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# Clinical Efficacy of Articaine and Lignocaine Hydrochloride for Pudendal Nerve Block in Bullock

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## ABSTRACT

The study was carried out during September, 2023 to February, 2024 at the Veterinary Clinical Complex, College of Veterinary and Animal Sciences, MAFSU Parbhani, Maharashtra, Indiato compare the clinical efficacy of Articaine and Lignocaine Hydrochloride for Pudendal Nerve Block in Bullocks. A total of 12 clinical cases with affections of penis, scrotum and prepuce were included in the study, these cases were randomly divided into two distinct groups (n=6). Group 1 was administered 4% articaine hydrochloride (1 mg $kg^{-1}$), whereas Group 2 was given 2% lignocaine hydrochloride at the same dosage. The animal was restrained in standing position and pudendal nerve block was performed on both sides.The onset of action was notably faster in Group 1 ($p\leq0.01$) as compared to Group 2, while prolonged duration of action was reported in Group 2 ($p\leq0.01$) as compared to Group 1. The speed and extent of drug dispersion in Group 1 were more rapid and consistent compared to Group 2, resulting in a larger area of desensitization. Clinico-physiological and haemato-biochemical parameters were taken at 0, 20, 40, and 60-minute intervals. The mean heart rate, Rectal temperature and Respiratory rate showed non-significant changes. Similarly, haemoglobin and packed cell volume along with AST, ALT BUN and Creatinine displayed non-significant ($p\geq0.05$) changes in either group throughout the study.

**KEYWORDS:** Articaine, lignocaine, pudendal nerve block, bullock

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***Data Availability Statement:*** Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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## 1. INTRODUCTION

Agriculture plays a very vital role in the Indian economy,most of the farming practices are done with the help of bullocks. Along with various surgical affections, bullocks and breeding bulls are also prone to a range ofdisorders which affects penis including balanoposthitis, phimosis, paraphimosis eversion of theprepuce, pendulous prepuce, neoplasia of penis and prepuce etc. Due to the presence of "S" shaped sigmoid flexure,it becomes difficult to deal with various affection of penis in bullocks ascompared to the other animals. The retrieval and catheterisation of the penis is simple and non-invasive in otherdomestic animals, however in bullocks it requires post-scrotal urethrotomy.

As ruminants are highly susceptible to respiratory compromise, ruminal tympany, regurgitation, profuse salivation, and related complications during general anaesthesia. Therefore most of the surgical interventions in ruminant are undertaken with or without sedation along with local or regionalnerve block. Hence, the use of local and regional anaesthesia plays a crucial role in veterinary practice (Hall and Clarke, 1983). Many researchers attempted relaxation of the penis in a bullock by epidural anaesthesia. Nevertheless, this method comes with certain drawbacks including hind limb motor paralysis, incoordination, and prolonged recumbency. The bilateral pudendal nerve block (or internal pudendal) was the most advantageous alternative, as it effectively generates analgesia for clinical examination and surgical procedures of the penis. The pudendal nerve originates from the union of the ventral primary branches of the 2$^{nd}$, 3$^{rd}$, and 4$^{th}$ sacral spinal nerves. Its course extends caudoventrally along the sacro-sciatic ligament before exiting the pelvic cavity at the ischial arch. In males, it divides into the dorsal nerve responsible for penile innervation and the superficial perineal nerve responsible for innervating the scrotum and prepuce (Ghosh, 1998). Larson (1953) was the first to conduct bilateral internal pudendal nerve block via the ischiorectal approach to facilitate penile relaxation in bull without affecting locomotion. This method offers penile relaxation and analgesia distal to the sigmoid flexure (Endmonson, 2014). An alternative lateral approach for pudendal nerve block in bovines and ovines, as developed by McFarlane. The bilateral pudendal nerve block demonstrated superior compared to epidural analgesia with regards to faster onset, enhanced penile relaxation and extended duration of analgesia (Zayed et al., 2022). Articaine is a newly introduced amide group local anaesthetic chemically known as 4-methyl-3[2-(propylamino)-propionamido]-2-thiophene carboxylic acid methyl ester hydrochloride. Articaine is unique amide groups anaesthetic with an ester group which allows it to be metabolized by plasma esterase (Snoeck, 2012). Similarly, the presence of the thiophene ring enhances rapid diffusion through the nerve cell and surrounding tissues and increases the solubility of lipids (Martin et al., 2021). The impact and safety of various local anaesthetics on ruminants have been thoroughly examined by numerous researchers. However, there exists notably limited literature on the effects of lignocaine and articaine with special reference to pudendal nerve block in bullocks. As a result, the present research titled "Clinical Efficacy of Articaine and Lignocaine Hydrochloride for pudendal nerve block in Bullock" was undertaken to address this knowledge gap. The main objective of the research was to compare the therapeutic efficacy of 4% articaine hydrochloride and 2% lignocaine hydrochloride, specifically focusing on pudendal nerve block in bullocks.

