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Haemodynamic and Electrocardiographic Changes Following Epidural Ropivacaine with or without Dexmedetomidine in Black Bengal Goat

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ABSTRACT

The aim of this study to find out the effect of ropivacaine and its combination with dexmedetomidine in goats on systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP) and electrocardiographic changes. A total of 10 clinically healthy goats of 1-3 years aged and weighing between 10-15 kg were used for the present experiment. All the animals were randomly divided into two groups of five animals each. Ropivacaine (0.75%) @ 1 mg/kgbwt was epidurally administered in the lumbosacral space in group I whereas, the animals of group II were given dexmedetomidine @ 2 µg/kgbwt in combination with ropivacaine hydrochloride (1 mg/kgbwt). Haemodynamic parameters viz. SAP, DAP and MAP revealed non-significant alterations in group I, whereas, group II showed significant decrease ($P<0.05$) in SAP and MAP at different intervals of observations. Electrocardiogram revealed bradycardia in group II with prolongation of RR intervals, QT intervals and width of QRS complex, whereas, in group I these changes was variables which of little significance. In conclusion, the ropivacaine in combination with dexmedetomidine was synergistically decreasing the systolic arterial and mean arterial pressure within normal physiological limits and transient changes in ECG. Hence ropivacaine along with dexmedetomidine can be used in cardiovascular compromised animals.

Keywords: Goats, haemodynamic changes, electrocardiographic changes, dexmedetomidine, ropivacaine.

Ropivacaine has been used in animals as epidural anaesthesia for achieving hindquarter analgesia in goats (Khajuria *et al*., 2014; Singh *et al*., 2015)). Dexmedetomidine is an alpha – 2 receptor agonist which might be use as additive to local anesthetic for various regional anaesthetic technique (Marhofer *et al.,* 2013). The present paper deals the haemodynamic and electrocardiographic alterations in goats after administration of ropivacaine alone or in combination with dexmedetomidine.

MATERIALS AND METHODS

The present experiment/study were conducted on 10 clinically healthy female black Bengal goats of 1-3 years of age and weighing between 10-15 kg. They were divided into two groups with 5 goats in each group. Each goat was selected to one treatment of epidural administration. 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. Frequent clinical examination of animals was done to rule out the possibility of any illness. The work has been approved (No. 143) by Institutional Animal Ethical Committee (IAEC).

Ropivacaine 0.75% (Ropin – NEON Pharma. laboratories Limited, 28 Mahal Ind. Est., M Caves Rd.,(East), Mumbai -400093) @ 1 mg/kg b. Wt. was epidurally administered in the lumbosacral space in group I whereas, the animals

of group II received dexmedetomidine [Dextomid 50 - Neon Pharma, Lab Ltd laboratories Limited, 28 Mahal Ind. Est., M Caves Rd., (East), Mumbai-400093] @ 2 µg/kg b.wt., in combination with ropivacaine hydrochloride (1 mg/kg body weight). A total volume of 3 ml should be maintained by addition of distilled water in all the goats. Base line data of different parameters were obtained before administration of analgesic agents.

To accomplish epidural block, an 18-gauge 3.5 cm hypodermic needle was inserted per-cutaneous at the prepared site into the lumbo-sacral epidural space to inject analgesic agent. Following epidural administration of analgesic agents different haemodynamics and electrocardiographic changes were carried out at the time intervals of 0, 5, 15, 30, 45, 60, 90, 120 and 240 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 3rd proximal portion of the left radius in order to measure the pressure in the brachial artery (De Rossi *et al.,* 2005).Mean arterial pressure was calculated by indirect method (Geddes *et al.,* 1980) using the formula: MAP = DAP + (SAP — DAP) / 3 (mmHg).

Electrocardiographic monitoring

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.

Statistical analysis

ANOVA and DMRT were used to compare the means at different intervals with base values as per method described by Snedecor and Cochran (2004). The level of significance was set at 0.05.

