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Analgesic Effects of Lignocaine Alone and in Combination with Meloxicam Administered Epidurally in Dogs Undergoing Femoral Exposure

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Abstract The experiment was done to evaluate and compare the analgesic effects of lignocaine alone and in combination with meloxicam administered epidurally in dogs undergoing femoral exposure. Eight (n=8) apparently healthy Nigeria local dogs with average weight 9.6kg were used for the research. They were randomly grouped into two groups (A and B) of four dogs each. Pain assessment was done using physiologic parameters (temperature, pulse rate and respiratory rate), haematologic parameters (total WBC count and differential neutrophil count) mined using clinical algometer at o minute and subsequently and 30, 60, 90,120,150 and 180 minutes respectively. The mean values of each parameter were subjected to student t-test with p-values (0.05).Pain threshold showed no significant difference between group A and B ($p>0.05$).There was no significant difference between the two groups with respect to rectal temperature ($p>0.05$). For pulse rate, significant difference was observed between group A and B($p<0.05$).For respiratory rate, there was significant difference between the two groups ($p>0.05$).Differential neutrophil count statistical analysis revealed no significant difference between the two groups ($p>0.05$).There was no significant difference at any time interval between the two groups with respect to Complete White Blood Cell Count($p>0.05$).It was concluded that combined lignocaine and meloxicam administered epidurally rendered prolong analgesia than use of lignocaine alone without any postsurgical complication.

Keywords: Analgesic effect of lidocaine, Meloxicam administered, Dogs Femoral Exposure.

Background Information

Epidural anaesthesia involves administration of anaesthetic agents through an intervertebral space into the epidural space, i.e the space between the dura matter, the periosteum and arachnoid. It is used to produce block in spinal nerves conduction before they enter the intravertebral foramina (Spenser *et al.*, 1980). In dogs, the injection of the local anaesthetic agent is made in the lumbo-sacral space (Aliu, 2011).The use of this technique may provide preemptive analgesia by inhibiting central sensitization and modulating afferent signals to the dorsal horn, reducing pain and inhalant or analgesic requirement during peri-operative period. Epidural analgesia suppress the markers of stress response as represented by decrease in serum concentration of cortisol and norepinephrine for up to 48hours after administration in dogs (Sayyed *et al.*, 2015).

Indication for caudal epidural anaesthesia in dogs may include most soft tissues surgical procedures around pelvic or inguinal region and hind limb fracture repairs (Jagdeeps *et al.*, 2018). Local anaesthetic agents are sometimes combined with analgesic agents, and can be effective in varieties of surgical procedures such as cesarean section, orthopaedic procedures in the hind limb and soft tissues surgeries.

The benefit of this technique often outweighs the risk (Hanse, 2003).However, clinicians should be aware of the potential complications such as technical failure, accidental intrathecal injection, hypotheism neurological deficit, delayed hair growth, pruritus and urinary retention (Hanse, 2003).Non-steroidal Anti-inflammatory Drugs (NSAIDS) also called antipyretic analgesic and they are a group of chemically dissimilar agents that differ in their antipyretic, analgesic and anti-inflammatory activities are used for moderate pain (Aliu, 2011).Meloxicam and piroxicam fall under this group and are class of enolic acids that have anti-inflammatory, antipyretic and analgesic activities. Meloxicam is a potent long acting NSAIDS with a plasma half-life of nearly 2 days. It is suitable for use as short term analgesic and long term anti-inflammatory drugs (Aliu, 2011).

Statement of the Problem

The assessment and management of pain in human and animals has generated unprecedented discussion in the last 20 years (McMillian, 2003). In veterinary field, heightened awareness to pain has prompted several professional organization, veterinarians and pet owners to make formal position statement on pain relief and pain control with less or no post-surgical complications essential for successful surgical procedures (McMillian, 2003).

Orthopaedic surgery can result to severe post-operative pain (Mathew, 2014).There is need for preemptive analgesia that can provide prolong pain relief and shorter recovery period than administering analgesia after painful procedure (Bromley, 2006).