## 2. MATERIALS AND METHODS

The experiment was conducted for six months during September, 2023 at February, 2024 at Veterinary Clinical Complex, College of Veterinary and Animal Sciences, MAFSU, Parbhani (19°15'33'N76°46'59'E) Maharashtra, India. All the bullocks were randomly divided into two equal (n=6) groups irrespective of their age and breed. The cases in the group1 were treated with 4% articaine hydrochloride (Septodont, Saint-Maur-des-Fosses Cedex -France) @ 1 mg $kg^{-1}$ b. wt. Whereas, group 2 was treated with 2% lignocaine hydrochloride (Neon Laboratories Ltd. Caves Road, Andheri (East) Mumbai 400 093, Maharashtra, India) @ 1 mg $kg^{-1}$ b.wt. The animal was restrained in a standing position and the ischio-rectal fossa was prepared aseptically for nerve block.

To desensitize the pudendal nerve, a 14-gauge, 1.25-cm needle is inserted through the desensitized skin at the ischiorectal fossa to serve as a cannula. Subsequently, an 18-gauge, 10 to 15 cm spinal needle is carefully manoeuvred through the cannula to reach the pudendal nerve. The operator's left hand is positioned into the rectum up to the wrist level, with the fingers oriented laterally and ventrally to identify a soft depression known as the lesser sacrosciatic foramen (Plate no 1).

The internal pudendal nerve is precisely located on the sacrosciatic ligament, positioned cranially and dorsally to the foramen, approximately one finger's width dorsal to the pulsating pudendal artery. Following this, the spinal needle is introduced through the cannula, guided medially to the ligament, and then advanced cranioventrally for a distance of 5–7 cm until the nerve is successfully reached. A local anaesthetic is subsequently administered, the needle is withdrawn, and the area is gently massaged to facilitate dispersion. This entire process is then replicated on the contralateral side. (Sidelinger, 2021).

Plate no 1: Needle placement for pudendal nerve block

## 3. PARAMETERS STUDIED

The onset of action was documented as the period following the bilateral pudendal nerve block until the prolapse of the preputial ring as shown in Plate no 2.

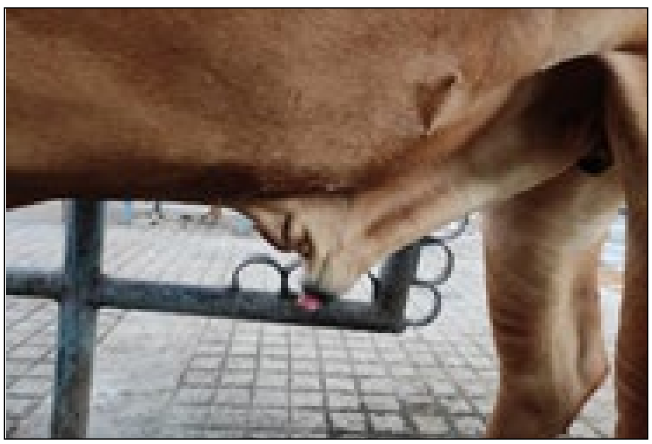

Plate no 2: Prolapse of preputial ring

The timeframe from the commencement of action to the retraction of the penis within the penile sheath. This was regarded as the duration of action and complete relaxation of penis was observed (Plate no 3)

