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Effect of intravenous and intraperitoneal lignocaine on post operative pain scores in dogs undergoing ovariohysterectomy#

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Abstract

The study was conducted in twelve female dogs of different breeds, randomly divided into two groups of six dogs each. All dogs underwent a comprehensive pre-anaesthetic evaluation prior to surgery. One hour before the procedure, the dogs received firocoxib orally. Pre-anaesthetic medication included injections of xylazine and buprenorphine, followed by induction with ketamine and midazolam. In Group I, lignocaine was administered during induction followed by a constant rate infusion (CRI), while in Group II, lignocaine was applied directly to the peritoneal cavity and viscera during surgery. Anaesthesia was maintained with isoflurane in both the groups. The quality of sedation, induction and recovery from anaesthesia was noted as excellent in both groups. Haematological and serum biochemical parameters varied within normal acceptable ranges and showed no significant differences between the groups. Electrocardiographic parameters, blood pressure values and blood gas parameters also remained within normal limits, without significant differences between the groups. Pain scores were lower in Group II compared to Group I, although the difference was not statistically significant. Both multimodal anaesthetic protocols proved effective in managing postoperative pain in dogs.

Keywords: *Pain, multimodal anaesthesia, multimodal analgesia, OHE, GCMPS*

Pain is a complex amalgamation of physiological and chemical responses that lead to the perception of an unpleasant sensation following tissue damage (Beckman, 2006). Ovariohysterectomy, the standard procedure of sterilisation for female dogs, has been recognised to induce acute pain, encompassing both somatic and visceral pain elements. When inadequately managed, this acute pain can progress to chronic postoperative pain, significantly impacting the recovery of the patient and quality of life (Jin and Chung, 2001). Optimum pain management during surgical procedures can be achieved by multimodal anaesthetic protocols (Sooryadas *et al*., 2019) which includes small doses of multiple nervous depressants combined to get the positive effects of an anesthetic mixture while minimising the disadvantages of each individual component. Kehlet and Dahl (2003) pointed out that effective perioperative pain management

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requires a carefully balanced multimodal analgesic approach and an appropriately balanced anaesthesia protocol. This is essential for controlling the intricate humoral and neurological responses that occur following surgery. Combining systemic analgesics with locoregional anaesthesia techniques provides a multimodal approach to pain management, reducing the dosage and potential side effects of systemic analgesics and anaesthetic drugs (Grubb and Lobprise 2020). As most studies focus on different multimodal analgesic approaches for pain management, our objective was to evaluate the effect of intraperitoneal lignocaine application compared to intravenous lignocaine in managing intraoperative and postoperative pain in dogs.

Materials and methods

The study was conducted in twelve young female dogs less than four years of age irrespective of breed presented for ovariohysterectomy procedure in Teaching Veterinary Clinical Complex, Mannuthy and University Veterinary Hospital, Kokkalai. All the dogs were subjected to thorough pre-anaesthetic evaluation including complete blood count, serum biochemical parameters, arterial blood gas analysis, electrocardiographic evaluation and blood pressure monitoring, to assess the functional status of vital organs. Based on the pre-anaesthetic evaluation, all the dogs were assigned American Society of Anaesthesiologists (ASA) status I. Food and water were withheld for 12 hours and six hours respectively before the surgical procedure. Tab. firocoxib was given orally at the dose rate of 5 mg/kg bodyweight, one hour prior to pre-anaesthetic medication to all dogs under study. One hour later, inj. xylazine 0.25 mg/kg bodyweight and inj. buprenorphine 20µg/kg bodyweight were administered intravenously as pre-anaesthetic medication. After five minutes, anaesthesia was induced using inj. ketamine at 2.5 mg/kg bodyweight and inj. midazolam at 0.05 mg/kg bodyweight intravenously in dogs of both groups. In Group I dogs, after induction of anaesthesia, inj. lignocaine at 2 mg/kg bodyweight was administered as a loading dose for analgesia followed by inj. lignocaine at 50µg/kg/min as CRI using a volumetric infusion pump and in Group II dogs, a placebo CRI was administered using normal saline at the same fluid rate. All the dogs were pre-oxygenated for two minutes after endotracheal intubation and anaesthesia was maintained using isoflurane 2% in oxygen.

