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Research article

Clinical anatomy of regional anesthetic sites in the head region of the male adult Zebu cattle (*Bos indicus*)

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A B S T R A C T

The basic knowledge of the applied anatomy of the head region is important in clinical practices since regional anesthesia is the only choice for ruminants. Thus, using three head region samples we aimed to reveal the proper anesthesia sites of clinically important nerves of adult male Zebu cattle through a surface approach. Our study revealed that either the mean distance of 4.26 ± 0.46 cm from the lateral canthus of the eye or the mean distance of 4.66 ± 0.57 cm from the base of the horn along the temporal line was the suitable site for the cornual nerve blocking. Similarly, the supraorbital nerve emerged mean of 3.63 ± 0.32 cm dorsomedial to the mid-orbital rim and the infraorbital nerve emerged mean distance of 4.46 ± 0.15 cm rostral and dorsomedial to the facial tuber. Finally, the mental nerve blocking site was measured at a distance of a mean of 3.63 ± 0.15 cm caudoventral to the canine tooth and a mean of 3.9 ± 0.36 cm ventral to the lip commissure. These data may be helpful for the field veterinarians to desensitize the regions related to various surgical conditions such as dehorning, disbudding, sinus trephining, and wound management in lip and cheek in Zebu (indigenous) cattle.

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1. INTRODUCTION

Zebu cattle (*Bos indicus*) are the species of tropically adapted indigenous cattle (Chan et al., 2010) originated from south and southwest Asia (Sanders, 1980). Among Zebu in different regions, non-descript Deshi, Pabna, Red Chittagong and North Bengal Grey are predominant that constitute 90% of the total cattle population in Bangladesh. These tropical cattle show a greater ability to survive in poor feed and inconsistent climates (Chan et al., 2010) and are raised for milk, meat, and draught purposes. Considering their population size and contribution to the economy, they became an important species in the livestock sector and veterinary practices in Bangladesh. Zebu cattle often encounter surgical conditions in the head region, abdominal region, and body extremities where regional anesthesia is the only choice for sedation since general anesthesia adversely alters cardiovascular and respiratory function in the ruminant (Seddighi and Doherty, 2016). Among different body regions, head region is especially important due to carrying some vital organs and structures such as brain, tongue, eyes, ears, teeth, nose, lips, horn and skull (Uddin et al., 2009). Studies have been done on the head region of temperate cattle (*Bos taurus*) (König et al., 2009; Sisson et al., 1975), Iranian

native cattle (Monfared, 2013), mandibular and maxillofacial regions of Kuri cattle (*Bos taurus longifrons)* (Gambo et al., 2015), and on the skull of domestic cattle (*Bos indicus*) and water buffalo *(Bubalus bubalis)* (Özkan et al., 2019). However, very little research has been conducted to assess the regional anesthetic sites of the head region through a surface approach compared to others in Zebu cattle.

The basic knowledge of the clinical anatomy of the head region is important since desensitization of different nerves is needed for dehorning and disbudding, sinus trephining and accidental wound surgery in lip and cheek (Clarke et al., 2013). Especially, dehorning became a routine practice in modern dairy cattle husbandry (Aubry, 2005). Therefore, the aim of this study was to determine the regional nerve blocking sites for regional anesthesia of the head region in Zebu cattle.

2. MATERIALS AND METHODS

Source of the sample

A total of three (n=3) head regions as the samples of the healthy male adult (2~3 years) Zebu cattle was collected immediately after halal slaughter from the local market of Chattogram city and brought to the anatomy laboratory of Chattogram Veterinary and Animal Sciences University (CVASU). Each sample was kept in a refrigerator at 4 ºC for a few hours and then went for dissection on the same day.

Morphometry

Firstly, the samples were examined externally and included into the study if found no injury and anatomical deformities. Then the location of different surgically important nerve blocking sites was determined based on bony landmarks and was further confirmed by dissection. Then a total of six gross anatomical measurements was done in the head region of Zebu cattle using scale and thread as described below.