All instances were consistently monitored for two hours, followed by assessments at five-minute intervals until full recovery was achieved. The area of desensitization was evaluated based on the bullock response to needle pricks by a 20-gauge 2.5 cm hypodermic needle in the perianal area (both sides of the midline), scrotum, and prepuce at 5, 10, 15, 20, 25, 30, and 40-minute intervals post-anaesthesia as shown in plate 3. The area of desensitization was classified on a scale of 0 to 3 as outlined by Pathak et al., 2012, as per Table 1.

Plate no 3: Complete relaxation of penis

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 |

The clinico-physiological and hemato-biochemical parameters were assessed before (0 minutes) and at 20, 40, and 60-minute intervals following drug administration in both cohorts. Statistical analysis was performed utilizing SPSS 21.0 software. The mean variances between intervals were compared using one-way ANOVA, while discrepancies between groups were evaluated through two-sample independent t-tests. In the case of non-parametric data (Desensitization score), the Kruskal-Wallis H test (one-way ANOVA) was employed to ascertain statistically significant variations among groups.

## 4. RESULTS AND DISCUSSION

### 4.1. *Assessment of analgesia :Onset of action (minutes)*

The mean onset of action was 24.33±0.95 minutes in group 1 and 34.00±1.34 minutes in group 2, with a pooled mean of 30.66±1.27 minutes as shown in Table 2.

Group 1 showed a significantly quicker onset ($p$≤0.01)

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

| Parameters | Group 1 | Group 2 | Pooled mean | t-statistics | d.f | Sign. |
|---|---|---|---|---|---|---|
| Onset of action | 24.33±0.95[a] | 34.00±1.34[b] | 30.66±1.27 | 4.04 | 10 | .000 |

Means bearing different superscripts differ significantly ($p$≤0.01) compared to group 2 similar findings was also reported by Allman et al. (2002), they revealed that the articaine group exhibited a quicker onset of action for peribulbar anaesthesia compared to the bupivacaine/lidocaine combination. Moreover Costa et al. (2005) and Robertson et al. (2007) concluded that 4% articaine had rapid onset of action for maxillary and buccal infiltration in humans as compared to 2% lignocaine. Similarly, Shruthi et al. (2013), Jain and John (2016) reported slower onset of action in patients subjected to the surgical extraction of tooth in 2% lignocaine treated group as compared to 4% articaine. Chepte et al. (2019) noted rapid onset of action in 4% articaine group than 2% lignocaine and 0.75 % ropivaiciane group used for proximal paravertebral nerve block in cattle. The articaine group's faster onset ($p \leq 0.01$) may be due to its greater lipophilicity due to the presence of a thiophene ring (Becker and Reed, 2012), while the lignocaine group's delayed onset could be attributed to its lower lipid solubility.

*4.2. Assessment of analgesia: duration of anaesthesia (minutes)*

The mean duration of action in group 1 was 158.83±2.30 minutes, whereas 105.16±3.65minutes in group 2, with a pooled mean of 132.00±8.34 minutes as shown in table 3.

Analgesia lasted for significantly longer ($p \leq 0.01$) duration in the articaine group. Malamed et al. (2001), reported longer duration of action in 4% articaine treated group. Shruthi et al. (2013) also reported similar finding in patients underwent teeth extraction, Chepte et al. (2019) undertake proximal paravertebral analgesia in cattle by using 4% articaine and 2% lignocaine, they reported prolonged duration of action in 4 % articaine group. Bansal et al. (2018) observed longer duration of action in 4% articaine treated group as compared to 2% lignocaine. Moreover the longer duration in group 1 is likely due to articaine's higher plasma protein binding affinity (95%) compared to lignocaine's (65%).