RESULTS AND DISCUSSION

A non-significant decrease in the heart rate was noticed at different intervals of observation in the animals of group I after administration of epidural anaesthetics. The value recorded in group II exhibited significantly lower at 90 min onwards observation as compared to base line values. However these values were returned towards normalcy by end of observation. All most similar trend of variation in systolic arterial pressure just like heart rate has also been observed in systolic and diastolic arterial pressure. Systolic arterial pressure was non-significantly variable at different interval of observation in group I. whereas, the systolic arterial pressure showed a significant fall at 30 to 120 min

Table 1: Mean ± SE values of systolic arterial pressure (SAP), diastolic arterial pressure (DAP) and mean arterial pressure (MAP) at different intervals in animals of group I and II

Parameters	Groups	Period of observation (min)						
		0	15	30	60	90	120	240
SAP	I	116.80 ±3.34	113.20 ±3.79	113.80 ±4.38	107.80 ±2.50	115.80 ±4.53	116.80 ±3.65^{B}	115.20 ±4.68
	II	122.60 ±2.94^{b}	114.00 ±5.33^{ab}	109.40 ±5.26^{a}	109.20 ±1.71^{a}	109.60 ±1.99^{a}	111.00 ±2.41^{aAB}	116.20 ±3.07^{ab}
DAP	I	84.40 ±3.19	81.20 ±4.25	83.40 ±4.24^{B}	80.40 ±1.50	84.00 ±2.19	84.20 ±3.04	79.60 ±2.66
	II	86.20 ±3.09^{b}	82.80 ±2.60^{ab}	74.20 ±1.50^{aA}	76.80 ±3.26^{a}	78.00 ±4.68^{ab}	76.40 ±3.49^{a}	80.60 ±2.79^{ab}
	I	94.60 ±2.62	91.8 ±3.62	93.40 ±2.71^{B}	89.80 ±0.97	94.60 ±2.91	95.00 ±2.86	91.40 ±2.66
MAP	II	98.60 ±1.44^{c}	93.20 ±1.53^{bc}	86.00 ±1.34^{aA}	87.60 ±2.06^{ab}	88.40 ±3.40^{ab}	88.00 ±2.51^{ab}	92.40 ±2.32^{bc}

Group I: Ropivacaine, Group II: Ropivacaine + Dexmedetomidine

Value bearing different superscripts in small letter within groups and capital letter among groups differed significantly (P<0.05).

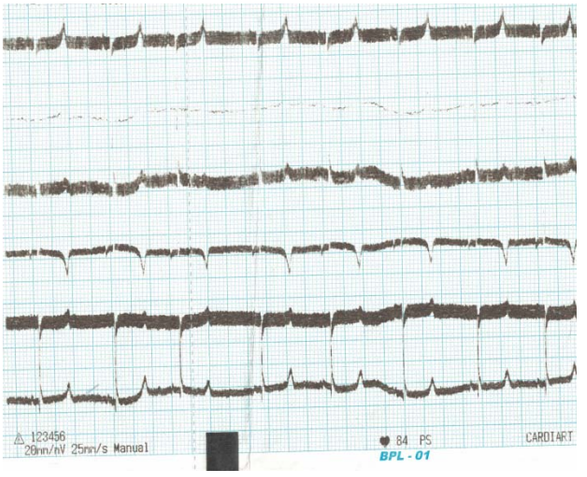

Fig. 1: Electrocardiograph showing normal sinus rhythm before administration of anaesthesia

