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Original Research

Haemodynamic Study Following Epidural Administration of Tramadol and Butorphanol in Combination of Lignocaine Hydrochloride in Goats

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Abstract

The objective of the study was to compare the haemodynamic changes in goats after epidural administration of lignocaine alone and in combination with butorphanol and tramadol. A total of 18 clinically healthy goats of 1-2 years of age and weighing between 12-15 kg were randomly divided in three groups containing six goats in each. Group I was treated with inj. lignocaine hydrochloride @ 4 mg/kg bwt. Epidurally in the lumbosacral space, whereas goats of group II and III received inj. lignocaine Hcl in the same dose rate in combination with inj. butorphanol tartrate @0.04 mg/kgbwt and inj. tramadol hydrochloride@ 1 mg/kgbwt, respectively. A significant decrease in the value of SAP was found at 15 min in group II and at 30 min in group III. Diastolic and mean arterial pressure did not show significant variation within and among the groups. The animals of group II showed a significant bradycardia (P<0.05) as depicted by increase in R-R and Q-T intervals. It is concluded that the epidural administration of lignocaine in combination of butorphanol and tramadol produces transient alteration in haemodynamic alterations thus these agents are considered as safer agents for achieving analgesia.

Keywords: Butorphanol, Goats, Haemodynamic Changes, Lignocaine, Tramadol

Introduction

Epidural and intrathecal administration of agents with greater duration of action may be more appropriate for surgical procedures requiring long duration anaesthesia. Opioids can provide good analgesia without causing ataxia by highly selective actions on spinal receptors (Natalini and Robinson, 2000). The pharmacological profile of tramadol such as activation of opioid receptors, inhibition of the monoaminergic system and local anaesthetic effects (Raffa *et al*., 1993; Altunkaya *et al.,* 2003) makes it an attractive drug for epidural administration. Butorphanol is a morphine congener with a profile of action similar to that of pentazocine with an increase in pulmonary arterial pressure and decrease in systemic arterial pressure (Popio *et al*., 1978). The present study deals with haemodynamic changes after lumbosacral administration of lignocaine alone and in combination with tramadol and butorphanol.

Materials and Methods

The experiment was carried out as per the guidelines and approval of Institutional Animal Ethical Committee (IAEC) and Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA). The study was conducted on 18 clinically healthy goats of either sex of 1-2 years of age weighing between 12-15 kgs. They were allocated into three groups with 6 goats in each group. The goats were maintained in isomanagemental condition in the indoor ward of Ranchi Veterinary College Clinics. All the goats were dewormed with broad spectrum anthelmentic (fentas plus) two weeks prior to the experiment. Group I was treated with inj. lignocaine hydrochloride (Xylocaine 2%: AztraZeneca Pharma India Ltd) @ 4 mg/kgbwt epidurally in the lumbosacral space, whereas goats of group II and III received inj. lignocaine hcl in the same dose rate in combination with inj.butorphanol tartrate (Butrum : Aristo pharmaceutical Pvt. Ltd)@ 0.04 mg/kgbwt and inj. tramadol hydrochloride (Biotram: E.G. Pharmaceutical Ltd.) @ 1mg/kgbwt, respectively.

One goat was randomly selected from the group for the experiment to be performed next morning. The goat was kept off feed and water for 12 and 6 hours, respectively before the commencement of experiment. A five centimetres square area in the lumbosacral region was aseptically prepared and painted with alcohol as the site for lumbosacral epidural analgesia. Medial area of both forelimbs near elbow joint and hind limbs near stifle joint was shaved for electrocardiographic recording of the goat.

An 18-gauge 3.5 cm hypodermic needle used for giving anaesthesia at the prepared site into the epidural space at lumbosacral area. The goat was supported in sternal recumbency for at least 2 min following drug injection to ensure that a bilateral blockade is achieved. The goat was placed at an isolated corner without disturbance to monitor the development and progression of analgesia sequentially.

Following epidural administration of analgesic agents different haemodynamic parameters as well as electrocardiographic monitoring were carried out at the time intervals of 0, 5, 15, 30, 45, 60, 90 and 120 minutes.

