COMPARATIVE EVALUATION OF ROPIVACAINE-XYLAZINE AND LIGNOCAINE-XYLAZINE COMBINATION FOR DORSOLUMBAR EPIDURAL ANAESTHESIA IN CATTLE

Mahesh Tanpure[1], Sharad Chepte[2*], V. D. Ambhore[1], Narayan Karad[3] and Shahir Gaikwad[2]
Department of Veterinary Surgery and Radiology, College of Veterinary and Animal Sciences, Maharashtra Animal and Fishery Sciences University, Parbhani-413 401, Maharashtra, India

Received on:13.07.2023
Accepted on:12.08.2023

ABSTRACT

The present investigation was conducted on 12 clinical cases of cattle reported to the Veterinary Clinical Complex at College of Veterinary and Animal Sciences, Parbhani. These cases randomly divided in to two groups. Group 1 treated with combination of lignocaine hydrochloride @ 0.2 mg/kg and xylazine hydrochloride @ 0.025 mg/kg. Whereas, 0.75 % ropivacaine hydrochloride @ 0.2 mg/kg. and xylazine hydrochloride @ 0.025 mg/kg used in group 2 by dorsolumbar epidural route in cattle. The onset of action and distribution of analgesia was significantly ($p<0.01$) quicker in group 1 than in group 2. However, the duration of anaesthesia in group 2 was significantly ($p<0.01$) higher in group 1. The clinico-physiological and haemato-biochemical parameters were taken at 0, 15, 30, 60 and 120 minutes intervals. The clinico-physiological and haematological parameters showed momentary changes which were within normal physiological range.

Keywords: Lignocaine, ropivacaine, dorsolumbar, epidural, flank, xylazine

Introduction

In ruminants the regional anaesthetic techniques is preferred over the other methods of anaesthesia. In cattle various surgical interventions are performed at flank region in standing position under paravertebral nerve block. However, this technique urges a significant amount of anaesthetic solution at three different sites and required an expert or skilful person with sound anatomical knowledge and experience (Skarda, 1996). On the contrary dorso-lumbar epidural nerve block provides complete anaesthesia of the flank by single injection in small volume. In this technique the epidural space between the L1 and L2 lumbar vertebrae approached dorso-medially (Hiraoka *et al*., 2007). Epidural regional anaesthesia is relatively safe, economical, lack of drug residues with efficient analgesia and muscle relaxation (Khajuria *et al.,* 2014). Combination of sedative with local anaesthetics has additive effect on duration of analgesia. A lot work on xylazine and lignocaine combination has been done in veterinary surgery. However, xylazine in combination with ropivacaine for dorsolumber epidural anaesthesia in cattle has very limited literature. Therefore this study was undertaken to compare the clinical efficacy of ropivacaine hydrochloride and lignocaine hydrochloride in combination with xylazine for dorsolumbar epidural anaesthesia in cattle.

Materials and Methods

The animals were divided into two groups (Group 1 and Group 2), consisting of six animals in each group irrespective of age, sex, productive and reproductive status. The animals in group 1, treated with dorsolumbar epidural (L1-L2) administration of lignocaine hydrochloride (Lox^{m} 2%, Neon Laboratories limited Mumbai) and xylazine hydrochloride (Indian Immunological Limited, Siddipet Dist. Telangana) (@ 0.2 mg/kg and @ 0.025 mg/kg) body weight respectively. In group 2, anaesthesia was induced by dorsolumbar epidural (L1-L2) administration of ropivacaine hydrochloride (Ropin® 0.75% Neon Laboratories limited Mumbai) and xylazine hydrochloride (@ 0.2 mg/kg and @ 0.025 mg/kg) body weight, respectively.

After standing alongside of animal the depression form by spinous process of lumbar vertebrae, palpated by thumb and confirmation of inter-lumbar (L1-L2) space was done. A desensitise skin weal was prepared by using 1 ml lignocaine hydrochloride. A 20 gauge spinal needle with stylet was inserted using dorsal midline approach and the needle was advanced until abrupt reduction to needle passage was noted. When the needle tip reached up to the ligamentum flavum then the stylet from needle was removed and normal saline were added to the hub of the needle. The needle was then slowly inserted into the epidural space (Lee *et al*., 2006). The entrance into the epidural space was identified by the hanging drop technique.

