

## Original Research Article

# Evaluation of lumbo-sacral epidural anaesthesia or analgesia with lidocaine-acepromazine combination in dogs undergoing cystotomy

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**Received:** 10 March 2020

**Revised:** 16 April 2020

**Accepted:** 24 April 2020

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## ABSTRACT

**Background:** Epidural anaesthesia is one of the most frequently used regional anesthetic techniques recommended for surgical procedures caudal to the umbilicus in dogs. However, the use of lignocaine alone for epidural regional analgesia has been discovered to have shorter duration of analgesia and prolong onset of action, hence there is need to explore combinations of agents that will overcome this challenge. This study aimed to evaluate the anaesthetic/analgesic effect of cranial epidural anaesthesia in dogs undergoing cystotomy using Lignocaine in combination with acepromazine at the dose rates of 7 mg/kg and 0.05 mg/kg respectively.

**Methods:** Eight apparently healthy matured, male and female dogs were used for the experiment. The onset and duration of analgesia was determined. The pulse rates, respiratory rates, mean arterial blood pressure, rectal temperature, complete blood count and the oxygen saturation level were determined at baseline, intra operative and post-operative.

**Results:** There were no significant differences in all the parameters measured before and after the epidural administration of the agents. The onset of anaesthesia was rapid and the duration of anaesthesia was sufficient enough for the procedure to be carried out. However, there was significant difference in PCV, Hb and total RBC count between the baseline and other timing intervals. There were no significant differences in leucocytic and cardiopulmonary parameters between the baseline and other timing intervals.

**Conclusions:** The epidural administration of lignocaine and acepromazine combination at the doses indicated can produced sufficient epidural anaesthesia with rapid onset for the purpose of cystotomy in dogs without major systemic influence on hemodynamic and cardiopulmonary changes.

**Keywords:** Lumbo sacral, Epidural anaesthesia, Dogs, Lignocaine, Acepromazine

## INTRODUCTION

There is increased awareness of local anesthetic-induced neural blockade in dogs over the recent years. The major advantage behind this increased usage and the acceptance of the concept of blocking multimodal pathways to manage pre and post-operative animals pain.<sup>1</sup> Unlike many general anesthetics agents, that blocked the

perception of pain by inducing anesthesia in an unconscious patient, local anesthesia and regional anesthesia completely block transmission of noxious impulses in a targeted region of the body in a conscious patient.<sup>2</sup> General anesthesia may have an advantages in small animal patients that are considered difficult to handle for surgery and in some procedures where complete immobilization and relaxation of the

patient are required.<sup>3</sup> Local and regional anesthesia also decreases the quantity of opioid and inhalation anesthetic required to obtain the desired intra-operative surgical plane anesthesia.<sup>1,4</sup>

Campoy et al and Hall et al reported that local anaesthesia can be achieved using different means; topical application, infiltration, field blocks, selected nerve blocks, intravenous regional anesthesia, multiple inter-costal nerve blocks, lumbo-sacral epidural anesthesia and continuous epidural anesthesia techniques for providing surgical analgesia and anesthesia in dogs that are considered at risk for inhalant or intravenous anesthesia.<sup>5,6</sup> Continuous interpleural analgesia and epidural opioid analgesia can also be used to relieve postoperative pain following general anesthesia as reported by Skarda et al.<sup>1</sup>

Generally, the techniques of administering epidural anaesthesia have been reported to be simple, safe and effective. It is one of the most frequently used regional anesthetic techniques described for surgical procedures caudal to the umbilicus in dogs.<sup>7</sup> Currently, epidural anesthesia is recommended for cesarean section due its inability to cross placenta and cause depression of the puppies.<sup>6</sup> The bitch will remain conscious postoperative and will be able to take care of the puppies immediately after surgery.<sup>8</sup>

Lignocaine is one of the most widely utilized local anesthetics and is considered to be the prototype of the aminoamide family of drugs.<sup>6,8</sup> It was reported that, lignocaine provides quick onset and intermediate duration of action. It is commonly used for local anesthesia of peripheral nerves, neuraxial anesthesia, local infiltration, intravenous regional anesthesia (IVRA), and for topical desensitization of mucosa or skin.<sup>9</sup> It was also reported that, it can be used systemically as an intravenous agent for its analgesia, anti-inflammatory, and anti-arrhythmic effects.<sup>10</sup>