Analgesic protocol involving a sole agent may be a problem because no single agent can provide quick onset of action, prolong analgesia, smooth recovery and devoid of post-operative complication (Swindle *et al.*, 1998).

Justification

Procedures done using caudal epidural anaesthesia are usually accompanied with reduced pain and distress, less risk of intra-operative cardiopulmonary embarrassment. Hence, the use of various readily available anaesthetic and analgesic combinations for epidural technique needs to be known with respect to their effectiveness on surgical and obstetrician interference.

Lignocaine is a local anaesthetic that is frequently used in veterinary medicine due to its fast onset of action (5 to 10 minutes) and low toxicity (Swindle *et al.*, 1998). Hence, there is need for study and research on the use of combination of a drug with lignocaine to compensate for its short analgesic half-life. Meloxicam as an NSAID has long lasting half-life 22 to 23 hours (Aliu, 2011), hence its combination with lignocaine will compensate for lignocaine short analgesic duration of action but there is less information on how safe the combination of the two drugs could be (Aliu, 2011).

Aim and Objectives

Aim

The aim of the study is to evaluate and compare the analgesic effect of lidocaine alone and in combination with meloxicam administered epidurally in dogs undergoing femoral exposure.

Objectives of the Study

1. To evaluate and compare the analgesic effects of lidocaine alone and in combination with meloxicam administered epidurally in dogs undergoing femoral exposure.
2. To evaluate and compare the analgesic effect lidocaine alone and in combination with meloxicam on physiological parameters (Rectal temperature, Pulse rate and Respiratory rate).

3. To evaluate and compare the analgesic effect lidocaine alone and in combination with meloxicam on Haematological parameters (Differential Neutrophil Count and Complete White Blood Cell Count).

MATERIALS AND METHODS

Study Area

The research was carried out in Veterinary Teaching Hospital, Usmanu Danfodiyo University, Sokoto. The kennel was properly cleaned, disinfected and fumigated prior to introduction of the dogs.

Experimental Animals

Eight (*n*=8) apparently healthy Nigerian local dogs five(5) males and three(3) females with average weight of (9.6±2.1) kg were used for the research. The dogs were sourced from Sokoto metropolis and kept at Usmanu Danfodiyo University Veterinary Teaching Hospital facilities for acclimatization. They were acclimatized for two weeks during which prophylactic treatment was given and food and water were supplied *ad lib.*

Experimental Design

The dogs were randomly grouped into two groups (A and B) of four dogs each. The dogs in each group were identified as A1, A2, A3 and A4 (control group) and B, B2, B3 and B4 (experimental group).

Pre-surgical Evaluations

They were conditioned for two weeks during which they were evaluated and stabilized for surgery. During evaluation, Rectal temperature, Pulse rate and Respiratory rate were monitored daily and serial blood sampling was done for comprehensive haematology to ascertain that the dogs are fit for surgery. The dogs were maintained on a daily meal comprising table remnants.

Animal Preparation

Hair around the proposed surgical site (left lateral thigh) of each dog was shaved. The site was scrubbed with purit® aseptic solution containing Chlorhexidine Gluconate B. P 0.3% W/V (Saro Life Care Limited ,Lagos, Nigeria) and rinsed with Methylated spirit (Binji Pharmaceutical Company, Sokoto, Nigeria).

Anaesthetic Protocol

Acepromazine (0.3mg/kg) was administered intramuscularly as premedicants. Lumbo-sacral epidural anaesthesia was achieved with plain lignocaine hydrochloride (5mg/kg), B.P 2% (Sahib Singh Agencies, Munbai, India) for Group A dogs (control group) and lignocaine/meloxicam (5mg/kg / 0.3mg/kg), also administered epidurally respectively .

Animal grouping

The Groups, Number of Dogs and Drug used respectively

Groups	Number of dogs	Drug used
A	4	Lignocaine
B	4	Lignocaine +Meloxicam

Surgical Procedure

The skin incision was made along the craniolateral border of the femoral shaft from a point distal to the greater trochanter to the point proximal to the patella (**Plate 3.1**).The femur was exposed **(Plate 3.3**), according to the standard procedure described by (Bruno,2021). The muscular layer was sutured using simple continuous suture pattern with chromic catgut size 2.0. The subcutaneous layer was then sutured using subcuticular suture pattern .The skin was sutured using simple interrupted suture pattern using nylon size 2.0.

