

# Clinical Evaluation of Anaesthetic and Physiological Effects of Dorsolumbar Epidural Xylazine-Lignocaine Anaesthesia in Cattle

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**Abstract:** *The study was conducted on 14 cattle to evaluate quality and cardio-pulmonary response of dorsolumbar epidural anaesthesia by using two different dosage of lignocaine hydrochloride in combination with xylazine hydrochloride. Except one animal in group A, epidural administration of anaesthetic solution was successful in all animals of both the groups. Except two animals from group A, all the animals of both groups showed signs of sedation. Analgesia was good and sufficient for surgery in both the groups. There was no significant difference observed in ataxic effects between group A and group B. Sedation produced is also advantageous to restrict movements of animals during surgery. A significant ( $P < 0.05$ ) decrease was found in rectal temperature, heart rate and respiration rate at 30 min during intervals of anaesthesia in both the groups. The study illustrated that dorsolumbar epidural anaesthesia was easy to perform in cattle and consume low dose from anaesthetic drug which save cost, time and effort. The epidural xylazine hydrochloride and lignocaine hydrochloride may have slight decrease in physiological parameters during 30 min duration of anaesthesia but did not have any adverse cardiopulmonary effects as evidenced by observations recorded. Also, the physiological parameters returned to the base level after anaesthesia.*

**Keywords:** Sedation, analgesia, ataxia, anaesthesia, epidural

## 1. Introduction

The standing position is preferred for most abdominal surgeries in cattle because of side effects on physiological parameters from general anaesthesia and recumbency (Lee *et al.*, 2006). Several methods of anaesthesia are used for laparotomy in standing cattle. Each method has some advantages and disadvantages for clinical use. Infiltration anaesthesia has been widely used in clinics, although a higher volume of anaesthetic solution is needed to desensitize at least three vertebral nerves for flank surgery. On the other hand, in segmental dorsolumbar epidural anaesthesia very less volume is needed to desensitize same spinal nerves (Hiraoka *et al.*, 2007).

A variety of local anaesthetic viz. lignocaine HCl commonly used for producing dorsolumbar epidural anaesthesia. Alpha-2-agonist like xylazine HCl is now a days commonly used to increase depth of local anaesthesia for epidural block. Dorsolumbar epidural anaesthesia is recently used technique for laparotomy in cattle, buffalo, camel, horse and donkey.

Xylazine is very popular sedative, analgesic and muscle relaxant used in almost all species of animals. Alpha-2-adrenergic agonists activate presynaptic alpha-2-adrenoreceptor, which are located on the superficial laminae of dorsal horn of spinal cord. These alpha-2-adrenergic agonists administered epidurally produce direct effect on sensory transmission and mediate analgesia (Lemke, 2007). Local anaesthetic drugs are the conventional drugs for epidural anaesthesia. Local anaesthetic agents reversibly block action potential along nerve axon by interference with voltage negative gated sodium channel (Skarda and Tranquilli, 2007).

The present work was conducted to study quality of anaesthesia and physiological effects of dorsolumbar epidural anaesthesia produced by combination of Xylazine hydrochloride and Lignocaine hydrochloride in cattle.

## 2. Materials and Methods

Total 14 clinical cases of cattle presented at T.V.C.C., COVAS, Parbhani for laparotomy were included for this study. The animals were divided irrespective of age, sex, productive and reproductive status into two groups viz. Group A and Group B, each comprising of seven animals. Animals included in present research have age 3.5 years to 11 years and body weight 200 kg to 400 kg.

Each animal was restrained in trevis in standing position and the skin above the first interlumbar (L1-L2) space was prepared aseptically (Figure 1). The first lumbar intervertebral space was located 1.5 to 2.0 cm caudal to imaginary line drawn across cranial border of transverse process of second lumbar vertebra. Skin weal was prepared by using 1 ml lignocaine hydrochloride at site of epidural anaesthesia (Figure 2). An 18 gauge spinal needle with stylet was inserted vertically through skin weal (Figure 3). Needle was advanced until abrupt reduction to needle passage was noted. This was indicated piercing of interarcuate ligament and entry of needle tip in epidural space of vertebral canal (Figure 4). Stylet was removed from needle to confirm position of needle tip in epidural space. The entrance into the epidural space was identified by hanging drop technique (Figure 5). After confirming that there was no blood or CSF present in the aspirate, drug was administered at speed of 0.5 ml/second and needle was removed immediately (Figure 6).