Intravenous general anesthesia is the most frequently used anesthetic protocol in veterinary surgical practice in most part of the developing countries. This is due to its availability, inexpensiveness and simple equipment for the induction and maintenance of anaesthesia when compared to inhalant general anaesthesia. However, the risk factors associated with the general anaesthesia leading to various anaesthetic emergencies are the most common challenges that discourage the choice of the general anaesthesia as the sole anaesthetic protocol in some surgical procedures in small animal practice.<sup>11-13</sup> In order to overcome these challenges associated with the general anaesthesia, there is need to explore various means of achieving surgical anaesthesia with agents that can desensitize targeted region of the body without general depression of the central nervous system. Steagall et al have reported the use of various combinations of drugs used for epidural administration to achieved anaesthesia or analgesia in small animal practice.<sup>8</sup>

However, there was no documented use of lignocaine and acepromazine combination in dogs for the purpose of achieving regional anaesthesia that can be used to perform any surgical procedure.

This study was designed to overcome some challenges associated with general anaesthesia in small animal surgery, particularly challenges related to cardiopulmonary depression induced by most injectable anaesthetic agents. The study was aimed at evaluating the effects of lignocaine and acepromazine combinations in lumbo-sacral epidural anaesthesia in dogs undergoing cystotomy. It was hypothesized that, the combinations of lignocaine and acepromazine administered through lumbo-sacral epidural space could provide sufficient analgesia for longer duration of time to conduct cystotomy with minimal alteration of physiological parameters.

## METHODS

### *Experimental animals*

This study was approved by the institutional animal care and use committee of the Usmanu Danfodiyo University, Sokoto ref. no. UDU/FAREC/2019/AUP-R0-5.

Five apparently healthy adult Nigerian local dogs, male and females were used for this experiment. The dogs were kept in the experimental animal facilities of Veterinary Teaching Hospital, Usmanu Danfodiyo University, Sokoto. They were dewormed and prophylactic antibiotic treatment was given to them prior to the commencement of the experiment. The dogs were allowed to acclimatize for two weeks to the new environment before commencing the experiment. They were fed on table remnant twice a day.

### *Baseline data generation*

Physiological vital parameters involving heart rate (HR), respiratory rate (RR) and rectal temperature (RT) were taken as a baseline data at zero time before the administration of the agents to serve as a normal control values for comparison with experimental test values. Blood samples were also collected at baseline through the indwelling cephalic catheter for hematological analysis. The saturated partial pressure of oxygen (SpO<sub>2</sub>) was also determined at zero time before the administration of the agents.

### *Preparation of the animals*

After proper physical restraint and muzzling of the dogs, a liberal area was clipped around the lumbo-sacral region up to cranial aspect and base of the tail. The lumbo-sacral area was scrubbed using Purit® (chlorhexidine gluconate 0.5%; Samstella industry, Nigeria Ltd). The dogs were placed on sternal recumbency and the seven lumbar vertebrae (L7) and the first sacral vertebrae (S1) were

palpated and located as the anatomic landmarks of deposition of the agents as described by Campoy.<sup>5</sup> The Pelvic limbs were drawn cranially to stretch out the ligamentum flavum in order to expand the intervertebral space to ensure uniform distribution of the agent as described by Tacke.<sup>14</sup> The caudal mid-ventral area was clipped and aseptically prepared with Purit<sup>®</sup>, methylated spirit and povidone iodine.

