatomical location of the defect, even under suboptimal physiological conditions (Forgione, 2010). However, gonadectomy is not without risk. Potential complications include orthopaedic issues (e.g., increased risk of joint disorders in certain breeds), urinary incontinence, and intra- or postoperative complications such as haemorrhage, wound dehiscence, ovarian remnant syndrome, and scrotal hematoma (Leelakajornkit *et al.*, 2024). OVH carries risks common to any celiotomy, including anaesthetic reactions, intra-abdominal bleeding, incisional hernias, delayed healing, abscesses, infections, and, in rare cases, death (Benavides Melo *et al.*, 2019).

Post-surgical pain assessment at home is a crucial aspect of ensuring optimal recovery and welfare for companion animals. Owners play a vital role as part in the pain management,

they can identify specific behavioural changes, including decreased activity, playfulness, and altered locomotion up to three days after procedures like castration or ovariohysterectomy (Steagall *et al*., 2022). In dogs, recording simple behaviours such as eating, drinking, sleeping patterns, licking of the abdominal midline, self-grooming, urinating and defecating can provide valuable data for understanding pain levels and the effectiveness of different analgesic protocols (Hardie *et al*., 1997). In cats, the Feline Grimace Scale has been shown to be a reliable tool for cat owners and non-veterinary caregivers, enabling the detection of pain-related facial changes at home and promoting earlier veterinary intervention. Incorporating these observations into post-surgical care plans can improve outcomes and facilitate early detection of complications (Steagall *et al*., 2022).

Short-term complications include bleeding, discharge, pseudopregnancy, wound issues, and infections, with rare severe cases like peritonitis and evisceration. Long-term complications range from granulomas and recurrent oestrus to incontinence and adhesions (Benavides Melo *et al*., 2019). Moreover, poor suture choices can also cause complications like delayed healing and infections, emphasizing the need for proper suture selection (Cymbryłowicz *et al*., 2024).

The main objective of this study is to evaluate short-term postoperative recovery in small mammals, particularly dogs and cats, undergoing routine surgical sterilization procedures, such as ovariohysterectomy (OVH) in females and orchiectomy in males. The analysis focused on both physiological responses and behavioural changes observed during the first hours after surgery, as well as the clinical progression over the first postoperative week. This evaluation included the condition of the surgical wound, the presence of any potential signs of complications, and the possible influence of different antiseptic products used by owners for at-home wound care. Through this approach, the study aims to enhance the understanding of factors that impact patient well-being during recovery and to contribute valuable insights for optimizing postoperative management protocols in veterinary clinical practice.

2.   Materials and methods

2.1.   Animals

The present study was conducted on a total of 40 animals, specifically 15 female dogs (Canis lupus familiaris), 6 female cats (Felis silvestris catus), 2 female rabbits (Oryctolagus cuniculus), 10 male dogs, 6 male cats, and 1 male rabbit; all of which were attended to at the Clinical Veterinary Hospital between 2024 and 2025. The selection of animals was entirely random, and only those undergoing routine surgical procedures, specifically neutering, were included in the study. However, in addition to standard castration surgeries, data were collected from two non-routine procedures: an abdominal cryptorchid castration and a combined castration with cystotomy.

The animals enrolled in this study had body weights ranging from 1.6 kg to 30 kg and ages between 5 months and 13 years. Both nulliparous and multiparous females were included, as well as males with either scrotal or cryptorchid testicles. The sample encompassed various canine breeds, such as Rough Collie, Miniature Schnauzer, and German Shepherd, in addition to mixed-breed dogs. In the feline population, the majority consisted of domestic shorthair (European Shorthair) cats, along with a smaller number of Sphynx cats.

All animals included in the study were classified as ASA I according to the American Society of Anesthesiologists (ASA) physical status classification system, indicating that they were clinically healthy with no systemic diseases that could interfere with the anaesthetic or surgical protocol. Animals with pre-existing medical conditions identified during the preoperative evaluation were excluded from the study

2.2.   Experimental design

Animals were classified according to species, breed, age, weight, and type of surgery performed. The primary classification for the study was based on the surgical procedure. During the surgical intervention, several relevant clinical and surgical parameters were systematically recorded, including: the premedication administered prior to anaesthetic induction, the use of regional anaesthetic blocks (yes/no), total duration of surgery (in minutes), total anaesthesia time (in minutes), use of intraoperative rescue fentanyl (yes/no), type of suture material used for surgical closure, and the length of the surgical incision (in centimetres).