The existence (score 0) or non-existence (score 1) of light sedation was defined in terms of the drooping of the animal's upper eyelids, the position of the head relative to

the shoulders, and the reduction in the animal's awareness of its surroundings. The analgesic effect was assessed and scored by the animal's response to skin, muscular and peritoneal incisions (0, no responses; 1, movement with no kicking; 2, movement with a little kicking; 3, struggling with repeated kicking). When the cattle showed purposeful movement, indicated by a score of 3. However, when the animal showed non-purposeful movement, indicated by a score of 2, the surgery was performed without additional anesthesia. The degree of ataxia was assessed and scored by observing the posture of the animal (0, standing with 2 limbs; 1, swaying or standing with 1 limb; 2, leaning against the trevis; 3, sternal recumbency).

Time of onset was noted as time taken from epidural administration of anaesthetic solution to the onset of anaesthesia and recorded in minutes. Duration of anaesthesia was noted as time taken from onset of anaesthesia to the first response to painful stimuli at desensitized area and recorded in minutes. After preparation of the surgical site, surgery was performed at the left flank for rumenotomy and cystorrhaphy and at the right flank for enterectomy. Duration of surgery was recorded in each animal from time of skin incision to last skin suture.

Physiological parameters viz. rectal temperature, heart rate and respiration rate were evaluated before anaesthesia during anaesthesia at 0 min., 15 min., 30 min., 45 min., 60 min. and after recovery from anaesthesia.

### 3. Results & Discussion

Except one animal from group A, the entrance to the epidural space was successful in all animals of both the groups. Left flank laparotomy for performing rumenotomy in 6 cases in each group, right flank laparotomy for performing enterectomy and left flank laparotomy for performing cystorrhaphy in solitary was undertaken in group A and group B respectively.

The hanging drop technique was found useful to check the position of needle tip in epidural space. The cause of difficulty in reaching epidural space in one animal might be due to the ossification of interarcuate ligament in old age (Skadra, 2007 and Hiraoka *et al.*, 2007). Use of this dorsolumbar epidural anesthesia technique to administer xylazine and lignocaine was resulted in sufficient sedation and anesthesia for flank surgery in standing cattle.

In group A, out of seven animals, five animals showed signs of sedation whereas in two animal sedation was not observed. In group B, all seven animals showed signs of sedation.

In group A, out of seven animals, good analgesia was developed in four animals, whereas, movement without kicking observed in one animal and movement with kicking observed in one animal. Struggling with repeated kicking observed in one animal in which anaesthesia was not developed and surgery was performed after infiltration anaesthesia. In group B, out of seven animals, good analgesia was developed in six animals, whereas, movement without kicking observed in one animal. There was no

significant difference observed in analgesia between both group A and group B.

In group A, out of seven animals, three animals did not show signs of ataxia, standing with one limb in one animal and leaning against trevis in two animals were observed, whereas, one animal showed recumbency at 30 min interval for 45 minutes. In group B, out of seven animals, two animals did not show signs of ataxia, standing with one limb in two animals and leaning against trevis in one animal were observed, whereas, one animal showed recumbency at 60 min interval for 30 minutes and one animal showed sudden recumbency after onset of anaesthesia.

There was no significant difference observed for ataxia between both group A and group B. Recumbent animal was able to stand and walk after completion of duration of anaesthesia. The 6 animals in group A and 5 animals in group B revealed standing without ataxia which is indication of effectiveness of dorsolumbar epidural anaesthesia for standing surgery. The transient ataxia in one animal in group A and two animals in group B was due to severe sedation in weak and diseased animals. Sedative, analgesic and ataxic effects after epidural administration of mixed anesthetics have been represented in table 1.

**Table 1:** Sedative, analgesic and ataxic effects after epidural administration of mixed anesthetics (no. of animals)

Effect	Group	Score			
		0	1	2	3
Sedation	A	5	2	-	-
	B	7	0	-	-
Analgesia	A	4	1	1	1
	B	6	1	0	0
Ataxia	A	4	1	2	1
	B	2	2	1	2