1. Distance from the lateral canthus of the eye to the base of the horn.
2. Distance from the lateral canthus of eye to the proposed site of injection.
3. Distance from the base of the horn to the proposed site of injection.
4. Distance from the mid-dorsal orbital rim to the supraorbital foramen.
5. Distance from the facial tuberosity to the infraorbital foramen in the maxilla.
6. Distance from the lateral border of the canine tooth to the mental foramen in the mandible.
7. Distance from the lip commissure to the mental foramen in the mandible.

Statistical analysis

All the measurements were expressed as mean with standard deviation (Mean± SD) using Microsoft Excel.

3. RESULTS AND DISCUSSION

Cornual nerve blocking site

Cornual nerve is the branch of the zygomaticotemporal (lacrimal) nerve that emerges through the orbit, courses dorsal and dorsolateral aspect of the orbit, runs along the temporal line, give branches and innervate mainly the lateral and caudal part of the base of the horn as stated previously in temperate cattle (*Bos taurus*) (Sisson et al., 1975). The landmark for blocking cornual nerve is temporal line (temporal ridge of the frontal bone) that extends from the lateral canthus of the eye to the base of the horn which was measured an average of 8.93±0.90 cm (Fig. 1 A, B and Table 1). To determine the location of the nerve, our fine dissection revealed the nerve along the temporal line subcutaneously (Fig. 1 A, B). Thus, a subcutaneous injection at a position before branching of the nerve either at a mean distance of 4.26 ± 0.46 cm from the lateral canthus of the eye toward the base of the horn or at the mean distance of 4.66 ± 0.57 cm (Table 1) from the base of the horn to the lateral canthus of the eye was the suitable site. It was reported that the cornual nerve could be efficiently blocked along the temporal ridge of the frontal bone, roughly halfway between the lateral canthus of the eye and the base of the horn (Fillmore and Seifert, 2015) which coincides with our present findings. The needle should be inserted at caudomedial direction and the syringe plunger should be withdrawn to check whether the needle has not penetrated the vessels vicinity of the nerve.

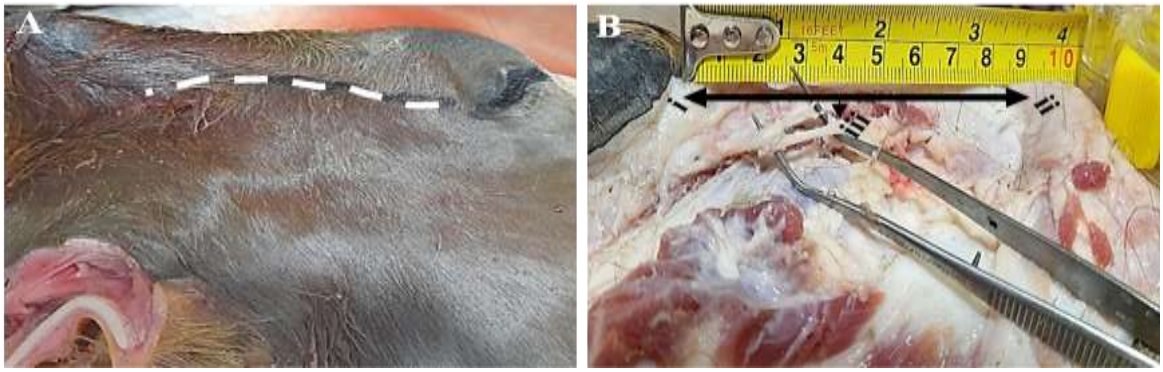

Figure 1. Representative image of cornual nerve blocking site (**A)** Dotted line indicating temporal line **(B)** Distance between lateral canthus of the eye to the base of the horn with exposed cornual nerve. (i) Base of the horn, (ii) Lateral canthus of the eye (iii) Cornual nerve

Table 1. The measurements of the head region of the Zebu cattle (cm).