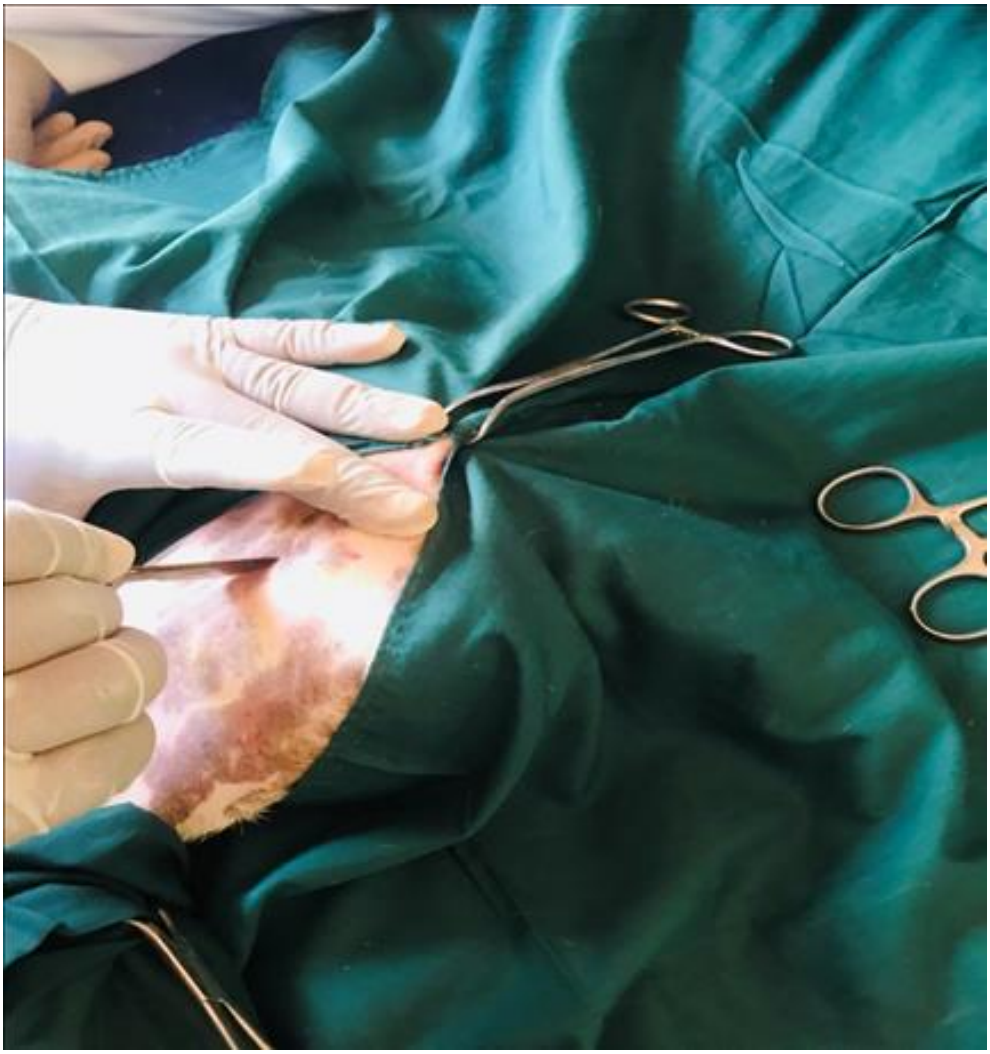

Plate 3.1: Skin Incision

Plate 3.2: Exposure of the femur

Plate 3.3: Skin closure

Plate 3.4: Algometer

Evaluation of Physiological Parameters

The vital parameters which includes temperature was taken using a thermometer ,pulse rate was taken using the femoral artery and respiratory rate was taken using abdominal movement. The assessment of these parameters were recorded pre-operatively at 0min. and subsequently at 30min, 60min, 90min 120min,150min and 180min post-surgery.