The systemic effect of sedation induced by absorption of xylazine from the epidural space (Pagliosa *et al.*, 2015, Saifzadeh *et al.*, 2007 and Singh *et al.*, 2005). The epidural analgesia induced by xylazine is mediated through  $\alpha_2$ -adrenoceptors in substantia gelatinosa of dorsal horn in spinal cord. There is high concentration of  $\alpha_2$ -adrenoreceptors in the dorsal horn of the spinal cord, where nociceptive fibers synapse and also in the brainstem, where modulation of nociceptive signal is likely to be initiated. Analgesia produced by xylazine may be due to the inhibition of the release of substance P at level of substantia gelatinosa of the dorsal horn of the spinal cord (Gurbb *et al.*, 2002 and Molaei *et al.*, 2010). Lidocaine induced analgesia by inhibiting propagation and conduction of nerve impulses through blockade of sodium channels in the cells with subsequent prevention of depolarization (Molaei *et al.*, 2010). A combination of xylazine, an alpha-2 adrenergic agonist, and lidocaine, a local anaesthetic agent, was additive for the duration of analgesia when administered epidurally (Gurbb *et al.*, 2002 and Molaei *et al.*, 2010). The possible mechanism of an  $\alpha_2$ -agonist induced prolongation of analgesia is through adrenoceptor mediated vasoconstrictors and inhibitions of local anaesthetic vasodilatory effects and consequently delay subsequent vascular uptake. The prolongation of sensory blockade could also be explained by synergism between the antinociceptive effects of xylazine and the neural blocking action of

lidocaine. Alpha-2 agonists induced analgesia may intensify and prolong the lidocaine-induced sensory blockade through a pre or post-synaptic  $\alpha_2$ -mediated mechanism and/or an  $\alpha_2$ -agonist effect on arterioles (Molaei *et al.*, 2010).

Higher dose of lignocaine produced greater degree of analgesia (Sharshar *et al.*, 2015). Severe ataxic effects produced in weak and animals that have various diseases and disorders (Lee and Yamada, 2005). Recumbency might be due to severe sedation in weak animals (Hiraoka *et al.*, 2007). The mean  $\pm$  S.E. time of onset were 20.17 $\pm$ 1.35 min and 12.86 $\pm$ 1.19 min in group A and group B, respectively. The onset of anaesthesia was significantly ( $P<0.01$ ) faster in group B than group A. The mean  $\pm$  S.E. duration of anaesthesia were 106.00 $\pm$ 4.52 min and 129.86 $\pm$ 2.47 min in group A and group B, respectively. The duration of anaesthesia was significantly ( $P<0.01$ ) longer in group B compared to group A. The mean time required for duration of surgery in group A (62.00 $\pm$ 1.54 min) and group B (61.43 $\pm$ 2.21 min).

The difference in the onset of anaesthesia between the two groups depends on the dose of the anaesthetic mixture (Sharshar *et al.*, 2015). Lignocaine causes early onset of action due to predominant conduction blockade of spinal nerve roots (Singh *et al.*, 2005). The differences in the duration of analgesia between the two groups depend on the dose of the anaesthetic mixture (Sharshar *et al.*, 2015). The duration of anaesthesia was 106.00 $\pm$ 4.52 min in group A and 129.86 $\pm$ 2.47 min in group B. This duration of anaesthesia was more than the duration of surgeries (62.00 $\pm$ 1.54 min) in group A and (61.43 $\pm$ 2.21 min) in group B.

The overall mean  $\pm$  S.E. rectal temperature was 100.95 $\pm$ 0.34 and 101.05 $\pm$ 0.28 in group A and group B, respectively. No significant difference was observed in overall rectal temperature between groups A and B. The overall heart rate on its duration based assessment revealed significant ( $P<0.05$ ) difference between group A and group B, 64.83 $\pm$ 4.15 and 64.52 $\pm$ 5.04, respectively. The significant ( $P<0.05$ ) difference was observed in overall respiration rate between the group A and group B, 20.10 $\pm$ 3.30 and 21.38 $\pm$ 3.36, respectively. A significant ( $P<0.05$ ) decrease was recorded in rectal temperature, heart rate and respiration rate at 30 min during intervals of anaesthesia in both groups. The values of these parameters were returned to base level after recovery from anaesthesia. The mean  $\pm$  S.E. values of biochemical parameters have been represented in table 2.

**Table 2:** Mean + S.E. values of physiological parameters

Parameter	Group	Interval					
		BA	15 min	30 min	45 min	60 min	AA
RT ( $^{\circ}$ F)	A	101.14 $\pm$ 0.35	101.03 $\pm$ 0.40	100.67* $\pm$ 0.33	100.77 $\pm$ 0.36	100.86 $\pm$ 0.31	101.21 $\pm$ 0.32
	B	101.21 $\pm$ 0.31	101.07 $\pm$ 0.34	100.77* $\pm$ 0.27	100.93 $\pm$ 0.27	101.03 $\pm$ 0.27	101.31 $\pm$ 0.26
HR (beats /min)	A	70.57 $\pm$ 5.66	66.29 $\pm$ 4.64	60.14* $\pm$ 4.37	62.43 $\pm$ 3.91	64.29 $\pm$ 5.64	65.29 $\pm$ 4.84
	B	68.29 $\pm$ 6.46	65.00 $\pm$ 5.86	59.29* $\pm$ 5.76	63.00 $\pm$ 5.43	63.14 $\pm$ 5.44	68.43 $\pm$ 6.34
RR (breaths /min)	A	21.71 $\pm$ 2.93	20.29 $\pm$ 2.98	17.00* $\pm$ 3.22	19.43 $\pm$ 3.38	18.57 $\pm$ 3.7	22.29 $\pm$ 3.59
	B	23.14 $\pm$ 3.75	21.43 $\pm$ 3.31	18.29* $\pm$ 3.11	20.00 $\pm$ 2.92	20.14 $\pm$ 3.3	24.00 $\pm$ 3.75