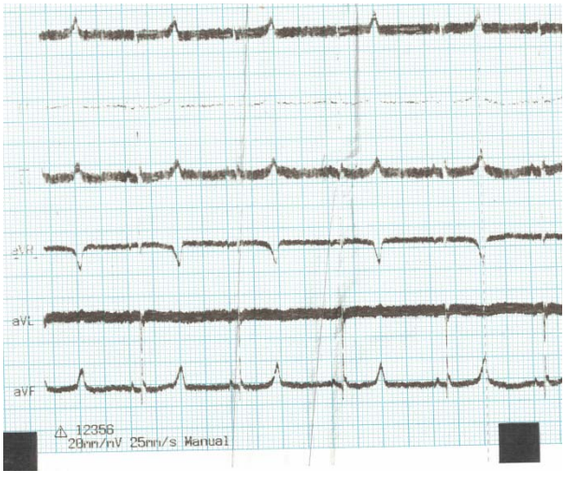

Fig. 2: Electrocardiograph showing bradycardia with increased R- R interval, Q- T interval and broader QRS complex at 30 min after administration of ropivacaine with dexmedetomidine (Group II)

of observation in group II. The animal of group I did not found a definitive trend of variation in diastolic arterial pressure, hence the value recorded at different intervals were non-significantly varied (P>0.05). In compare to this, the animal of group II showed a non significant decrease at 30, 60 and 120 min of observation (Table 1).

MAP was also found to be decreased after epidural administration in all the groups, however the value recorded at different interval of observation in group I did not show definitive trend of variation. MAP in group II measured as significant decrease at 30 to 120 min of observation.

Both the groups recorded with normal sinus rhythm before medication (Fig. 1). After epidural administration, both the groups exhibited slight changes with increase in RR intervals, Q-T intervals and width of QRS during electrocardiographic monitoring. Group II showed marked increase in RR intervals QT intervals and width of QRS as compared to group I.

Systolic, diastolic and mean arterial pressures were observed to be non-significant in ropivacaine treated groups which are in accordance with the finding of Yayla *et al.* (2013). This was further explained by the fact that ropivacaine produces less cardiotoxic effect (Simpson *et al.,* 2005) which might be the reason for non-significant changes in these groups. Animals of group II exhibited significant decrease in systolic arterial pressure and non–significant decrease in diastolic arterial and mean arterial pressure following administration of ropivacaine along with dexmedetomidine. The decrease in systolic arterial pressure and subsequent alteration in diastolic and mean arterial pressure might be due to the effect of dexmedetomidine, which acted on post – synaptic terminals in the central nervous system results in decrease in sympathetic activity leading to hypotension and bradycardia (Derbyshire *et al.,* 1983). Skarda *et al*. (1989) and Lavis *et al.* (1999) reported drop in heart rate and diastolic arterial pressure after epidural administration of alpha$_2$ agonist in combination with local anaesthetic which supported the findings of group II (ropivacaine-dexmedetomidine). The effect of dexmedetomidine on blood pressure are biphasic with an initial transient rise with a reflex fall in heart rate brought about by stimulation of α and ß receptors present in the vascular smooth muscles, which results in fall in blood pressure and heart rate due to inhibition of central sympathetic outflow and stimulation of pre-synaptic alpha$_2$ receptors cause decreased release of nor-adrenaline leading to further fall in the blood pressure (Bloor *et al.,* 1992; Hall *et al.,* 2000).

The sophistication of cardiac diagnosis has improved remarkably over the last few decades (Hughton and Gray,

1997) 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 both the groups which corroborates with previous findings of electrocardiographic study in goats (Upadhyay and Sud, 1977; Mohan *et al.,* 2005; Ahmad and Sanyal, 2008; Raina *et al.,* 2008).

Electrocardiogram revealed bradycardia in group II with prolongation of RR intervals, Q-T intervals and width of QRS complex (Fig. 2), whereas, in group I these changes were variables which is of little significance. Significant changes in cardiac function involving the contractility, conduction time and QRS width occurred and the increase in a QRS width was found to be significantly smaller with ropivacaine than with bupivacaine (Graf, 2001; Cederholm *et al*., 1992). Yayla and Kilic (2010) reported non-significant changes in ECG monitoring. It is fact that ropivacaine produces no pathological effect on the heart which is a consistent finding with the available literature.

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