Blood pressure was measured by using automatic NIBP machine (BPL Multi Parameter Monitor – Model No. MPM-5563, BPL India, Ltd.). An indirect automated device that incorporated a cuff inflation / deflation sequence was used to measure systolic arterial pressure (SAP) and diastolic arterial pressure (DAP). The suitable size cuff was wrapped around the proximal 3rd portion of the left radius in order to measure the pressure in the brachial artery (De Rossi *et al.,* 2005).

Mean arterial pressure was measured by indirect method (Geddes *et al.,* 1980) using the formula: MAP = DAP + (SAP — DAP) / 3 (mmHg).

The electrocardiograph was taken before and at different intervals after epidural administration of drugs. The attachment of electrodes (three bipolar standard leads) was carried out by shaving the suitable position on the anteromedial aspect of limbs just below the elbow and stifle joint with little cardiac gel. The entire ECG tracing was performed under lateral recumbency with manual restrained after wearing the rubber gloves using CARDIART 8108 R, BPL, India. The ECG machine was calibrated with the vertical sensitivity of the stylus adjusted to give 10 mm deflection /mV of input and with a paper speed of 25 mm/second.

Analysis of variance (ANOVA) and Duncan multiple range test (DMRT) were used to compare the means at different intervals with base values as per method described by Snedecor and Cochran (2004).

Results and Discussion

Following treatment, the animals of group I did not exhibit any significant alteration throughout the observation period in the value of systolic arterial pressure (SAP). In contrast to group I, group II and III showed a significant decrease ($P<0.05$) in the value of SAP at 15 and 30 minutes of observation (Table 1). This decrease in SAP is in agreement with the findings of Vnuk *et al.*, *(*2011), who reported significant decrease in MAP and DAP following administration of epidural lignocaine in dogs. Dias *et al.* (2018) also reported significant decrease after epidural bupivacaine in dogs agreement with the present findings. Statistical analysis of the data did not show any group-wise difference.

Table 1: Mean ± SE values of systolic arterial pressure (SAP) {mmHg} at different intervals in animals of group I, II and III.

Groups	Period of observation (min)							
	0	**5**	**15**	**30**	**45**	**60**	**90**	**120**
I	129.5±8.04	123.67±7.21	120.33±7.00	118.17±6.09	127.5±2.81	124.33±6.88	121.17±4.51	125.67±4.11
II	137.5±6.61^{a}	125.83±6.81^{ab}	119.5±5.77^{b}	120.67±6.02^{ab}	124.5±4.92^{ab}	129.33±4.33^{ab}	126.5±7.46^{ab}	129±7.21^{ab}
III	133.5±6.82^{b}	125.5±6.15^{ab}	122.5±4.38^{ab}	119±3.64^{a}	130.83±3.39^{ab}	135.17±4.73^{b}	133.5±4.23^{ab}	126.83±5.56^{ab}

Group I: Lignocaine, Group II: Lignocaine + Butorphanol, Group III: Lignocaine + Tramadol; Value bearing different superscripts in small letter within groups differed significantly <0.05); Value did not differ significantly (P>0.05) among groups.

Epidural anaesthesia did not show any significant effect on the measurement of diastolic arterial pressure (DAP) and mean arterial pressure (MAP) either within or among the groups (Table 2 and 3). However, in all the three groups, consistent increase in its level up to 45 – 60 minutes could be recorded throughout the observation period which is in accordance with finding of (Naeine *et al*., 2004) after epidural administration of morphine.

Table 2: Mean ±SE values of diastolic arterial pressure (DAP) {mmHg} at different intervals in animals of group I, II and III

Groups	Period of observation (min)							
	0	**5**	**15**	**30**	**45**	**60**	**90**	**120**
I	79±6.02	80.83±5.47	83.67±4.04	88.67±4.53	93±4.89	87±3.83	82±5.03	83.67±4.54
II	77.5±4.77	81.83±4.18	84.17±4.42	88.67±4.06	80.83±3.27	82.17±2.23	84.83±4.86	81.17±3.63
III	74.83±4.45	77.83±5.23	79.83±2.60	78.33±2.75	82±3.00	77.5±2.94	79±3.21	83.67±4.68

Group I: Lignocaine, Group II: Lignocaine + Butorphanol, Group III: Lignocaine + Tramadol; Value did not differ significantly (P>0.05) within and among groups.