Means bearing different superscripts differ significantly at corresponding intervals ( $P<0.05$ )

\* $P<0.05$  = Significant at 5% level

A decrease in RT following systemic administration of  $\alpha_2$ -adrenoceptor agonists might be due to the depression of the hypothalamic thermoregulatory centre. The decrease in RT was also probably due to the result of reduced basal metabolic rate, muscle activity and depression of thermoregulatory centre (Molaei *et al.*, 2010). The alpha2-agonists also depress the hypothalamic nor-adrenergic alpha2-receptors to cause hypothermia and also might be due to heat loss from relaxation of thoracic and abdominal skeletal muscles (Singh *et al.*, 2005).

The bradycardia recorded after the administration of xylazine could be attributed to decreased sympathetic outflow from CNS, inhibition of norepinephrine release from sympathetic nerve terminals, direct depression of cardiac pace maker and conduction tissue, increased vagal tone and a direct increase in the release of acetylcholine from parasympathetic nerves in heart (Molaei *et al.*, 2010 and Singh *et al.*, 2005). The decrease in heart rate probably due to sedation caused by the absorption of xylazine (Pagliosa *et al.*, 2015).

All the  $\alpha_2$ -adrenoceptor agonists cause some degree of respiratory depression. This might be attributed to the direct depression of the respiratory centre through stimulation of supraspinal adrenoceptors following systemic absorption of the drug (Molaei *et al.*, 2010 and Singh *et al.*, 2005). A respiratory depression by lignocaine probably may be due to the blockade of nerves innervating the muscles of respiration (Singh *et al.*, 2005). The decreases in respiration rate probably due to sedation caused by the absorption of xylazine (Pagliosa *et al.*, 2015).

#### 4. Conclusion

The current study illustrated the easiness and effectiveness of the dorsolumbar epidural anesthetic technique for flank anaesthesia in cattle. In conclusion, the results of this study suggested that, the higher dose of lignocaine in combination with xylazine have faster onset and longer duration anaesthesia. Good quality of anaesthesia produced by combination of lignocaine and xylazine combination without any complications. Dorsolumbar epidural anaesthesia using combination of xylazine hydrochloride @ 0.025 mg/kg and lignocaine hydrochloride @ 0.01 mg/kg was found effective and sufficient to perform laparotomy in cattle. Sedative effect due to xylazine is another benefit which helps to calm the animal during surgery.

It could be concluded from present study that epidural xylazine hydrochloride and lignocaine hydrochloride may have slight decrease in physiological parameters during 30 min duration of anaesthesia but did not have any adverse cardiopulmonary effects as evidenced by observations recorded. Also, the physiological parameters returned to the base level after recovery from anaesthesia.

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Figure 1: Site of dorsolumbar epidural anaesthesia



Figure 2: Preparation of skin weal



Figure 3: Insertion of spinal needle



Figure 6: Administration of anaesthetic solution

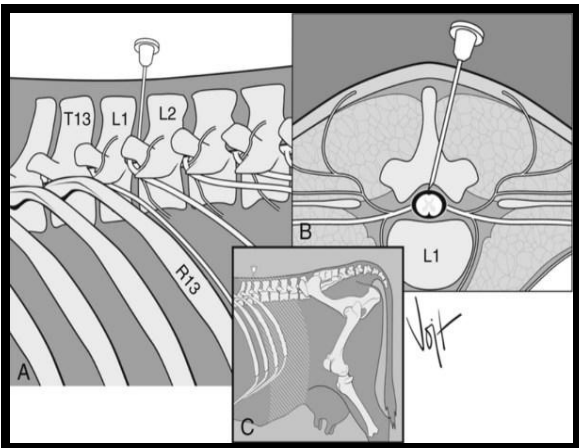


Figure 4: Direction of needle



Figure 5: Hanging drop technique