#### **Epidural drugs administration and cystotomy**

Lignocaine 20 mg/ml (Jawa pharmaceutical Ltd, Nigeria) and acepromazine 2 mg/ml (MWI animal health, USA) were combined in the same syringe and administered at the respective dose rate of 7 mg/kg and 0.05 mg/kg into the lumbosacral epidural space using 1.5 inch 21 gauge needle according to the technique described by Jones.<sup>7</sup> The correct positioning of the needle was confirmed by the absence of cerebrospinal fluid or blood at the hub and by absence of resistance while administering the agents. All the dogs underwent cystotomy through caudal mid ventral laparotomy approach after epidural administration of the test agents according to standard procedure described by Fossum et al.<sup>15</sup>

#### **Assessment of the quality of anaesthesia/analgesia**

Sensory blockade was indicated by absence of groaning, biting attempts, looking at the limb and head shaking by inflicting painful stimulus using Allis tissue forceps on inter-digital space of hind foot after administration of the agents and after every 5 minutes while the surgical procedures were going as described by Dzikiti et al.<sup>16</sup> The onset and duration of the analgesia were determined and recorded following disappearance of the pedal reflex.

#### **Cardiopulmonary and hematological evaluations**

The respiratory and heart rates were measured using stethoscope (Littmann<sup>®</sup> India), while rectal temperature was determined using digital clinical thermometer (united surgical diagnostic company, India). Blood samples (5 mL) were collected pre, intra and post-operative intervals from the indwelling cephalic catheter after the onset of analgesia. The blood samples were preserved in a 5 mL EDTA sample bottle (Frank healthcare Co. Ltd, China) for complete hematological analysis using fully automated blood cell counter (PCE-210, ERMA Inc. Tokyo, Japan). The saturated partial pressure of oxygen (SPO) was determined using pulse oximeter (PC=66V<sup>®</sup>, hand held pulse oximeter; Devon medical groups).

#### **Data analysis**

The data generated were tabulated and expressed as mean  $\pm$  SEM from the raw data. One-way ANOVA with repeated measures was used to compare the means of the hematology and cardiopulmonary parameters at baseline with other timing values. Statistically significant values

were considered when p value is  $<0.05$ . GraphPad in STAT statistical package was used for the data analysis.

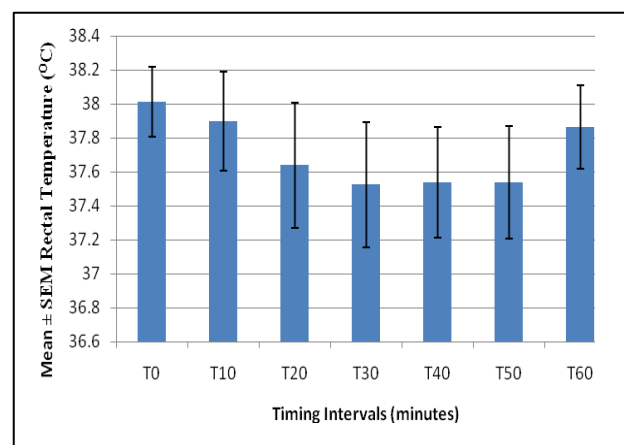
## **RESULTS**

#### **Evaluation of analgesia**

The average onset and durations of analgesia were  $2 \pm 0.42$  minutes and  $122.3 \pm 14.23$  minutes respectively. The average duration of the surgical procedure was  $79.1 \pm 5.83$  minutes. At early onset of analgesia, the degree of desensitization was lower about 1-2 ratchets response of the pain infliction with Allis tissue forceps. Whereas after 5 minutes of onset of analgesia, when the neuronal blockade was ascertained, there was no response to mechanical pain inflicted at maximum third ratchet of the Allis tissue.

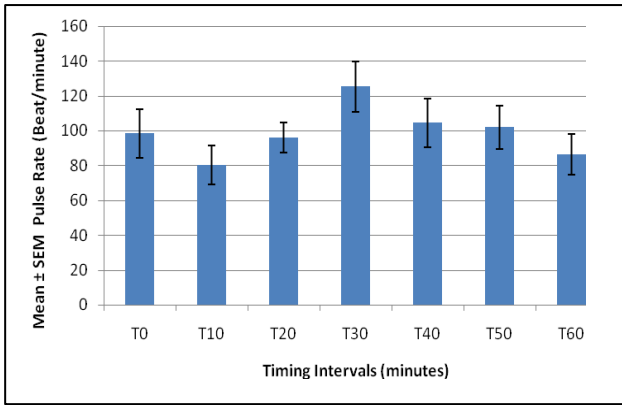
#### **Effects of cardiopulmonary parameters following epidural anaesthesia/analgesia**