The surgery was done as per the standard procedure.The dogs were positioned in dorsal recumbency and a midventral skin incision was made (Fig. 1). In Group I dogs, the ovaries along with the suspensory ligaments on both sides were identified, exteriorised. In Group II dogs, before exteriorising the ovaries and suspensory ligaments, inj. lignocaine at the dose rate of 4 mg/kg bodyweight was calculated and two third of this calculated volume was splashed onto the parietal peritoneum lining the abdominal wall on both sides of incision (Fig. 2**)**. The

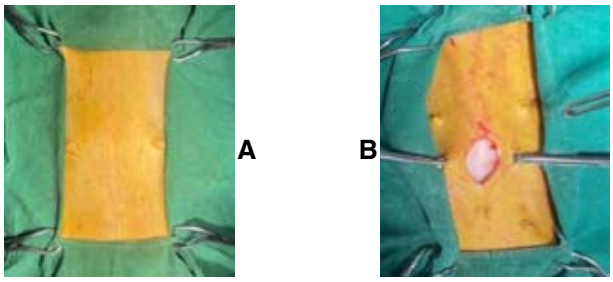

Fig. 1. A- Surgical draping **B-** Skin incision

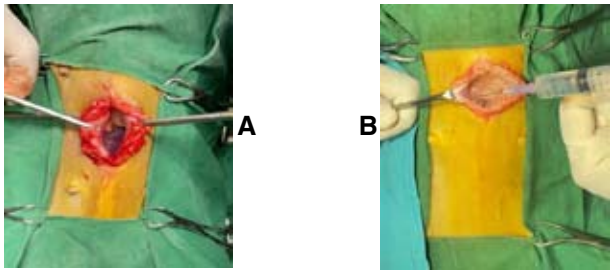

Fig. 2. A- Linea alba Incision **B**- Splash block on peritoneum

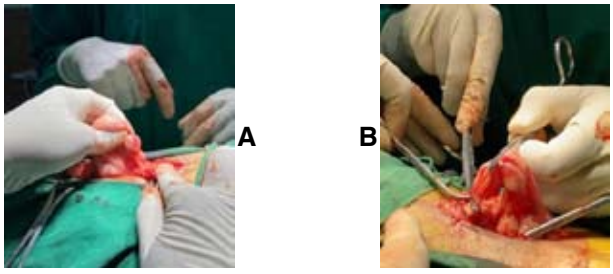

Fig. 3. A- Exteriorisation of ovary **B**- Resection of ovary and adnexa

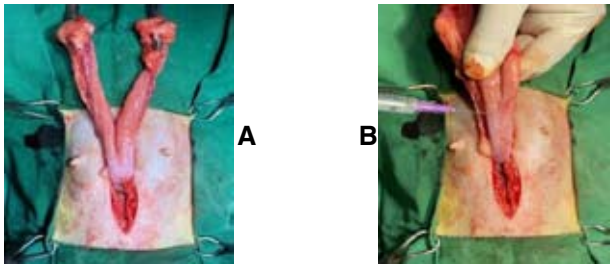

Fig 4. A- Exteriorisation of uterine body **B**- Splash block on uterine body

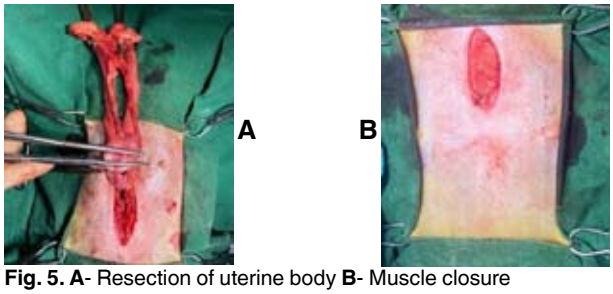

Fig. 5. A- Resection of uterine body **B**- Muscle closure

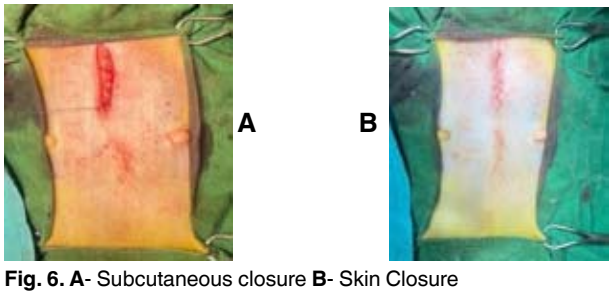

Fig. 6. A- Subcutaneous closure **B**- Skin Closure

ovarian pedicles were then clamped with artery forceps, ligated with polyglactin 910 (2-0) and resected (Fig. 3).

The uterine body was then exteriorised and resected in Group I dogs as per standard procedures and in Group II dogs, the remaining one-third of the calculated volume of lignocaine was splashed over the uterine body (Fig. 4) before its resection (Fig. 5). The abdominal wall was closed following standard procedure (Fig. 6). All the dogs were given inj. ceftriaxone at the dose rate of 25 mg/kg bodyweight intravenously before the surgical procedure. It was followed by cephalexin at a dose rate of 20 mg/kg body weight for seven days and meloxicam at 0.2 mg/kg body weight for three days postoperatively, administered orally starting from the next day. All the vital parameters were monitored from the time of preanaesthetic administration till recovery.