Parameters studied

Onset of action was noted as time taken for onset of anaesthesia after epidural administration of anaesthetic solution to the loss of sensation. This was recorded by response of cattle to needle pricks with a 20 gauge 2.5 cm long hypodermic needle. A strong avoidance response manifested in kicking, rapidly moving tail and turning of the head towards the needle pricks site was considered the normal response of the animal to the stimulus. The time at which no response was recorded, considered as the onset of action.

The duration of action noted as time taken from onset of anaesthesia to the full return of sensation at the site was considered as the duration of action. Area of desensitization at upper and lower flank was scored based on a 0 to 3 grading scale by the cattle response to noxious stimulus applied by pin prick as per Pathak *et al.*, 2012 and described in Table 1. The responses were measured at 5, 10, 15, 20, 30 and 45 minutes interval till loss of sensation. The clinico-physiological

[1]M.V.Sc. Scholar; [2*]Assistant Professor and corresponding author, Email: drsharadchepte512@gmail.com, Mob no. 7722043766;[3]Assistant Professor, Dept. of veterinary Anatomy, College of Veterinary and Animal Sciences, Parbhani-413401

Table 1: Grading of response to the painful stimuli

Grading	Depth analgesia	Response
0	No analgesia	Strong avoidance response to the needle pricks
1	Mild analgesia	Weak avoidance response to the needle pricks
2	Moderate analgesia	Occasional avoidance response to the needle pricks
3	Complete analgesia	No avoidance response to the needle pricks

and haemato-biochemical parameters were recorded at 0, 15, 30, 60 and 120 minutes intervals.

Statistical analysis was performed using statistical package for social sciences (SPSS 21.0 software). One way ANOVA was used to compare the differences of means between intervals. Two sample independent t- test was used to compare difference between two groups whereas, area of desensitization score was compared with paired t test

Results and Discussion

Assessment of analgesia

Onset of action (minutes)

The mean ± SE values for the onset of action in group 1 and group 2 was 14.17 ± 0.74 and 23 ± 0.81 minutes, respectively, with pooled mean of 18.58 ± 1.43. On comparison of results, the onset of action in group 1 was significantly (**p <0.01) quicker than group 2 (Table 2). These findings are accordance with Khajuria *et al.* (2014), Sekhar *et al*. (2019), Chepte *et al.* (2019) and Gupta *et al.* (2022).

The onset of action in local anaesthetic drug was mainly dependent on the pKa and lipid solubility, the drug which have lower pKa value and high lipid solubility have quicker onset of action as compared to the drugs which have high pKa and low lipid solubility Taylor and McLeod (2020). The local anaesthetic agent Lignocaine hydrochloride of group 1 had lower pKa (7.8) and high lipid solubility than the Ropivacaine hydrochloride (8.1) which was used in group 2. Therefore, rapid onset of action was recorded in group 1 as compared to group 2.

Table 2: Mean ± SE values for the onset of action in both groups expressed in minutes

Group 1	Group 2	Pooled mean	t-statistics	d.f.	Sign.
14.17±0.74[a]	23.00±0.81[b]	18.58±1.43	7.97	10	0.00

Means bearing different superscripts differ significantly (**p<0.01).

Duration of action (minutes)

The mean ± SE values for the duration of action in group 1 were 135.00 ± 4.28 minutes, while in group 2 the mean values recorded were 411 ± 8.81 minutes, with a pooled mean of 273.33 ± 41. After correlating the groups, it was reported that analgesia lasted significantly (**p<0.01) longer in group 2 than that in group 1 (Table 3). The findings are with accordance with De Moraes *et al.* (2014), Khajuria *et al.* (2014), Sekhar *et al*. (2019), Chepte *et al.* (2019) and Gupta *et al.* (2022). The ability of local anaesthetic to last longer was determined by its affinity for plasma protein. The ropivacaine had a higher affinity (94%) towards plasma protein, that could account for the longer duration of action compared to the lignocaine (70%) treated group Taylor and McLeod (2020). Moreover, the intrinsic vasoconstriction ability of ropivacaine may be attributed to its delayed absorption and prolonged clearance than lignocaine (Ahilasamy *et al*., 2021).