Postoperative pain assessment was conducted 4 hours after the completion of surgery, considering various observational parameters. Animals were then categorized into two groups based on established criteria: "presence of pain" or "absence of pain."

Furthermore, at the 7-day postoperative follow-up, the healing progression of the surgical wound and the general condition of the patient were evaluated. This assessment included inspection of the incision site, identification of any inflammatory signs or local complications, and clinical evaluation of the animal's functional recovery and overall wellbeing. Additionally, information regarding wound care at home, specifically the disinfectant products used during the recovery period, was taken into account.

2.3. Patient Preparation and Monitoring

Animals were premedicated via intramuscular administration of different pharmacological combinations, selected according to the individual characteristics of each patient. In all cases, dexmedetomidine (3 µg/kg IM; Sedadex 0.5 mg/mL, Dechra, Barcelona, Spain) was used as the primary sedative agent. Depending on the established anaesthetic protocol, it was combined with methadone (0.2 mg/kg IM; Semfortan 10 mg/mL, Dechra Veterinary Products S.L.U., Barcelona, Spain) or maropitant (1 mg/kg SC; Vominil 10 mg/ml, VetViva Richter GmbH, Wels, Austria), or alternatively with butorphanol (0.2 mg/kg IM; Torphadine, 0.2 mg/mL, Dechra Veterinary Products S.L.U., Barcelona, Spain) and ketamine (2 mg/kg IM; Ketabel, 100 mg/mL, Fatro Ibérica S.L., Barcelona, Spain). Approximately 10 minutes after premedication administration, and once an adequate level of sedation was achieved, the animal was prepared for surgery, which included placement of an intravenous catheter in the cephalic vein and shaving of the surgical area.

anaesthetic induction was carried out using Propofol (1 mg/kg IV; Propovet, 10 mg/mL, Esteve, Spain). Following induction, the animal was intubated with a tracheal tube and connected to the anaesthesia machine (Mindray WATO –EX35, Shenzhen, China). Anaesthesia was maintained with sevoflurane at a concentration of 2% in 100% oxygen (1–2 L/min), administered via mechanical ventilation.

Throughout the surgical procedure, continuous monitoring was performed (ePM 12M Vet, Mindray, Shenzhen, China). The parameters monitored included electrocardiography

(ECG), pulse oximetry (SpO$_2$, %), capnography (end-tidal CO$_2$, mmHg), body temperature (ºC), and oscillometric non-invasive blood pressure, recorded at 5 minute intervals.

2.4. Surgical procedure

Animals were positioned in dorsal recumbency for the surgical procedure, except in the case of orchiectomies in cats, where sternal recumbency is used. In these cases, the tail is secured in a cranial direction to prevent interference with the surgical field.

Ovariohysterectomies, in female dogs, cats, and rabbits, were carried out via a midline laparotomy. An incision was made through the skin and subcutaneous layers to access the linea alba. Once the abdominal cavity was open, the uterine horns and ovaries were identified. The ovarian and uterine blood vessels were ligated using a vascular sealing device (Caiman, B. Braun Surgical SA, Spain), and the entire reproductive tract was removed. To complete the procedure, the surgical site was closed in layers: the abdominal wall and subcutaneous tissues were sutured with a continuous pattern, and the skin was finally closed with an intradermal suture using a monofilament absorbable suture (Monosyn, B. Braun Surgical SA, Spain). The suture thickness depended on the size of the animal and usually ranged from 0 to 3/0 USP.

Regarding orchiectomies, a closed pre-scrotal approach was performed in male dogs. A midline skin incision was made cranial to the scrotum. The subcutaneous tissue was dissected to access the spermatic cord, and the parietal vaginal tunic was left intact. The testicle was exteriorized by gentle traction, and the spermatic cord, still within its tunic, was ligated using absorbable suture material before being transected. The same procedure was repeated for the contralateral testicle through the same incision. After removal of both testes, the subcutaneous tissue was closed using a continuous suture pattern with absorbable material, and the skin was closed with an intradermal suture pattern, using 2/0 or 3/0 diameter depending on the size of the animal (Monosyn, B. Braun Surgical SA, Spain).