Table 3: Mean ± SE values of mean arterial pressure (MAP) {mmHg} at different intervals in animals of group I, II and III.

Groups	Period of observation (min)							
	0	**5**	**15**	**30**	**45**	**60**	**90**	**120**
I	97±5.46	95.27±4.78	96.28±4.08	97.77±4.03	104.5±3.87	99.5±3.30	96.72±4.70	97.56±3.85
II	97.5±4.87	95.95±4.71	95.39±4.99	98.67±4.79	95.39±3.49	97.33±2.27	97.33±2.27	97.84±4.87
III	94.39±4.52	93.72±5.27	94.61±1.99	92.11±1.85	97.89±2.45	96.72±3.45	95.83±2.94	98.06±4.62

Group I: Lignocaine, Group II: Lignocaine + Butorphanol, Group III: Lignocaine + Tramadol; Value did not differ significantly (P>0.05) within and among groups.

Cardiovascular effect of these opioids included vagally induced bradycardia, depression of the synoatrial node and slowed atrioventricular conduction (Naeine *et al*., 2004), which are the probable reasons for decrease in heart rate and systemic arterial pressure in tramadol and butorphanol groups. Haemodynamically, lignocaine-butophanol was more stable. Tramadol is weakly bind with the μ-receptor therefore; it produces minimal cardiovascular depression as compared to butorphanol group.

On ECG, a normal sinus rhythm was recorded before medication in all the groups at different intervals of observation. Negative P wave was observed in two animals before administration of analgesic agents. Group I and III showed a variable trend which was nonsignificant, whereas the animals of group II showed a significant bradycardia as depicted by increase in RR and QT intervals whereas QRS complex did not show a significant variation in its amplitude. The variation in T wave amplitude was not marked at any intervals of observation in all the groups. The RR and QT intervals remained slightly higher up to 90 min of observation in group II and III and then returned to normal sinus rhythm afterwards.

The sophistication of cardiac diagnosis has improved remarkably over the last few decades and the study of electrocardiogram pattern is very useful in the detection of abnormal heart conditions. Normal sinus rhythm before administration of agent was the consistent findings in all the groups which corroborates with previous findings of electrocardiographic study in goats (Mohan *et al.*, 2005; Ahmad and Sanyal, 2008; Raina *et al.*, 2008). Negative P wave was observed in two animals before administration of agents which implies that the impulse was generated from atrioventricular junction (Ahmad and Sanyal, 2008). Group I and III did not show any significant variation at different intervals of observation. Similar trends of variation after administration of tramadol in goats (Raina *et al.* (2008), romifidine and lignocaine in goats (Kinjavdekar *et al.* 2006) has been reported. Cardiac rhythm also did not show any difference after epidural treatment with morphine, fentanyl, methadone, lignocaine and lignocaine with epinephrine in cattle (Naeine *et al.*, 2004).

The lignocaine – butorphanol group showed a significant drop-in heart rate and significant increase in R-R intervals and Q-T intervals, which is according to Santos *et al.* (2004) in dogs. The increase in the R-R and Q-T intervals after administration of lignocaine in combination with butorphanol might be due to strong analgesia resulting into cardiovascular depression. Opioids can indirectly alter cardiac function via inhibitory actions on the autonomic and central nervous systems (Thurston *et al.*, 1993). Furthermore, opioids may alter cardiac contractibility directly via activation of opioids receptors and by membrane interactions because of their chemical properties and structures (Pepe *et al.*, 2004). A significant bradycardia was also reported after epidural administration of buprinorphine – lignocaine in goats (Staffieri *et al.*, 2009).

Conclusion

It is concluded that the epidural administration of lignocaine in combination of butorphanol and tramadol produces transient alteration in haemodyanamic alterations thus these agents are considered as safer agents for achieving analgesia in a goats.

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Conflict of Interests

There is no conflict of interest.

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