Mechanical Pain Threshold Assessment

The clinical Algometer (Plate 3.4) was used to measure post-operative analgesia .The device was applied to four different areas 1cm away from the incision (cranially, caudally, proximally and distally).The pain assessment was done pre-operatively at 0min and subsequently at 30min,60min, 90min 120min,150min and 180min post-surgery.

Blood Sampling

Two millimeter of blood sample was collected from the cephalic vein of each dog and was recorded pre-operatively at 0min and subsequently at 30min, 60min, 90min, 120min,150min and 180min post-surgery.

Evaluation of Complete White Blood Cell

About 0.38ml of Turk's solution and 20µl blood were put in a test tube. The blood and Turk's solution were mixed by shaken with thumb and finger over the end. The Neubauer Chamber was charged with the mixture using Micropipette. The counting chamber was placed on the microscope stage and allow for 2-3min.The number of white blood cells in four large corner square marked "W" were counted. Cells touching the lower the lower and right margins were excluded while cells touching the left-hand lines or upper line of the square are included. After counting of the cells the Total WBC count using the formula TLC= Total Cells (4 squares) x 50 (Randy, 2003).

Evaluation of differential neutrophil count analysis

To determine the differential neutrophil count, a drop of blood was thinly spread over a glass slide, air dried, and stained with a Romanowsky stain or May-Grunewald-Giemsa technique. Two hundred cells were then counted and multiplied by 100 .This was done in accordance to (Randy, 2003).

Statistical Analysis

The results were presented in graphs. The mean and standard deviation of the, pulse rate, respiratory rate, rectal temperature, algometer readings, differential neutrophil count and complete WBC count were analyzed using paired t-test.

RESULTS

The mean value of pain threshold for group A and B were presented in figure 1.0 .The highest values of 39.85 ± 13.81 and 27.30 ±8.00were recorded for both group A and B at 0minute and 60minutes respectively while lowest values(2.58 ± 0.40)and (11.4 ± 3.4) for group A and B were recorded at30minutes and 120minute respectively. Statistical analysis revealed no significant difference between group A and B ($p>0.05$) at any time interval.

Physiological parameters

The mean values of temperature for group A and B were presented in figure 2.0 .The highest values 39.18 ± 8.59 and 38.51 ± 8.37 for group A and B were recorded respectively at time 0minutes in both groups while the lowest values 37.30 ± 7.20 and 37.4 ± 7.40 for group A and Bwere recorded at 120minute in both groups. There was no significant different between and within the two groups ($p>0.05$).

The mean values of pulse rate for group A and B were presented in figure 3.0. The highest values 77 ± 22 and 77.5 ± 18.43 for group A and B were recorded at 30minutesand 0minutes respectively while lowest values 65.00 ± 14.00 and 69.00 ± 16.12 for group A and B were recorded at 120minute and 90minute respectively. There was no significant difference between group A and B at any time interval between group A and B ($p>0.05$).

The mean values of respiratory rate for group A and B were presented in figure 4.0. The highest values 37.00±7.57and 34.50 ±6.4 for group A and B were recorded respectively at 120 minutes and 0minute respectively while the lowest values 24.4± 3.3 and 18.20±2.4 for group A and B were observed at 0minutes and 120minutes respectively .There was significant difference between the two groups ($p<0.05$).

Haematological Parameters

The mean values of differential neutrophil count for group A and B were presented in figure 5 .The highest values 65.00 ± 16.10 and 55.70 ± 12.3 for group A and B were recorded at time 60minute and 30minute respectively while the lowest values 56.75 ± 8.4 and 48.90 ± 16.00at time 90minute and 60minute respectively**.** There was no significant difference at any time interval between group A and B ($p>0.05$).

The mean values of complete WBC count for group A and B were presented in figure 6 .The highest values$18.1x10^3$ ± $0.25\mu x10^3$ for group A and B were recorded at 0minute and 150minute respectively while the lowest values $10.1x10^3\mu l$ ± $1.2.2x10^3\mu l$ for group B were recorded at 120minutes and 0minute respectively**.** There was no significant difference at any time interval between group A and B ($p>0.05$).