The venous blood samples were examined before anaesthesia, during anaesthesia and after recovery from anaesthesia for complete blood count evaluation and for serum biochemical evaluation. Arterial blood was collected from either femoral artery or from dorsal pedal artery and examined for arterial blood gas analysis before premedication, after anaesthesia and after recovery. Non-invasive blood pressure monitoring and electrocardiographic examination were conducted before and during anaesthesia and after recovery from anaesthesia. Tissue oxygenation status was assessed through capillary refill time (CRT), colour of visible mucous membrane in gums and by pulse oximetry. Postoperatively, the pain scores of all dogs were assessed starting one hour after complete recovery using the Glasgow Composite Measure Pain Scale (GCMPS) at hourly intervals for four hours. The duration of surgery averaged fifty minutes in both groups and the same standard operating procedure was followed for all the dogs in the study. Although the surgeries were performed by different surgeons, postoperative pain scoring was conducted by a single evaluator. The statistical analysis was done by SPSS version 24.0 and Mann- Whitney U test and Friedman test was employed to statistically analyse the data.

Results and discussion

The dogs selected for the study were of mixed breeds in both groups and aged between seven months to four years. The mean bodyweight of dogs in Group I and Group II were 15.68 ± 3.51 and 13.00 ± 0.95 respectively. The selection and allotment of dogs to each group were random and totally unbiased. This is in accordance with Ramankutty (2008), Peeters and Kirpensteijn (2011) in which they have randomly selected dogs of mixed breeds aged between seven months to ten years for ovariohysterectomy.

The quality of sedation and quality of induction of anaesthesia were found to be excellent and was in accordance with the observations of Dinesh *et al*. (2019) where midazolam and ketamine were used for induction prior to isoflurane maintenance in dogs. Proper muscle relaxation was observed in all dogs which facilitated a smooth endotracheal intubation for anaesthetic maintenance.

The circulatory system functioning was monitored through heart rate and non-invasive blood pressure measurement and was found within the normal physiological ranges throughout the anaesthetic maintenance. The CRT remained less than two seconds and the colour of gums was pale roseate throughout the surgery. This was found in accordance with Bednarski *et al.* (2011) suggestive of sufficient perfusion in the anaesthetised patients.

The mean extubation time for Group I and Group II dogs were 6.50 ± 0.61 and 5.50 ± 0.22 respectively after discontinuing the inhalant anaesthesia at the end of surgery and the quality of recovery was found perfect and smooth in three dogs in each group (I_3, I_4, I_6, &II_1, II_2, II_3) whereas the other dogs had good recovery with minimal ataxia (I_1, I_2, I_5, & II_4, II_5, II_6). The observations were assessed as per Love *et al*. (2013).

Heart rate and rate of respiration were within the normal range throughout the observation period while rectal temperature was found decreasing throughout the anaesthetic maintenance (Aarnes *et al*. 2017), suggestive of hypothermia associated with CNS depression due to anaesthetics (Davies, 2012).

Haematological parameters were found within normal range throughout the observation period with non-significant variations observed within each group at different time point of observations. This was in accordance with Dewangan *et al*. (2016), Kumari *et al.* (2018) and Poonia *et al.* (2022).

The serum biochemical parameters did not show any significant variation between both groups and was found similar to the observations made by Singh *et al.* (2010) and Kumar *et al.* (2023).

The blood gas values (pH, P_aCO_2, P_aO_2), blood pressure readings (systolic and diastolic blood pressure, mean arterial blood pressure) and electrocardiographic parameters (P duration, P amplitude, QT interval, QRS complex) were found within the normal limits throughout the observation period.

The post-operative pain was measured for four consecutive hours following the end of surgery. GCMPS was used to assess the pain score in each animal under study during the post-operative period (Mitra *et al*., 2021). The purpose was to identify any animal that require rescue analgesia. GCMPS included a questionnaire which asked the evaluator about the patient status at rest, during walk

and during touch. It demonstrated a superior sensitivity in identifying the need for rescue analgesia and exhibited high correlation between experienced and novice evaluators (Tomacheuski *et al*., 2020). All the dogs under study exhibited a moderate pain response during the first two hours on palpation around the surgical site followed by a reduction in pain response in the subsequent hours (Fig. 7). The pain score obtained in third and fourth hours were lower and statistically significantly different ($p<0.05$) from that of first hour in both groups (Table 1). All the dogs were able to stand and walk on its own without any inhibition from first post-operative hour itself. There was no need for any rescue analgesia in the post-operative period. It could be attributed to the multimodal analgesic protocol employed in the surgery which was sufficiently effective in mitigating the upregulation of pain pathways and the onset of central and peripheral sensitisation (Gomez, 2017). Pain score values in Group II were lower compared to Group I, which can be attributed to the direct application of lignocaine into the viscera. However, the difference was not statistically significant ($p>0.05$) (Table. 1).