In male cats and rabbits, an open scrotal technique was performed. A single scrotal incision was made over each testicle. The parietal vaginal tunic was incised, allowing direct visualization of the spermatic cord structures. The spermatic cord was ligated using absorbable suture material before transection. The same procedure was repeated on the contralateral

testicle. In cats no skin sutures were placed, and the incisions were left to heal by second intention. While in rabbits both incisions were closed with a single cross stitch.

After each surgical procedure, all animals received robenacoxib (2 mg/kg SC; Onsior, 20 mg/mL, Elanco GmbH, Kiel, Germany).

2.5. Pain evaluation

Postoperative pain was assessed through clinical examinations and owner observations. The main evaluation was carried out 4 hours after surgery, with a follow-up examination performed seven days later.

In dogs, the 4-hour assessment included physiological parameters such as appetite, water intake, urination and defecation, as well as the identification of possible behavioural changes. These behavioural indicators included signs such as lethargy, stiffness, restlessness, agitation, licking of the surgical site or other signs of discomfort.

To collect these data, each animal was offered a small portion of gastrointestinal diet (Hill's) to check food acceptance, and a bowl of water was placed in the cage to assess water intake. In addition, the presence of urine or faeces on the absorbent pad placed in the cage was recorded. Behaviour was monitored for a few minutes while the animal remained in the cage to detect any signs of pain, and they were also allowed to come out of the cage and walk on the floor to better observe their behaviour.

The results were recorded using a pain scale from 0 to 9 points, in which a higher score indicated a higher level of perceived pain. Each parameter was given one point if the response was affirmative, except for food intake, water intake, urination and defecation, which were scored with one point if the response was negative. A total score of 5 or higher was considered indicative of clinically relevant postoperative pain, due to the subjectivity of the parameters assessed.
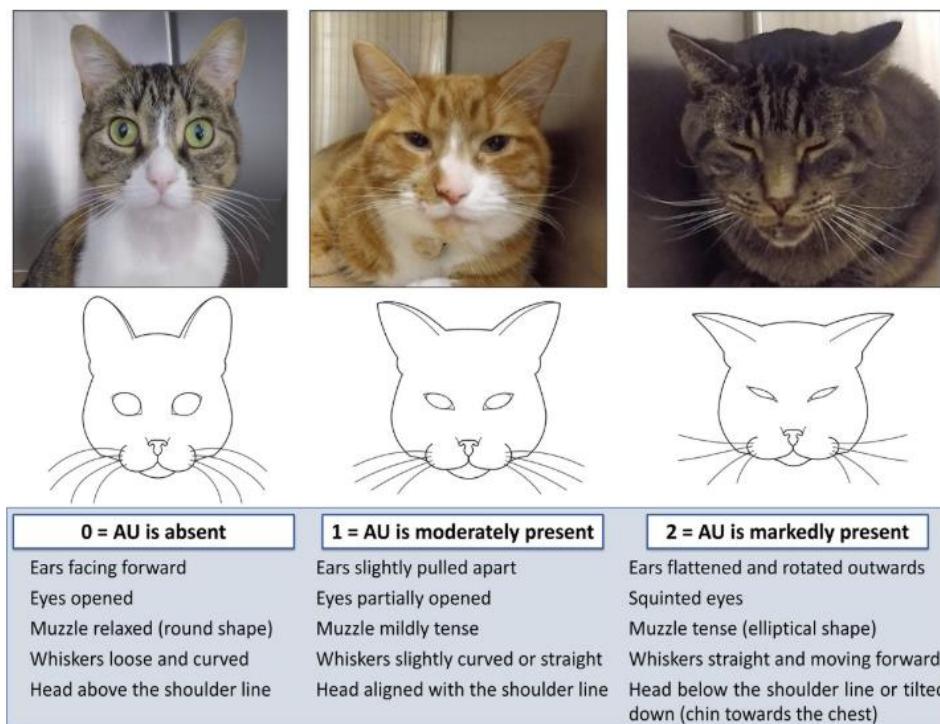
In cats, the Feline Grimace Scale (FGS) was employed as a reliable and validated method for acute pain assessment. The FGS evaluates five facial action units (AUs): ear position, orbital tightening, muzzle tension, whiskers change, and head position. Each AU is scored from 0 to 2, where 0 indicates the absence of the AU, 1 indicates moderate presence or