There were no significant changes ( $p=0.8542$ ) in the mean rectal temperature when baseline mean was compared with other the mean of other timing intervals. However, rectal temperature appeared to be higher at baseline but it slightly decreases during anaesthesia in the first 50 minutes duration of anaesthesia. The rectal temperature rose again at 60 minutes of the anaesthesia duration but it was not above the level recorded at the baseline. The rectal temperature fluctuations were within the normal physiological range (Figure 1).



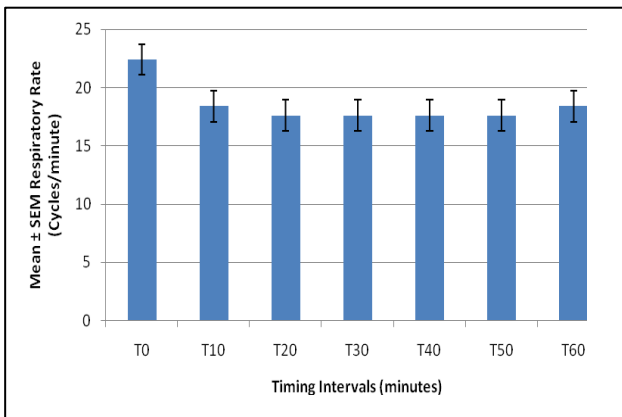
**Figure 1: Pattern of mean rectal temperature (°C) before and after the epidural anaesthesia in the dogs undergoing cystotomy administered with epidural anaesthesia using lignocaine and acepromazine combination.**

There were also no significant changes ( $p=0.1734$ ) among the mean pulse rate before and after administration of the epidural lignocaine and acepromazine at different timing intervals. However, pulse rate appeared to be higher at 30 minutes (above the mean baseline value) of the anaesthesia (Figure 2).



**Figure 2: Pattern of mean pulse rate (beats/minute) before and after epidural anaesthesia in dogs undergoing cystotomy administered with lignocaine in combination with acepromazine.**

There were no significant changes ( $p=0.1580$ ) in the mean respiratory rates (cycles/minutes) among the timing interval before and after epidural administration of the lignocaine with acepromazine. However, respiratory rate appeared to be higher at baseline and subsequently fluctuate but within the normal physiological limit (Figure 3).

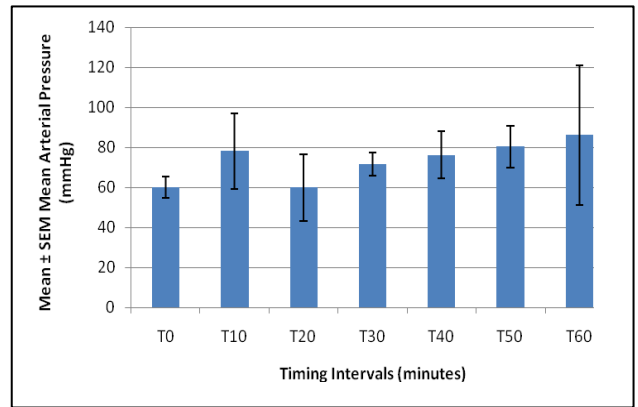


**Figure 3: Pattern of mean respiratory rate (cycles/minute) before and after epidural anaesthesia in dogs undergoing cystotomy administered with lignocaine with acepromazine combination.**

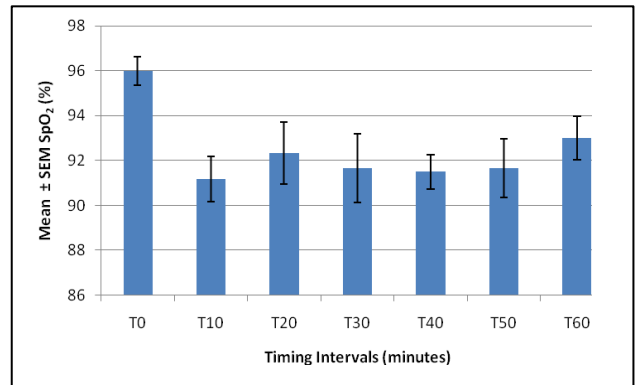
There were no significant differences ( $p=0.5727$ ) among the mean arterial pressure (MAP) recorded in mmHg before and after administration of the epidural lignocaine with acepromazine at different timing intervals. However, MAP appeared to be higher at 10 and 60 minutes of the anaesthesia (Figure 4).