	Nerve	Morphometric parameter	n=1	n=2	n=3	Average (Mean ± SD)
1	Cornual nerve	Lateral canthus of eye to the base of the horn	9.0	8.0	9.8	8.93 ± 0.90
2	Cornual nerve	Lateral canthus of eye to the site of injection	4.0	4.0	4.8	4.26 ± 0.46
3	Cornual nerve	Base of the horn to the site of injection	5.0	4.0	5.0	4.66 ± 0.57
4	Frontal nerve	mid of orbital rim to supraorbital foramen	3.4	4.0	3.5	3.63 ± 0.32
5	Infraorbital nerve	facial tuberosity to infraorbital foramen	4.5	4.6	4.3	4.46 ± 0.15
6	Mental nerve	The last incisor teeth to the mental foramen	4.2	4.0	3.5	3.9 ± 0.36
7	Mental nerve	The mental foramen to lip commissure	3.5	3.6	3.8	3.63 ± 0.15

Frontal (supraorbital) nerve blocking site

Cornual nerve block alone is not always sufficient in dehorning and disbudding procedures as substantial branches from the frontal (supraorbital) nerve extends from the frontal sinus to the horn core (Dyce et al., 2010). Blocking of frontal (supraorbital) nerve is necessary during trephining of frontal sinus also. It has been shown that frontal (supraorbital) nerve along with artery and vein emerges through the supraorbital foramina in frontal groove (König et al., 2009). To determine the location of the nerve, our study found that the frontal (supraorbital) nerve is located on an average of 3.63 ± 0.32 cm dorsomedial to the nearest bony landmark of mid of the orbital rim (Fig. 2 A, B and table 1). This result coincides with the study on Kuri cattle where it has been revealed that the supraorbital nerve emerges at 3.1 cm dorsomedial to the orbital rim (Gambo et al., 2015). Thus, subcutaneous injection at frontal groove in caudoventral direction avoiding the blood vessels may desensitize the nerve successfully.

Infraorbital nerve blocking site

Maxillary nerve continues as infraorbital nerve through infraorbital canal in temperate zone cattle (*Bos taurus*) (König et al., 2009; Sisson et al., 1975) and this infraorbital nerve is necessary to desensitize the skin of upper lip and nostril (Olopade and Onwuka, 2005). To determine the location of the infraorbital nerve, facial tuberosity could act as an important guide which was found prominent even in the undissected fresh samples in our study. The distance between facial tuberosity to infraorbital foramen

was estimated as an average of 4.46 ± 0.15 cm rostral and dorsomedial (Fig. 3 A, B and Table 1). Thus, a needle should be inserted at the craniolateral direction towards the foramen (Fig. 3 A, B) along with examining the penetration of blood vessels for successful regional anesthesia. It has been reported that the distance from the facial tuberosity to infraorbital foramen was 5.3 cm in Kuri cattle (Gambo et al., 2015). The distance in Zebu cattle differ somewhat with the Kuri cattle probably due to the longer size of the maxilla in the later.

Mental nerve blocking site

We determined the location of mental nerve which emerges from a single opening called mental foramen as a continuation of mandibuloalveolar nerve (König et al., 2009; Sisson et al., 1975) and innervate in chin and lower lip.

In this study, we determined the location of the site based on the lip commissure and the canine tooth. The distance from the lateral border of the canine tooth to the mental foramen and the mental foramen to lip commissure in the adult Zebu cattle were 3.63 ± 0.15 cm caudolateral and 3.9 ± 0.36 cm ventro-medial respectively (Fig. 4 A, B and Table 1) while the distance from the lateral alveolar tooth root to the mental foramen in the Iranian native cattle was reported to be 5.7 cm (Monfared, 2013). Another study on Kuri cattle (Gambo et al., 2015) found that the distance from the lateral alveolar tooth root to the mental foramen was 4.8 cm. This variation might be due to the differences in size of the mandible among these breeds. However, to achieve the desensitization, it is advisable to insert the needle in caudolateral direction along the anterior aspect of the lateral surface of body of mandible (Fig. 4 A, B) with taking precautions for avoiding the blood vessels.