uncertainty, and 2 indicates an obvious presence of the AU. The total maximum possible score for the FGS is 10, with scores of 4 or higher suggesting that the cat is in pain and requires administration of analgesics (Monteiro *et al.*, 2023). For this purpose, the Feline Grimace Scale application (Steagall Laboratory) was used, which allows data to be collected quickly and easily. The same method was used to assess acute postoperative pain in rabbits, considering that the facial expression scale has been proposed as a valid approach for evaluating pain in this species as well.

Figure 1

Pain evaluation in cats by Feline Grimace Scale

0 = AU is absent	1 = AU is moderately present	2 = AU is markedly present
Ears facing forward	Ears slightly pulled apart	Ears flattened and rotated outwards
Eyes opened	Eyes partially opened	Squinted eyes
Muzzle relaxed (round shape)	Muzzle mildly tense	Muzzle tense (elliptical shape)
Whiskers loose and curved	Whiskers slightly curved or straight	Whiskers straight and moving forward
Head above the shoulder line	Head aligned with the shoulder line	Head below the shoulder line or tilted down (chin towards the chest)

Note: Picture obtained from the article of Evangelista *et al.*(2020)

A follow-up examination was carried out seven days after surgery to complement the immediate postoperative pain assessment. During this visit, owners provided information on their animal's behaviour in the days following the procedure. Specifically, they were asked how long it took their animals to return to normal urination and defecation patterns, since delays in elimination can indicate discomfort or pain. They also described any abnormal behaviours

observed, such as lethargy, increased restlessness or excessive licking of the surgical site. Additionally, wound care was performed at home by the owners using chlorhexidine, diluted povidone-iodine (Betadine®) or water and soap, according to their preference and following the veterinarian's instructions. Finally, the veterinarian in charge performed a thorough clinical examination of the incision site to ensure proper healing and to detect any signs of pain, inflammation, infection or dehiscence.

2.6. Statistical Analysis

The data obtained from clinical records and postoperative follow-ups were compiled and organized using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Descriptive statistics were used to analyze the results, with categorical variables expressed as absolute frequencies and percentages. These included the distribution of surgical procedures by species and sex, presence or absence of postoperative pain, as well as the incidence of clinical signs and complications observed during the 7-day follow-up period.

Pain assessment results were grouped by species and type of surgery to identify trends. Due to the relatively small sample size and the observational nature of the study, no inferential statistical tests were applied. The analysis focused on descriptive comparison of proportions between groups to highlight potential patterns of clinical relevance.

3. Results

A total of 40 surgical procedures were analyzed in small mammals, including dogs, cats, and rabbits, as detailed in Table 1. The most frequently performed surgery was ovariohysterectomy (57.5%), followed by orchiectomy (37.5%) and a small proportion of other procedures (5%).

Dogs accounted for the majority of surgeries (62.5%) and underwent all three types of procedures, with a predominance of ovariohysterectomies. In cats (30% of cases), procedures were equally distributed between ovariohysterectomy and orchiectomy. In contrast, rabbits (7.5%) only underwent these two procedures, with no other types recorded.

Table 1.

Distribution of surgical procedures by species and type of intervention

	Ovariohysterectomy	Orchiectomy	Others	Total
Dogs	60%	32%	8%	62.5%
	(15/25)	(8/25)	(2/25)	(25/40)
Cats	50%	50%	0%	30%
	(6/12)	(6/12)	(0/12)	(12/40)
Rabbits	66.66%	33.33%	0%	7.5%
	(2/3)	(1/3)	(0/3)	(3/40)
Total	57.5%	37.5%	5%	
	(23/40)	(15/40)	(2/40)	

No apparent relationship was observed between surgical time, duration of anesthesia, or incision size and the level of pain perceived at 4 hours postoperatively or during the 7-day follow-up. These factors did not appear to significantly influence the pain response in the animals, regardless of the type of procedure performed.