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

| Parameters | Group 1 | Group 2 | Pooled mean | t-statistics | d.f | Sign. |
|---|---|---|---|---|---|---|
| Duration action (minutes) | 158.83±2.30$^{a}$ | 105.16±3.65$^{b}$ | 132.00±8.34 | 12.42 | 10 | .000 |

Means bearing different superscripts differ significantly ($p \leq 0.01$)

*4.3. Area of desensitization (minutes)*

The mean score analysis from 0 to 40 minutes showed in Table 4, an increase in desensitization scores in the perianal region from 3.92 to 30.50 in group 1 and from 4.25 to 30.50 in group 2. At the scrotum, scores ranged from 3.50 to 34.50 in group 1 and from 4.00 to 35.50 in group 2. For the preputial area, scores varied from 5.50 to 34.00 in group 1 and from 6.50 to 35.50 in group 2. Group 1 (articaine) had significantly higher analgesia scores ($p \leq 0.01$) than group 2 (lignocaine) at all time intervals, indicating a quicker onset and wider spread of action. Similar findings were reported by Gupta et al. (2022) and Tanpure et al. (2023).

The efficacy of local anaesthetics depends on their pKa value and lipid solubility; lower pKa values lead to quicker onset. Articaine, with a lower pKa (7.8) and a thiophene ring, showed a rapid onset and larger desensitization area compared to lignocaine, which has a higher pKa (7.9) and no thiophene ring (Becker and Reed, 2012). This chemical

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

| Time intervals (minutes) | Perianal | | Scrotum | | Prepuce | |
|---|---|---|---|---|---|---|
| | Group 1 | Group 2 | Group 1 | Group 2 | Group 1 | Group 2 |
| 5 | 3.92 | 4.25 | 3.50 | 4.00 | 5.50 | 6.50 |
| 10 | 11.58 | 11.75 | 10.00 | 10.25 | 10.25 | 10.33 |
| 15 | 21.75 | 17.00 | 18.33 | 18.50 | 13.42 | 14.17 |
| 20 | 24.67 | 25.25 | 20.00 | 20.25 | 21.25 | 19.33 |
| 25 | 27.58 | 28.00 | 29.67 | 28.75 | 32.08 | 30.75 |
| 30 | 30.50 | 30.75 | 34.50 | 33.25 | 34.00 | 33.92 |
| 40 | 30.50 | 30.50 | 34.50 | 35.50 | 34.00 | 35.50 |
| $Chi^2$ t-test | 31.00 | 31.00 | 38.33 | 35.87 | 38.30 | 36.54 |
| d.f. | 6 | 6 | 6 | 6 | 6 | 6 |
| Significance | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

difference explains the faster and broader analgesia in group 1.

The clinico-physiological and heamto-biochemical parameters showed non-significant changes, which were within the normal physiological limit and had no clinical relevance.

## 5. CONCLUSION

4% articaine hydrochloride demonstrated a rapid onset and prolonged duration of action when compared to 2% lignocaine hydrochloride, suggesting its suitability for situations necessitating quick onset. Both articaine and lignocaine were found to be safe and effective for pudendal nerve block in standing bullocks at specified doses.

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## 7. REFERENCES

Allman, K.G., Barker, L.L., Werrett, G.C., Gouws, P., Sturrock, G.D., Wilson, I.H., 2002. Comparison of articaine and bupivacaine/lidocaine for peribulbar anaesthesia by inferotemporal injection. British Journal of Anaesthesia 88(5), 676–678.

Bansal, S.K., Kaura, S., Sangha, P.K., Kaur, P., Bahl, R., Bansal, S., 2018. Comparison of anesthetic efficacy of 4% articaine versus 2% lignocaine. Indian Journal of Dental Sciences 10(2), 92–97.