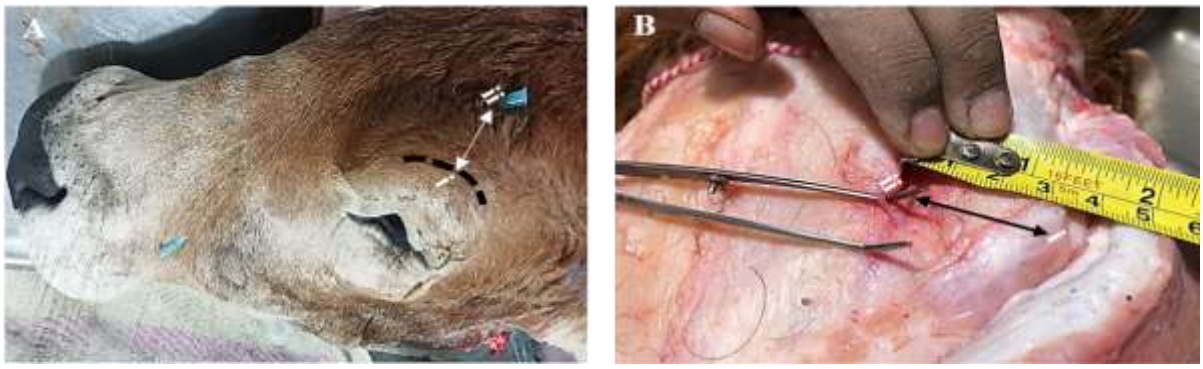

Figure 2. Representative image of frontal nerve blocking site **(A)** Orbital rim to supraorbital foramen, (i) orbital rim (ii) supraorbital foramen. **(B)** Mid-orbital rim to supraorbital foramen showing the frontal nerve, (i) orbital rim (ii) supraorbital foramen in supraorbital groove.

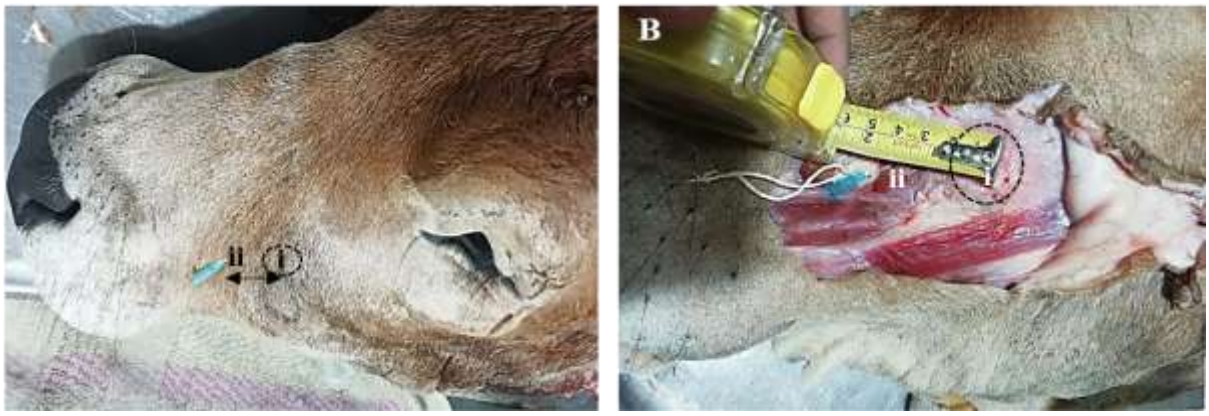

Figure 3. Representative image of infraorbital nerve blocking site **(A)** Facial tuber to infraorbital foramen, (i) infraorbital nerve (ii) facial tuberosity. **(B)** Distance from facial tuberosity to the infraorbital foramen, (i) infraorbital nerve (ii) facial tuberosity.