Postoperative behavioral and physiological responses were evaluated 4 hours after surgery in dogs, as shown in Table 2. The table summarizes the percentages and frequencies of animals that exhibited or did not exhibit certain behaviors or physiological functions, categorized by the type of surgical procedure: ovariohysterectomy, orchiectomy, or others.

Within the first 4 hours after surgery, slightly more than half of the animals consumed food, with comparable proportions across surgical groups. In contrast, drinking behavior was notably infrequent, as the vast majority of animals—regardless of surgical procedure—did not ingest water during this period.

Urination and defecation were rare events, each observed in only one animal, both belonging to the ovariohysterectomy group. Overall, more than 90% of the animals did not eliminate within the first 4 hours postoperatively.

Behavioral signs such as depression and restlessness were observed in a minority of animals. Depression appeared slightly more frequently in the ovariohysterectomy and miscellaneous surgery groups, while restlessness was only noted in the orchiectomy group. Nonetheless, most animals remained behaviorally stable in the immediate postoperative period.

Table 2.

Postoperative behaviour and physiological functions at 4 hours by type of surgical procedure

	Ovariohysterectomy	Orchiectomy	Others	Total
Eat at 4 hours	53.33% (8/15)	50% (4/8)	50% (1/2)	52% (13/25)
Not eat at 4 hours	46.66% (7/15)	50% (4/8)	50% (1/2)	48% (12/25)
Drink at 4 hours	6.66% (1/15)	12.5% (1/8)	0% (0/2)	7.69% (2/25)
Not drink at 4 hours	93.33% (14/15)	87.5% (7/8)	100% (2/2)	88.46% (23/25)
Urinate	0% (0/15)	12.5% (1/8)	0% (0/2)	3.85% (1/25)
Not urinate	100% (15/15)	87.5% (7/8)	100% (2/2)	92.31% (24/25)
Defecate	6.66% (1/15)	0% (0/8)	0% (0/2)	3.85% (1/25)
Not defecate	93.33% (14/15)	100% (8/8)	100% (2/2)	92.31% (24/25)
Depression	13.33% (2/15)	0% (0/8)	50% (1/2)	11.54% (3/25)
Not depression	86.66% (13/15)	100% (8/8)	50% (1/2)	84.61% (22/25)

Restlessne ss	0% (0/15)	25% (2/8)	0% (0/2)	7.69% (2/25)
Not Restlessness	100% (15/15)	75% (6/8)	100% (2/2)	88.46% (23/25)

As shown in Table 3, postoperative pain was assessed four hours after surgery in a total of 40 animals. Overall, 87.5% (35/40) of the animals showed no signs of pain, while 12.5% (5/40) did.

Overall, postoperative pain was infrequent across the evaluated species, with the highest incidence observed in cats (16.7%), followed by dogs (12%), and no cases detected in rabbits. Among surgical procedures, ovariohysterectomy (OVH) in female cats was most commonly associated with early postoperative pain, affecting one-third of the individuals. In contrast, pain was rarely observed in dogs, regardless of the surgical intervention, and was absent in all rabbits. These findings suggest a generally low prevalence of acute postoperative pain, with species- and procedure-specific variations.

Table 3.

Postoperative pain assessment at 4 hours by species and type of surgery

Animals	Surgery	Presence of pain	Absence of pain
Dogs	**Ovariohysterectomy**	13.33% (2/15)	86.66% (13/15)
	Orchiectomy	12.5% (1/8)	87.5% (7/8)
	Others	0% (0/2)	100% (2/2)
	Total	12% (3/25)	88% (22/25)
Cats	**Ovariohysterectomy**	33.33% (2/6)	66.66% (4/6)
	Orchiectomy	0% (0/6)	100% (6/6)
	Total	16.66% (2/12)	83.33% (10/12)
Rabbits	**Ovariohysterectomy**	0% (0/2)	100% (2/2)
	Orchiectomy	0% (0/1)	100% (1/1)
	Total	0% (0/3)	100% (3/3)
	Total Animals	12.5% (5/40)	87.5% (35/40)

Owners were responsible for incision site disinfection, following standardized postoperative instructions. Cristalmina was the most frequently used product (57.5%), followed by povidone-iodine (25%) and soap and water (17.5%). No association was observed between the type of disinfectant used and the incidence of local complications. Of the 40 animals initially included, 62.5% (25/40) returned for the day 7 postoperative evaluation, comprising 17 dogs, 7 cats, and 1 rabbit. Clinical signs were reported in 88% (22/25) of these animals, with species-specific differences. In dogs, lethargy and delayed defecation were the most common findings (each in 17.6%). In cats, wound licking was predominant (57.1%), followed by lethargy (28.6%). The single rabbit evaluated showed no clinical abnormalities.