Becker, D.E., Reed, K.L., 2012. Local anaesthetics: review of pharmacological considerations. Anaesthesia Progress 59(2), 90–102.

Chepte, S.D., Thorat, M.G., Waghmare, S.P., Ingawale, M.V., Mehesare, S.P., Joshi, M.V., Fani, F.A., 2019. Comparative evaluation of lignocaine, articaine, and ropivacaine for proximal paravertebral anaesthesia in cattle. International Journal of Science, Environment and Technology 8(3), 674–679.

Costa, C.G., Tortamano, I.P., Rocha, R.G., Francischone, C.E., Tortamano, N., 2005. Onset and duration periods of articaine and lidocaine on maxillary infiltration. Journal of Prosthetic Dentistry 94(4), 381.

Edmondson, M.A., 2014. Local and regional anaesthesia for urogenital surgery. Bovine Reproduction 1st ed., 131–135.

Ghosh, R.K., 1998. Primary veterinary anatomy, 7th ed. Current Books International, 391–392.

Gupta, S.K., Chepte, S.D., Gaikwad, S.V., Sarode, I.P., Karad, N.M., Ali, S.S., 2022. Clinical assessment of articaine and ropivacaine hydrochloride for caudal epidural anaesthesia in cattle. Acta Scientific Veterinary Sciences 4, 69–72.

Hall, L.W., Clarke, K.W., 1983. Veterinary Anaesthesia, 8th ed. Bailliere Tindall, London, 256–257.

Jain, N.K., John, R.R., 2016. Anaesthetic efficacy of 4% articaine versus 2% lignocaine during the surgical removal of the third molar: a comparative prospective study. Anaesthesia, Essays and Researches 10(2), 356–361.

Malamed, S.F., Gagnon, S., Leblanc, D., 2001. Articaine hydrochloride: a study of the safety of a new amide local anaesthetic. Journal of the American Dental Association 132(2), 177–185.

Martin, E., Nimmo, A., Lee, A., Jennings, E., 2021. Articaine in dentistry: an overview of the evidence and meta-analysis of the latest randomised controlled trials on articaine safety and efficacy compared to lidocaine for routine dental treatment. BDJ Open 7, 27 (2021). https://doi.org/10.1038/s41405-021-00082-5.

Pathak, R., Pratap, K., Kinjavdekar, P., Aithal, H.P., Pawde, A.M., 2012. Comparison of bupivacaine, xylazine, and buprenorphine for spinal analgesia in buffalo calves. Indian Journal of Veterinary Surgery 33(2), 82–86.

Robertson, D., Nusstein, J., Reader, A., Beck, M., McCartney, M., 2007. The anaesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth. Journal of the American Dental Association 138(8), 1104–1112.

Shruthi, R., Kedarnath, N.S., Mamatha, N.S., Rajaram, P., Shetty, D.B., 2013. Articaine for surgical removal of impacted third molar; a comparison with lignocaine. Journal of International Oral Health 5(1), 48–53.

Sidelinger, D.R., 2021. Regional anaesthesia for urogenital procedures. Bovine Reproduction, 191–199.

Snoeck, M., 2012. Articaine: a review of its use for local and regional anesthesia. Local and Regional Anesthesia 5, 23–33.

Tanpure, M., Chepte, S.D., Ambhore, V.D., Karad, G., Gaikwad, S., 2023. Comparative evaluation of ropivacaine-xylazine and lignocaine-xylazine combination for dorsolumbar epidural anaesthesia in cattle. Veterinary Practitioner 24(2), 177–179.

Zayed, M., Yousef, N.A., Hassaneen, A.S., 2022. Pudendal nerve blockade is superior to epidural analgesia for andrological and surgical procedures on the external genitalia of male goats in the standing position. South Valley University-International Journal of Veterinary Sciences 5(2), 1–10.