Figure 4. Representative image of mental nerve blocking site **(A)** Distance between canine tooth to mental foramen, (i) mental foramen (ii) canine tooth. **(B)** Distance between lip commissure and mental foramen, (i) mental foramen (ii) lip commissure

4. CONCLUSION

Our study provided for the first time, a baseline data on regional anesthetic sites of head regions of the Zebu cattle to which comparisons could be made with other breeds of cattle found in Bangladesh and beyond. Most importantly, it would help the field veterinarians in regional analgesia of these areas while conducting common surgical procedures such as dehorning, disbudding, trephining of frontal sinus and surgeries for relieving animal sufferings and for improving production in livestock subsector. Finally, considering the importance of teeth extraction of lower jaw in Zebu cattle our future research will emphasize on the course and anesthetic sites of mandibuloalveolar nerve.

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REFERENCES

Aubry, P. 2005. Routine surgical procedures in dairy cattle under field conditions: Abomasal surgery, dehorning, and tail docking. Veterinary Clinics of North America - Food Animal Practice, 21(1), 55–72.

Chan, E. K. F., Nagaraj, S. H. and Reverter, A. 2010. The evolution of tropical adaptation: Comparing taurine and zebu cattle. Animal Genetics, 41(5): 467–477.

Clarke, K. W., Trim, C. M. and Hall, L. W. 2013. Veterinary anaesthesia: Eleventh edition. Veterinary Anaesthesia: Eleventh Edition, 1–694.

Dyce, K. M., Keith M., Wensing, C. J. G., Cornelis, J. G., Sack, W. O., Wolfgang, O. and Wensing, C. J. G. and Cornelis J. G. 2010. Textbook of veterinary anatomy. In Saunders/Elsevier.

Fillmore, E. P. and Seifert, M. F. 2015. Anatomy of the Trigeminal Nerve. Nerves and Nerve Injuries, 1: 319–350.

Gambo, B. G., Yahaya, A., Girgiri, I. and Olopade, J. O. 2015. Morphometric studies of the mandibular and maxillofacial regions of the Kuri cattle and the implications in regional anaesthesia. Folia Morphologica (Poland), 74(2): 183–187.

König, H. E., Liebich, H.-G. and Bragulla, H. 2009. Veterinary anatomy of domestic mammals : Textbook and Colour Atlas. 768.

Uddin, M. M., Ahmed, S. U., Islam, K.. N. and Islam, M. 2009. Clinical Anatomy of the Head Region of the Black Bengal Goat in Bangladesh Anatomía Clínica de la Región de la Cabeza de la Cabra Negra Bengal en Bangladesh. In Bangladesh. Int. J. Morphol, 27(4):

Monfared, A. L. 2013. Gross anatomical measurements of the head region of the Iranian native cattle (Bos taurus) and their clinical value for regional anesthesia. Global Veterinaria, 10(2): 219–222.

Olopade, J. O. and Onwuka, S. K. 2005. Some Aspects of the Clinical Anatomy of the Mandibular and Maxillofacial Regions of the West African Dwarf Goat in Nigeria. International Journal of Morphology, 23(1).

Özkan, E., Siddiq, A. B., Kahvecioğlu, K. O., Öztürk, M. and Onar, V. 2019. Morphometric analysis of the skulls of domestic cattle (Bos taurus L.) and water buffalo (Bubalus bubalis L.)

in Turkey. Turkish Journal of Veterinary and Animal Sciences, 43(4): 532–539.

Sanders, J. O. 1980. History and Development of Zebu Cattle in the United States. Journal of Animal Science, 50(6): 1188–1200.

Seddighi, R. and Doherty, T. J. 2016. Field Sedation and Anesthesia of Ruminants. Veterinary Clinics of North America - Food Animal Practice, 32(3): 553–570.

Sisson, S., Grossman, J. D. and Getty, R. 1975. Sisson and Grossman's The anatomy of the domestic animals (5th ed. /). Saunders.