Local complications were infrequent. Wound inflammation was detected in 8% (2/25) of cases, and a single case of dehiscence was observed in a cat (4%). Despite the variability in home care and the relatively low follow-up rate, most postoperative findings were mild and self-limiting, with more frequent behavioral signs observed in felines.

Table 4.

Clinical Signs Detected at the 7-Day Postoperative Follow-Up by Species

Observed Sign	Dogs	Cats	Rabbits	Total
Eating on day 2	0% (0/17)	0% (0/7)	100% (1/1)	4% (1/25)
Drinking on day 2	0% (0/17)	0% (0/7)	100% (1/1)	4% (1/25)
Urination on day 2	5.9% (1/17)	0% (0/7)	100% (1/1)	8% (2/25)
Defecation on day 2	17,6% (3/17)	0% (0/7)	100% (1/1)	16% (4/25)
Defecation on day 3	5,9% (1/17)	0% (0/7)	0% (0/1)	4% (1/25)
Inflammation	5,9% (1/17)	14,3% (1/7)	0% (0/1)	8% (2/25)
Wound licking	5,9% (1/17)	57,1% (4/7)	0% (0/1)	20% (5/25)
Lethargy	17,6% (3/17)	28,6% (2/7)	0% (0/1)	20% (5/25)
Dehiscence	0% (0/17)	14,3% (1/7)	0% (0/1)	4% (1/25)
Total signs observed	**58,8% (10/17)**	**114,3% (8/7)**	**400% (4/1)**	**88% (22/25)**

Of the 25 animals examined during postoperative follow-up, 13 underwent ovariohysterectomy (OVH) and 10 underwent castration, while the remaining 2 were subjected to other surgical procedures. As these two animals did not show any clinical signs or postoperative complications, they were not included in the corresponding table.

As shown in Table 5, the most frequent clinical signs were wound licking and lethargy (both observed in 21.7% of cases), followed by delayed defecation (on days 2 or 3), also present in 21.7% of the animals. Wound dehiscence was recorded in only one OVH patient (4.3%). Overall, a higher proportion of postoperative signs was observed in the OVH group (15 signs in 13 animals) compared to the castration group (7 signs in 10 animals).

Table 5.

Incidence of clinical signs and wound complications according to surgical procedure

Observed Sign	Ovariohysterectomy	Orchiectomy	Total
Eating on day 2	7.7% (1/13)	0.0% (0/10)	4.3% (1/23)
Drinking on day 2	7.7% (1/13)	0.0% (0/10)	4.3% (1/23)
Urination on day 2	15.4% (2/13)	0.0% (0/10)	8.7% (2/23)
Defecation on day 2	23.1% (3/13)	10.0% (1/10)	17.4% (4/23)
Defecation on day 3	7.7% (1/13)	0.0% (0/10)	4.3% (1/23)
Inflammation	7.7% (1/13)	10.0% (1/10)	8.7% (2/23)
Wound licking	15.4% (2/13)	30.0% (3/10)	21.7% (5/23)
Lethargy	23.1% (3/13)	20.0% (2/10)	21.7% (5/23)
Dehiscence	7.7% (1/13)	0.0% (0/10)	4.3% (1/23)
Total signs observed	115.38% (15/13)	70% (7/10)	95.65% (22/23)

4.   Discussion

This study aimed to evaluate the short-term postoperative recovery in small mammals—mainly dogs and cats—undergoing routine surgical procedures such as ovariohysterectomy (OVH) and orchiectomy. The analysis focused on behavioural and physiological responses within the first hours post-surgery, as well as clinical evolution during the first week, including surgical wound healing and the potential influence of different disinfectants.

The most frequently performed surgery was OVH, accounting for over half of all cases, particularly in dogs. This predominance is consistent with trends in companion animal practice, where elective spaying is routinely recommended to prevent unwanted reproduction and reduce the incidence of reproductive pathologies such as pyometra or mammary tumours.