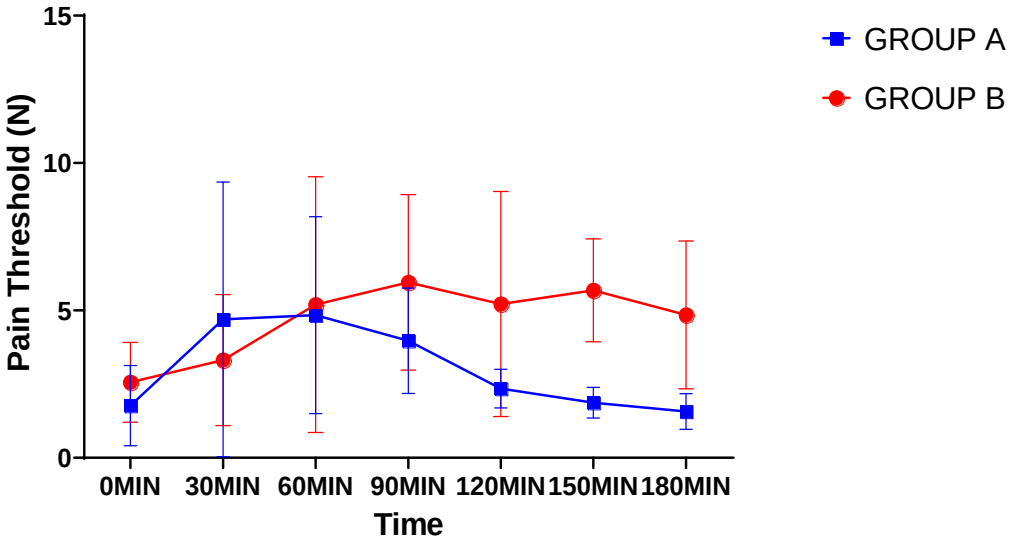

Figure 4.1 Showing comparative analgesic effects on pain threshold

Key: Group A (lignocaine group)

Group B (lignocaine + meloxicam)

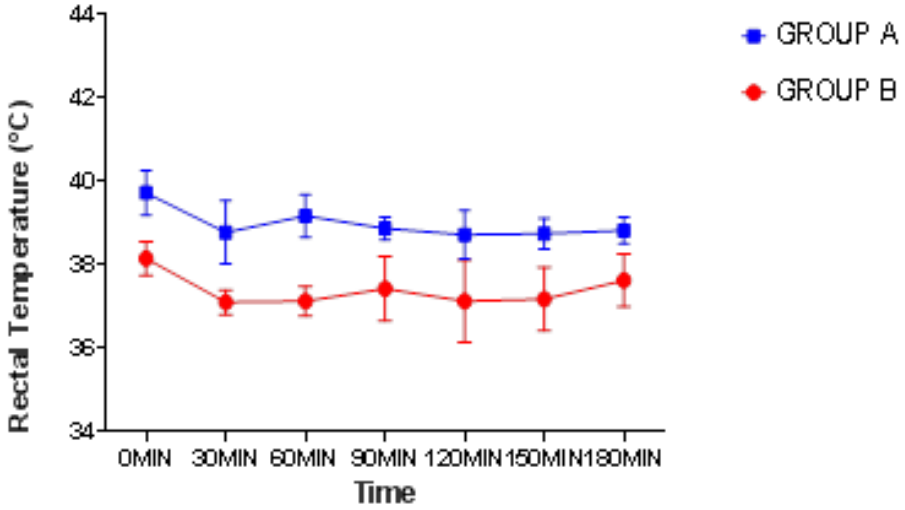

Figure 4.2 Showing comparative analgesic effect on rectal temperature.