There were no significant differences ( $p=0.0689$ ) among the mean percentage oxygen saturation level ( $SpO_2$ ) before and after administration of the epidural lignocaine with acepromazine at different timing intervals. However,  $SpO_2$  appeared to be higher at baseline and subsequently

decreases over time during the period of anaesthesia (Figure 5).



**Figure 4: Pattern of mean arterial pressure (mmHg) before and after epidural anaesthesia in dogs undergoing cystotomy using lignocaine with acepromazine combination.**



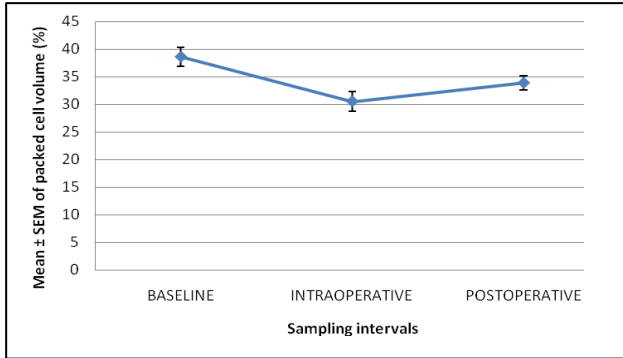
**Figure 5: Pattern of mean percentage  $SpO_2$  before and after epidural anaesthesia administered with lignocaine with acepromazine combination in dogs undergoing cystotomy.**

**Hemodynamic changes following epidural anaesthesia with lignocaine and acepromazine combination in dogs undergoing cystotomy**

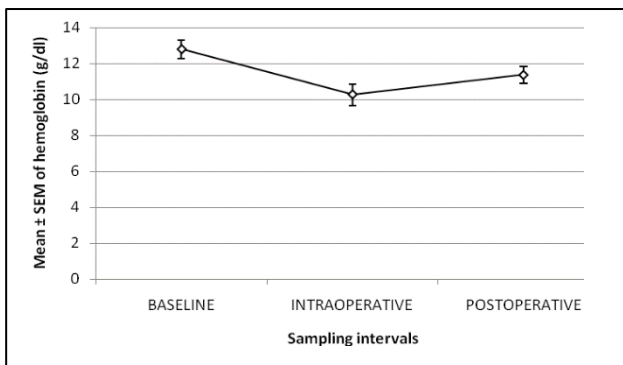
There was slight variation in the mean packed cell volume (PCV) at baseline, intraoperative and postoperative. The mean baseline PCV seems to be higher than those of intra-operative and that of postoperative sampling periods. There was transient decrease of the PCV intra operative with significant differences ( $p=0.0068$ ) between the mean PCV values of the three-timing interval (Figure 6).

There was significant difference ( $p=0.0094$ ) among the mean hemoglobin concentration (g/dl) at baseline, intraoperative and postoperative. Similar pattern of results was also recorded in the mean hemoglobin concentration as in mean PCV values (Figure 7).