Four hours after surgery, most animals (87.5%) did not display signs of pain, suggesting that the analgesic protocols used were generally effective in controlling immediate postoperative discomfort. However, pain was observed slightly more frequently in cats (16.7%) than in dogs (12%), with the highest incidence occurring in female patients undergoing OVH. Interestingly, this finding contrasts with the results of a study which reported that UK veterinarians generally perceive that cats tend to show fewer signs of pain than bitches after spay surgery (Martino-Boulton *et al*., 2025). This may suggest that these observed differences in pain may be influenced not only by the specific responses of each species to pain, but also by the method of assessment used, since pain in cats was assessed using a standardised scale, while in dogs it was assessed more subjectively through behavioural changes. Moreover, the higher incidence of pain observed in OVH patients may be attributed to the more invasive nature of the procedure, as well as potential hormonal or behavioural factors influencing postoperative recovery. This is consistent with previous findings indicating that female dogs and cats undergoing OVH tend to require significantly more postoperative analgesia than males undergoing orchiectomy. Factors such as the greater invasiveness of OVH, longer surgical times, extensive peritoneal manipulation, and traction of the ovarian pedicles may collectively contribute to a higher degree of postoperative pain in females (Quarterone *et al*., 2017).

Regarding early postoperative behaviours in dogs, appetite was the most variable parameter, with 52% of canine patients accepting food four hours after surgery, while the other 48% did not. This variability could be influenced by individual differences in anaesthetic

recovery, pain perception, and stress levels rather than the surgical procedure itself. Similar findings have been described in experimental studies, where it has been shown that the administration of subanaesthetic doses of propofol (2 mg/kg IV) can significantly stimulate food intake in dogs after surgical procedures, with up to 87% of animals starting to eat within minutes of treatment, compared to only 5% in the placebo group. This suggests that, in some cases, a lack of immediate appetite could be related to residual anaesthetic effects or insufficient pain control (Papageorgiou *et al.*, 2021). In feline patients, it has also been observed that certain injectable anaesthetic agents may influence postoperative appetite recovery (Armstrong *et al.*, 2018). These findings highlight the importance of considering the pharmacological properties of anaesthetic agents not only for their anaesthetic and analgesic effects but also for their potential impact on early recovery behaviours such as appetite.

Physiological functions such as urination and defecation were infrequent in the immediate postoperative period, with only 3.85% of animals exhibiting these functions within the first four hours. This is an expected finding, as both general anaesthesia and perioperative fasting are known to temporarily impair gastrointestinal motility. Several studies have shown that agents commonly used to maintain general anaesthesia, such as volatile anaesthetics and propofol, inhibit peristaltic activity and delay intestinal transit through mechanisms including smooth muscle relaxation, calcium channel blockade, and reduced muscarinic receptor-induced contraction (Tonge *et al.*, 2023). These pharmacological effects contribute to delayed gastric emptying—which may be prolonged for up to 49 hours—and a significant reduction in the strength and frequency of gastrointestinal contractions, although small intestinal motility usually recovers within a few hours (Boscan *et al.*, 2014). In the present study, defecation was observed in 16% of animals on postoperative day 2 and in 4% on day 3, consistent with the expected pattern of gradual gastrointestinal recovery. These findings suggest that delayed defecation in the early postoperative period does not necessarily indicate complications, as long as normal function resumes within the first three days.

Wound care during the first week post-surgery revealed a low incidence of complications. Only one case (4%) of wound dehiscence was reported, and inflammation was observed in just 8% of animals. These low rates suggest appropriate surgical technique and adequate home management by owners. Published data suggest that the surgeon's inexperience can significantly increase the risk of wound healing complications, as prolonged surgical time

and unnecessary tissue trauma can compromise suture integrity and patient recovery (Cavagnari *et al*., 2024). Therefore, the low incidence observed in this study could partly be explained by the involvement of well-trained surgeons, reinforcing the importance of surgical experience in minimising perioperative complications and promoting optimal recovery. Moreover, the correct choice of suture pattern also plays a key role. In one study, using four-throw interrupted patterns and five-throw continuous patterns to close the incision in ovariohysterectomies, no cases of dehiscence were recorded in 120 dogs (Sylvestre *et al*., 2002). These findings highlight the importance of combining solid surgical training with well-planned closure techniques to minimise complications and ensure a smooth postoperative recovery.