Table 3: Mean ± SE values for the duration of action in both groups expressed in minutes

Group 1	Group 2	Pooled mean	t-statistics	d.f.	Sign.
135.00±4.28[a]	411±8.81[b]	273.33±41	28.22	10	0.00

Means bearing different superscripts differ significantly (**p<0.01)

Area of desensitization (minutes)

The mean score for an area of desensitization at the upper flank at 0 to 30 minutes intervals in group 1 increased from 1.83 ± 0.16 to 3.00 ± 00, respectively. Whereas, in group 2 it was 0.33 ± 0.20 to 3.00 ± 00, respectively (Table 4). At the lower flank region in group 1 and group 2 analgesia score was ranged from 1.00 ± 00 to 3.00 ± 00 and 0.00 ± 00 to 2.00 ± 00 at 20 minutes interval, respectively. There was statistically significant (**p<0.01) difference in onset of action between group 1 and 2 at 5, 10 and 15 minutes time interval. At 15 minutes time interval score of desensitization was 3.00 ± 00 in group 1 whereas, in group 2 it was 2.66 ± 00. The complete analgesia of upper and lower flank in group 1 was observed on 15 minutes onward however, in group 2 it took 20 and 30 minutes, respectively for upper and lower flank analgesia. At 45 minutes time interval and onwards analgesic score remains constant indicating complete analgesia in both groups. The higher analgesic score in group 1 indicates rapid analgesia over a larger but limited portion of the flank region. However, in group 2 the onset of analgesia was slower and required more time for diffusion than group 1. The potency of the local anaesthetic drugs relied on the pKa value and lipid solubility (Taylor and Mcleod, 2020). The local anaesthetic agent Lignocaine hydrochloride having lower pKa (7.9) required less time for onset than Ropivacaine hydrochloride with higher pKa (8.1). Similarly, Lignocaine hydrochloride has more lipid solubility than Ropivacaine hydrochloride. Therefore, rapid spread of anaesthesia in group 1 as compared to group 2.

Clinico -physiological parameter

In clinico-physiological parameters the mean heart rate varied from 81.33 ± 15.33 to 78.33 ± 14.90 in group 1, whereas in group 2 it was changed from 70.33 ± 6.68 to 67.00 ± 5.86. Whereas, values of rectal temperature in group 1 changed from 102.20 ± 0.12 to 101.78 ± 0.12, in group 2 the mean values varied from 102.26 ± 0.21 to 101.80 ± 0.18. The mean respiratory rate values in group 1 were changed from 24.33 ± 2.09 to 22.67 ± 2.15 in group 1, whereas, in group 2 values changed from 27.67 ± 1.90 to 22.67 ± 2.12. The mean values of heart rate, rectal temperature and respiratory rate were decreased non-significantly (p*<0.05) within a normal physiological limit.

Table 4: Mean ± SE values for the area of desensitization in both groups expressed in minutes

Time Intervals (minutes)	Upper flank region		Statistic	Lower flank region		Statistic
	Group 1	Group 2	Significance level	Group 1	Group 2	Significance level
5	1.83 ±0.16	0.33 ± 0.20	P < (1%)	1.00 ± 00	0.00 ± 00	P < (1%)
10	2.83 ±0.16	1.50 ± 0.22	P < (5%)	2.00 ± 00	0.16 ± 0.16	P < (1%)
15	3.00 ± 00	2.66 ± 00	P < (1%)	3.00 ± 00	1.00 ± 00	P < (1%)
20	3.00 ± 00	3.00 ± 00	P > (1%)	3.00 ± 00	2.00 ± 00	P < (1%)
30	3.00 ± 00	3.00 ± 00	P > (1%)	3.00 ± 00	3.00 ± 00	P > (1%)
45	3.00 ± 00	3.00 ± 00	P > (1%)	3.00 ± 00	3.00 ± 00	P > (1%)

Conclusions

A relatively small amount of anaesthetics at a single site was found to be sufficient to desensitize flank region essential for surgeries in cattle. Either lignocaine (@ 0.2 mg/kg) or ropivacaine (@ 0.2 mg/kg) in combination with xylazine hydrochloride (@ 0.025 mg/kg) at dorsolumbar epidural space between L1-L2 found to be effective and sufficient to perform flank surgeries in standing cattle.