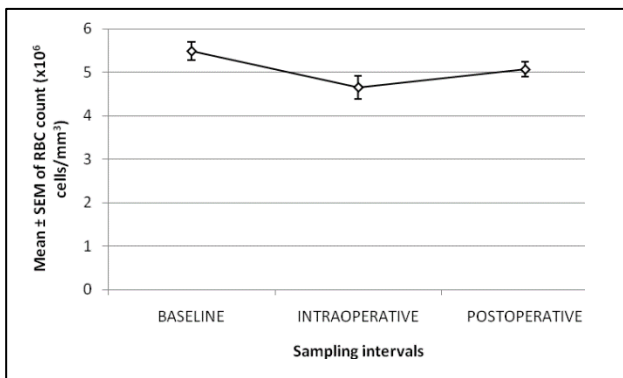
There were significant differences ( $p=0.0376$ ) among the mean of total red blood cell (RBC) count ( $\times 10^6$ ) at three different sampling intervals pre-operative, intra and postoperative. The total RBC was slightly higher at baseline and subsequently decreased during operation and increased at postoperative (Figure 8).



**Figure 6: Mean packed cell volume (%) before, during and after epidural administration of lignocaine in combination with acepromazine in dogs undergoing cystotomy.**



**Figure 7: Mean hemoglobin concentration (g/dl) before, during and after epidural administration of lignocaine with acepromazine combinations in dogs undergoing cystotomy.**



**Figure 8: Mean of total RBC count ( $\times 10^6$ ) before, during and after epidural administration of lignocaine with acepromazine combinations in dogs undergoing cystotomy.**

There were no significant changes among the mean value of total WBC count, neutrophils, eosinophils, basophils, lymphocytes, monocytes and band cells at different sampling intervals pre-operative, intra-operative and postoperative (Table 1).

**Table 1: Leucocytic changes before, during and after epidural administration of lignocaine with acepromazine in dogs undergoing cystotomy.**

Leucocytic parameters ( $\times 10^3$ cells/ $\text{mm}^3$ )	Baseline	Intra-operative	Post-operative
<b>WBC</b>	5.6 $\pm$ 0.3	4.8 $\pm$ 0.2	4.7 $\pm$ 0.2
<b>Neutrophils</b>	2.6 $\pm$ 0.4	2.9 $\pm$ 0.2	2.5 $\pm$ 0.3
<b>Eosinophils</b>	0.01 $\pm$ 0.01	0 $\pm$ 0	0 $\pm$ 0
<b>Basophils</b>	0.04 $\pm$ 0.03	0 $\pm$ 0	0 $\pm$ 0
<b>Lymphocytes</b>	1.6 $\pm$ 0.2	1.2 $\pm$ 0.2	1.4 $\pm$ 0.2
<b>Monocytes</b>	0.5 $\pm$ 0.2	0.09 $\pm$ 0.01	0.1 $\pm$ 0.04
<b>Band cells</b>	0.1 $\pm$ 0.06	0.07 $\pm$ 0.02	0.2 $\pm$ 0.07

## DISCUSSION

The effect of lignocaine and acepromazine mixture administered epidurally in the present study does not cause any significant change in the mean physiological parameters of the respiratory rate,  $\text{SpO}_2$ , rectal temperature and MAP. However certain significant transient increase and decrease were observed in the mean rectal temperature as compared to the baseline values at 10-15 minutes and a rise at 60 minutes post drug administration. This is in line with the findings of Gebremedhin, and Singh, where they reported a decrease in the body rectal temperature following epidurally administered ketamine-acepromazine combination.<sup>17,18</sup> The rectal temperature fluctuations observed in the present study is not of clinical importance, as the mean values of the rectal temperature is within the normal physiological limit as reported in Hassan and Hasaan.<sup>19</sup> Increase in rectal temperature observed in the present study can be attributed to the effects of the acepromazine on the blocking of the hypothalamic thermoregulatory center since acepromazine is highly lipophilic.<sup>20</sup>

In the present study, there was no significant changes observed in the pulse rate ( $p=0.1734$ ) as compared to the baseline values; even though there was decrease at 10 minutes and thereafter it was observed to rise at 30 minutes intra operative before it decreases to almost baseline values at 60 minutes post administration. The transient fluctuation of the pulse rates were within normal physiological limit 80-160 BPM.<sup>19</sup> Similar findings were reported by Gebremedhin.<sup>17</sup> This could be attributed to the known fact that acepromazine administration produces a moderate effects on the cardiovascular system in both conscious and anesthetized animals as it causes transient decrease by 20% to 25% to stroke volume, cardiac output and means arterial pressure as reported by Lemke.<sup>21</sup>