The lack of association between the type of disinfectant product used and the occurrence of complications suggests that hygiene practices may play a more significant role than the specific disinfectant applied. This aligns with previous research, which found no significant differences in wound healing or infection rates between different topical antiseptics—including chlorhexidine, povidone-iodine, and saline—when used in clean surgical wounds healing by first intention (Silva *et al*., 2025). Similarly, another study observed that although 0.05% chlorhexidine diacetate exhibited superior bactericidal activity compared to povidone-iodine and saline, all three resulted in comparable outcomes in terms of wound contraction and epithelialization (Sanchez *et al*., 1988). This indicates that, as long as proper hygiene is maintained and excessive manipulation of the wound is avoided, the choice of disinfectant may not be a determining factor in successful wound healing.

The incidence of postoperative signs recorded during the follow-up visit was relatively high (88%), although most findings were mild and self-limiting in nature. Wound licking and lethargy were the most frequently reported signs, consistent with previously described behaviours in animals recovering from routine surgeries. The increased frequency of these signs in cats, particularly wound licking (57.1%), may be attributed to species-specific behavioural tendencies and differences in how discomfort is expressed. Similarly, the presence of lethargy in 28.6% of cats and 17.6% of dogs reflects a normal response to surgery and perioperative medications, rather than a specific complication. Similar findings were reported by others authors, who observed transient reductions in activity, changes in movement, and increased resting behaviour in cats up to three days post-ovariohysterectomy or castration, reinforcing the

interpretation of such signs as expected responses to surgical intervention and perioperative medication, rather than complications per se (Väisänen *et al.*, 2007).

When evaluated by procedure type, animals undergoing ovariohysterectomy exhibited a slightly higher number of postoperative signs compared to those undergoing castration. This could suggest a greater degree of surgical stress or discomfort associated with the more invasive nature of OVH. Supporting this, a significant increase in serum cortisol concentrations has been reported at both 30 and 120 minutes after ovariohysterectomy in free-roaming female dogs, compared to baseline values. Cortisol, being a key biomarker of physiological stress, reflects the systemic impact of surgical trauma and nociceptive stimuli associated with the procedure, offering endocrine evidence consistent with heightened postoperative stress and discomfort (Nenadović *et al.*, 2017). Furthermore, another study found that female dogs undergoing ovariohysterectomy experienced minor local reactions, such as mild swelling or discharge, although there were no significant differences in infection rates or systemic complications (Burrow *et al.*, 2005). However, the low incidence of true complications, such as wound inflammation (8%) and dehiscence (4.3%), indicates that surgical and postoperative management was generally effective. Notably, no cases of wound infection, bleeding, or pain on palpation were reported, reinforcing the adequacy of the analgesic protocols and hygiene measures implemented.

One of the main limitations of this study is the relatively small sample size, which may affect the representativeness of the results and limit their extrapolation to larger populations. Furthermore, the assessment of postoperative pain involved a certain degree of subjectivity, particularly in dogs, for which no validated and standardized pain scale was used. Instead, pain evaluation was based solely on the presence or absence of certain behaviours associated with discomfort. This lack of specific and quantifiable measurement tools could have impacted the accuracy of interpreting the animals' actual level of pain. Therefore, future studies should consider increasing the sample size and employing objective, species-specific, validated pain assessment methods to obtain more robust and comparable data.

5.   Conclusions

The overall incidence of postoperative clinical signs was high (88%); however, most manifestations were mild and self-limiting, without interfering with recovery. The most frequently observed signs were wound licking and lethargy, particularly in cats, suggesting species-specific behavioral responses to postoperative discomfort. Pain was more frequently reported in females undergoing ovariohysterectomy, in alignment with previous studies that associate this procedure with a higher degree of surgical stress. Despite these observations, the rate of true postoperative complications—such as wound inflammation or dehiscence—was low, indicating both appropriate surgical technique and effective postoperative management. Furthermore, no association was found between the type of topical antiseptic selected by owners and the occurrence of local complications.

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