Conclusion

Both multimodal anaesthetic protocols employed in the present study provided sufficient analgesia during the intra-operative and post-operative period which resulted in lower pain score values in both groups causing no requirement for any rescue analgesics. The effectiveness of both anaesthetic protocols were satisfactory. Intraperitoneal application of lignocaine was found to reduce the pain score values in surgical patients although not significantly different from systemic administration of lignocaine.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

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Table 1. Comparison of pain score values in different post operative hours

	Post op 1hr	Post op 2hr	Post op 3hr	Post op 4hr	p-value
Group I	1.5[a]	1[a,b]	0.5[b]	0[b]	0.006
Group II	1.5[a]	1[a,b]	0.5[b,c]	0[c]	0.002
p-value	0.93	0.65	0.60	0.14	

Median with different superscript (a-c) in a row differ significantly ($p<0.05$)

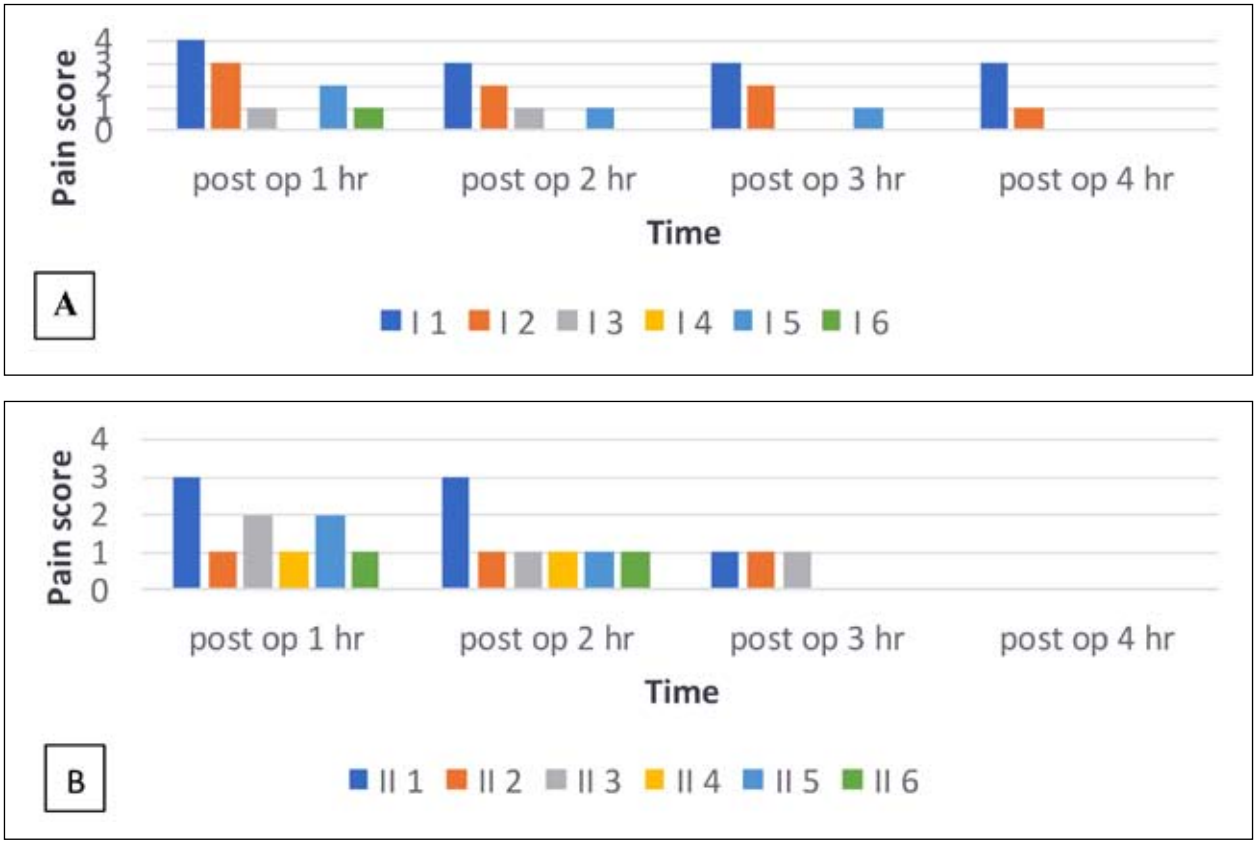

Fig. 7. A- GCMPS- Group I, **B-** GCMPS-Group II

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