At 10 minutes post drug administration in the present study, the effect on the mean respiratory rates does not differ significantly ( $p=0.1580$ ) as compared to the baseline data. This is in line with the previous findings reported by Gebremedhin; White; Sindak; Amarpal, this is in line with the findings of Lawal, in goats and Vesal, in dogs.<sup>17,22-26</sup> Although, there was slight variation of respiratory rates in this study, the values within the physiological limits. This result is however clinically acceptable as it is a known fact that the parenteral administration of acepromazine to both conscious and anesthetized animals has mild effects on pulmonary function as reported by Nishimura.<sup>27</sup>

The mean oxygen saturation level ( $SpO_2$ ) in the present study falls from 96% at 10-60 minutes after epidural administration of lignocaine-acepromazine mixture; this can be attributed to the decrease in the respiratory rates and hemoglobin concentration level which serve as the oxygen carrying capacity of the blood. This is in line with the study conducted by Wagner.<sup>28</sup>

The result of the present study showed that after epidural administration of a mixture of lignocaine-acepromazine, there was significant decrease in the mean values of the hematological parameters as compared to the baseline values especially the PCV, hemoglobin concentration and total erythrocyte count., The decrease in PCV, RBC and Hb following epidural administration of xylazine, lidocaine and their combination in acepromazine sedated dogs have been reported by Mwangi in lumbosacral epidural administration of ketamine alone or in combination with xylazine in dogs reported by Abubakar in epidural administration of xylazine alone in dogs; in cattle and also in horses.<sup>13,29-32</sup> Similar findings was also reported following epidural administration of xylazine-ketamine combination in buffalo calves, in goats.<sup>18,33</sup> Umar and Wakil reported a significant decrease in RBC, Hb and PCV in ketamine-medetomidine anesthesia in goats.<sup>34</sup> Ismail et al, has reported a decrease in RBC and hemoglobin concentration with increase in PCV in xylazine, ketamine and diazepam anesthesia in goats and sheep.<sup>35</sup> These can be attributed to the profound cardiovascular effects of acepromazine which leads to marked relaxation of the splenic smooth muscle leading to pooling of red blood cells in the spleen and this sequestration of red blood cells causes a drop in hematocrit of about 20% to 30%.<sup>15,21</sup> The decrease in PCV and Hb concentration can also be attributed to the shifting of fluid from extravascular compartment to intravascular compartment in order to maintain normal cardiac output in the animals.<sup>28,36</sup> The results of this study did not revealed any significant changes in the mean values of the differential leucocytes counts when compared with the baseline values; the transient intermittent decrease and increase observed were also similar with those of the findings reported by Gebremedhin, Abubakar and Mwangi contrary to our findings is the work reported by Ismail, who reported an increase in the differential leucocytes count following

epidural administration of ketamine, xylazine and diazepam in small ruminants.<sup>13,17,29,35</sup> The transient intermittent non-significant decrease and increase in the differential leucocytes count observed in this study could be attributed to the pooling of the circulatory blood cells in the spleen and other reservoirs secondary to decreased sympathetic activity and shifting of fluid from extra vascular compartments to intravascular compartment in order to maintain the normal cardiac output.

## CONCLUSION

It can be concluded that epidural administration of lignocaine in combination with acepromazine at 7 mg/kg and 0.05 mg/kg in clinically healthy matured dogs can produced onset of analgesia within ( $2\pm 0.4$ ) minutes (mean $\pm$ SEM) and ( $122.3\pm 14.23$ ) minutes duration of analgesia. With the combination, cystotomy can also be performed. The effect of the combination has minimal effects on cardiopulmonary and hemodynamics of dogs.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

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**Cite this article as:** Yakubu AS, Ebenezer AO, Abdulkareem AA, Adedokun DA, Abubakar AA, Oviawe EI, et al. Evaluation of lumbo-sacral epidural anaesthesia or analgesia with lidocaine-acepromazine combination in dogs undergoing cystotomy. *Int J Sci Rep* 2020;6(6):204-10.