Key: Group A (lignocaine group)

Group B (lignocaine + meloxicam)

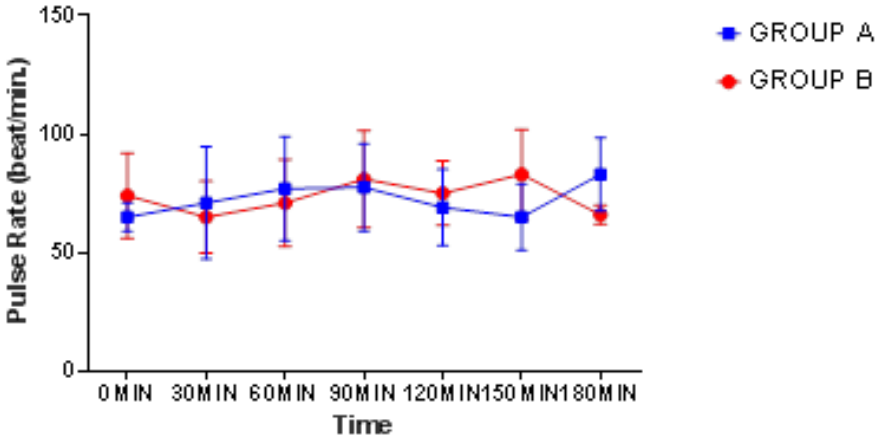

Figure 4.3 Showing comparative analgesic effect on pulse rate

Key: Group A (lignocaine group)

Group B (lignocaine + meloxicam)

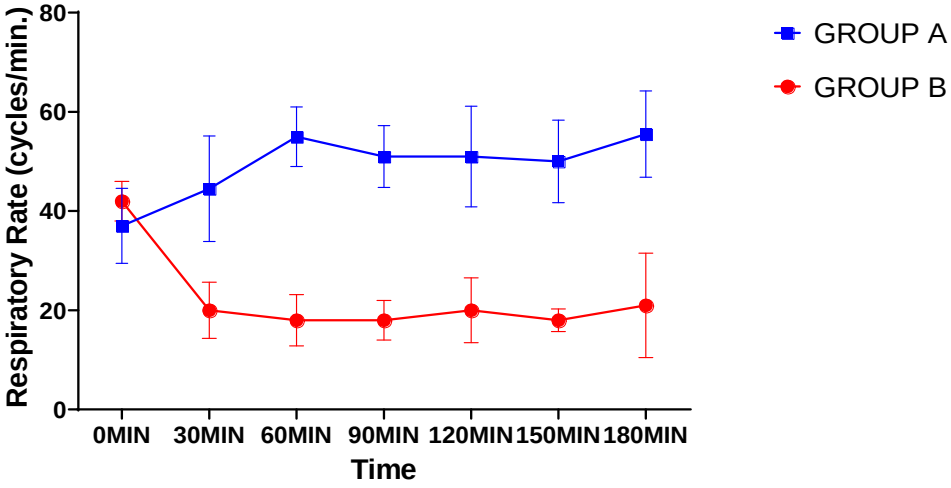

Figure 4.4Showing comparative analgesic effect on respiratory rate

Key: Group A (lignocaine group)

Group B (lignocaine + meloxicam)

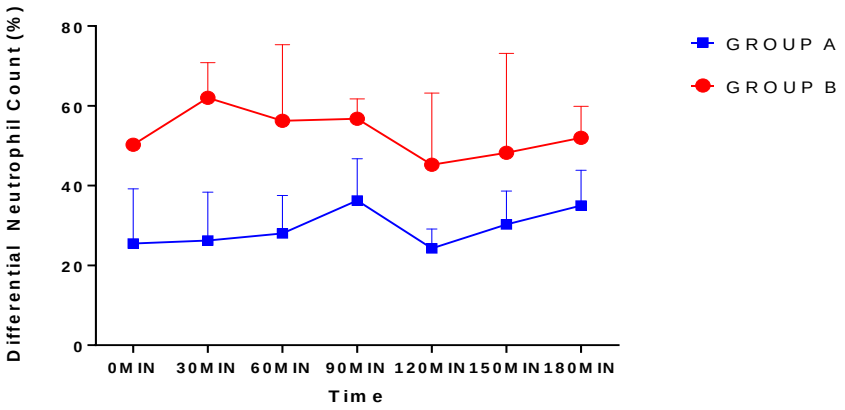

Figure4.5 Showing comparative analgesic effecton differential neutrophil count

Key: Group A (lignocaine group)