References

Ahilasamy NR, Dinesh Kumar, Nayagam HA, Shanmuganandam O, Vaibhavi KR and Modak V (2021) Ropivacaine: A novel local anaesthetic drug to use in otorhinolaryngology practice. *Indian J. Otolaryngol. Head, Neck Surg.* **73**(2):267–270.

Barot HM, Chaudhari KR, Patel PB, Sodagar BN and Chaudhari CF (2022) Physiological and hematobiochemical effects of proximal paravertebral administrated ropivacaine and lignocaine in bovine. *Pharma Innov. J.* **11**(5): 893-899.

Chepte SD, Thorat MG, Waghmare S P, Ingawale MV, Mehesare SP, Joshi MV and Fani FA (2019) Comparative evaluation of lignocaine, articaine and ropivacaine for proximal paravertebral anaesthesia in cattle. *Int. J. Sci. Environ. Technol.* **8**(3): 674-679.

De Moraes AN, Regalin D, dos Santos MA, da Costa BD, Flores FN and Oleskovicz N (2014) Epidural administration of ropivacaine or ropivacaine and xylazine in cattle. *Semina:* **35**: 2481-2490.

Gupta, SK, Chepte SD, Gaikwad SV, Sarode IP, Karad NM and Ali SS (2022) Clinical assessment of articaine and ropivacaine hydrochloride for caudal epidural anesthesia in cattle. *Acta Sci. Vet. Sci.* **4**: 69-72.10.31080/ASVS.2022.04. 0391.

Hiraoka M, Miyagawa T, Kobayashi H, Takahashi T, Kishi H, Kobayashi H and Lee I (2007) Successful introduction of modified dorsolumbar epidural anesthesia in a bovine referral center. *J. Vet. Sci.* **8**(2): 181-184.

Kalath RN, Kulal R and Gopinath S (2021) Comparison of clinical efficacy of ropivacaine and lignocaine with adrenaline for implant surgery anesthesia: a split-mouth randomized controlled clinical trial. *J. Dent. Anesth. Pain Med.*, **21**(4): 337-34.

Khajuria A, Shah RA, Bhat MH, Khan FA, Yaqoob SH, Naykoo NA and Ganai NA (2014) Comparison between lignocaine hydrochloride and ropivacaine hydrochloride as lumbosacral epidural anaesthetic agents in goats undergoing laparoscopy assisted embryo transfer. *Mac. Vet. Rev.* **37**(2): 141-149. http://dx.doi.org/10.14432/j.macvetrev.2014.06.017

Lee I and Yamada H (2005) Epidural administration of fixed volumes of xylazine and lidocaine for anesthesia of dairy cattle undergoing flank surgery. *J. Am. Vet. Med. Assoc.*, **227**(5): 781–784.

Lee I, Yamagishi N, Oboshi K, Sasakiand N and Yamada H (2006) Practical tips for modified dorsolumbar epidural anesthesia in cattle. *J. Vet. Sci*, **7**(1):69-72

Lokhande DS and Aher VD (2018_b) Clinical evaluation of anaesthetic and physiological effects of dorsolumbar epidural xylazine - lignocaine anaesthesia in cattle. *Int. J. Sci. Res.*, **7**: 374-377.

Pathak R, Pratap K, Kinjavdekar P, Aithal HP and Pawde AM (2012) Comparison of bupivacaine, xylazine and buprenorphine for spinal analgesia in buffalo calves. *Indian J. Vet. Sci.* **33**(2): 82-86.

Rostami M and Vesal N (2012) The effects of adding epinephrine or xylazine to lidocaine solution for lumbosacral epidural analgesia in fat - tailed sheep. *J. S. Afr. Vet. Assoc.*, **83**(1): 1-7.

Sekhar KC, Veena P, Kumar RV and Ramayya PJ (2019) Comparative evaluation of ropivacaine, ropivacaine dexmedetomidine and ropivacaine - clonidine combinations for epidural analgesia in cattle. *Indian J. Anim. Res.*, **54**(2): 202-208.

Singh K, Kinjavdekar P, Gopinathan, Aithal HP, Verma M and Amarpal (2015) Comparative evaluation of ropivacaine, bupivacaine and xylazine-ketamine combination for epidural analgesia in uraemic goats. *Vet. Arhiv*, **85**(2): 151 162.

Taylor A, and McLeod G (2020) Basic pharmacology of local anaesthetics. *BJA education*, **20**(2): 34.