Group B (lignocaine + meloxicam)

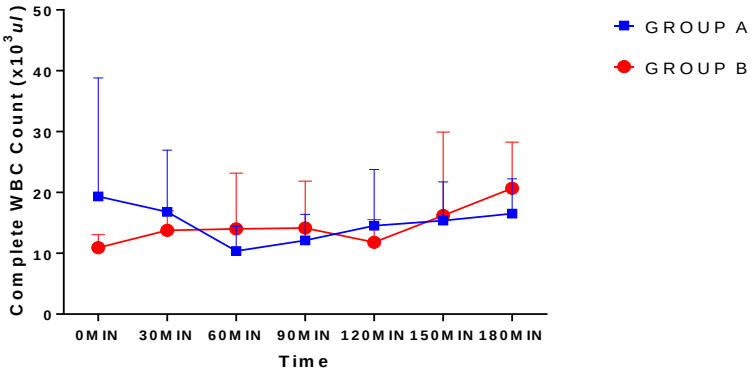

Figure 4.6 Showing comparative analgesic effect on WBC count (x10³µl).

Key: Group A (lignocaine group)

Group B (lignocaine + meloxicam)

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

Discussions

Epidural administration of local anesthetics and analgesics is an effective tool for veterinary anesthesia and analgesia. This technique is very useful for surgical procedures caudal to the diaphragm but is particularly well suited for procedures involving the hind limbs, pelvis and perineal region. Depending on what agent is used, desired results can be achieved with local anesthetics or analgesics involving orthopaedic management of hind limbs, pelvis and perineal region (Gary *et al*. 2004).The degree of post operative pain is related to the procedure performed (Gaynor, 2007).

In order to increase sensitivity and decrease biars while measuring pain parameters, multiple objective and subjective and subjective pain assessment methods needs to be use. In this research the mechanical pain threshold measured was not statistically significant in both groups .This could be indication of the analgesic effect of the two drugs .This finding is consistency with (Teng-yu *et al.*, 2013) who reported that lignocaine combined with meloxicam provide adequate and prolong analgesic effect. Also, consistent with (Gary, 2004) who reported that lignocaine has 60-90minutes effective analgesic effect duration.

Physiological parameters used for assessment of acute pain are temperature, pulse rate and respiratory rate, arterial pressure and mydriasis (Aliu, 2011). In this study, the temperature and pulse rate were normal and not statistically significant (P>0.05) for both groups at any time interval. However, the respiratory rates were statistically significant at different time interval between the groups. Change in physiological parameters, despite significant different, were not clinically relevant. These changes may have been influenced by other than pain, such as environmental condition, stress associated with manipulation and behavior of animals (Hellyer *et al*., 2007)

Total white blood cell count and differential neutrophil count in lignocaine and lignocaine-meloxicam groups showed no significant difference (p>0.05).This finding is contrary to (Daniela *et al.*, 2018) who reported that meloxicam combined with lignocaine reduce neutrophils and complete WBC count following ring block administration for castration in cats. The difference could be due route of administration and animal species that varies.

Conclusions

The study showed that combined lignocaine and meloxicam administered epidurally rendered prolong analgesia than use of lignocaine alone without any postsurgical complication. Combined lignocaine and meloxicam if correctly dosed and administered epidurally will offer lesser or no pain in surgery involving management of pelvic and hind limb bones traumatic injuries. Combined lignocaine and meloxicam is safer and can be conveniently perform without fear of complication in dogs in the management of fracture around pelvic region and hind limb.

Recommendations

We recommend the administration of combine lignocaine and meloxicam epidurally for surgery involving pelvic and hind limb anatomical region.

We also recommend further study experiment on the clinical use of combine epidural administration of lignocaine and meloxicam in the management of traumatic injuries involving the pelvic and hind limb especially in pregnant dogs.

Further evaluation of combination therapies is needed in larger groups of dogs.

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