



Prenatal development of membranous neurocranium in buffalo

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Received: 26 April 2011; Accepted: 7 February 2012

ABSTRACT

The study was conducted on 509 buffalo embryos and fetuses starting from 26 day to 310 day. The frontal, parietal, interparietal and upper part of squamous occipital formed the desmocranium. The parietals were located on roof of the skull throughout the prenatal life. The frontals and parietals showed a dome like appearance all prenatal stages. The occurrence of interparietals was inconstant. The ossification of desmocranium first appeared in frontal at 49 days. The early ossification in parietal was noticed at 60 days. The bone wise sequence of appearance of ossification was frontal, parietal, interparietal, upper part of squamous occipital.

Key words: Buffalo, Membranous neurocranium, Prenatal development

The development of neurocranium in prenatal skull of buffalo at different embryonic and foetal stages has not been studied in detail among farm animals. Hence the present study was taken up.

MATERIALS AND METHODS

Specimens (509) at embryonic and foetal stages starting from 26 days to 310 days were used for the study. The prenatal specimens of unknown age were collected from different slaughter houses irrespective of nutritional status and breed of the mother. The age of the specimens was calculated by Soliman's (1975) formula coined for buffalo. The CVRL of the specimens ranged from 2.1 cm to 105 cm at 38 and 310 days respectively. The embryos and foetuses were collected and fixed in 10% neutral formalin and Bouin's fluids and processed for serial paraffin sections of 6–8 μ thickness. The foetal heads of 70 days (9.2 cm CVRL) and above were subjected to decalcification by acid - citrate method after fixation and the sections were stained by Mayer's stain for routine developmental study (Singh and Sulochana 1997), Von Kossa and Alcian blue methods (Humason 1967) and Bismarck brown methyl green method (Gurr 1956). The foetal heads of 70 days and above were subjected to Alizarin Red S and Toluidine Blue (Burdick 1965) method to study extent of bone formation.

*Part of Ph.D thesis submitted to Sri Venkateswara Veterinary University, 2006.

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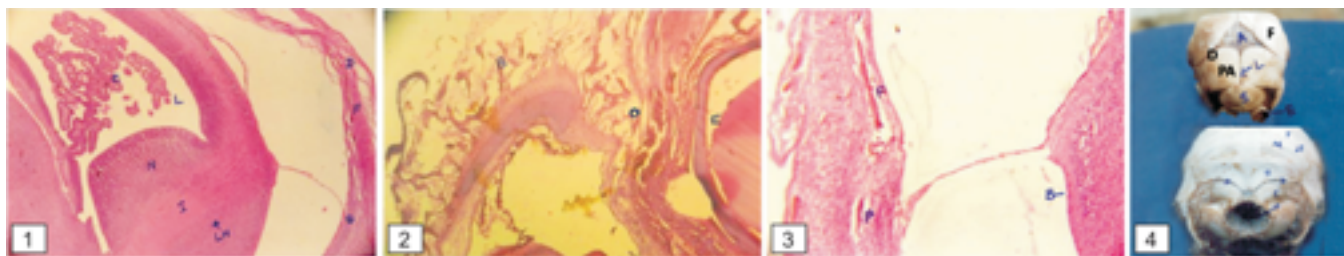
RESULTS AND DISCUSSION

The frontal, parietal, squamous occipital, interparietal and upper part of squamous occipital were grouped under membranous neurocranium. However frontal, parietal and squamous temporal in domestic animals (Latshaw 1987) were classified under the bones of membranous neurocranium. Intramembranous bone formation was seen in the bones of the membranous neurocranium.

Frontal: The frontal bone was developed from single ossification center in the body near the region of supraorbital groove as in bovines (Matthews, 1972) first at 49 days (Fig. 1), extended well into the orbital part at 75 days (Fig. 2) and complete by 83 days. The early ossification in frontal bone was reported to be observed at 45 days and 52 days respectively by Matthews (1972) and Soana *et al.* (1996) in bovines. Frontals along with parietals gave a dome like appearance to skull during the prenatal life. The supraorbital groove and foramen were evident at 98 days. The bulging of frontal bone one on either side just medial to the supra orbital groove was observed from 97 days and disappeared beyond the age of 225 days. The cornual process was small at 220 days. Two small triangular unossified areas one on either side of median plane were observed between frontal and nasal bones up to 119 days and disappeared beyond the age of 120 days.

Parietal: The parietal was developed from single intramembranous ossification center. The first sign of ossification in parietal was evident at 60 days (Fig. 3), while Matthews (1972) reported the same at 52 days and Soana *et al.* (1996) at 97 days in bovines. Most of the parietal was ossified completely at 141 days.

The parietals were located on roof of the skull through



Figs 1–4. Cross section of — 49-day embryonic head showing early ossification of frontal (F) in the body. H & E×40. D. Desmocranium; O. orbitosphenoidal cartilage; C. choroid plexus; L, lateral ventricle; N, caudate nucleus; I. internal capsule; LN, lenticular nucleus; 2. 75-day foetal head showing advanced ossification in body (B) and orbital part (O) of frontal. H & E×40. E, Eye ball; 3. 60-day foetal head showing early ossification of parietal (P).H & E×40. F. Ossification in frontal B, Brain. 4. Dorsal view of 126 day (top) and posterior view of 310 day (bottom) foetal skulls showing line of demarcation (L) between two parietals, line of demarcation (D) between parietal (PA) and frontal (F) and line of demarcation (DP) between SQ and parietal (P). F. diamond shaped foramen magnum; A, anterior fontanelle; SQ, upper part of squamous occipital; S, squamous occipital; E,exoccipital.

out the prenatal life which may be attributed to poor development of frontal sinus in prenatal stages. The convexity of parietals was well marked at 83 days. The line of demarcation between 2 parietal bones and between parietal and squamous occipital (Fig. 4) was evident throughout the prenatal period. Contrary to this the right and left parietals were reported to fuse with each other and also with the squamous occipital before birth in bovines by McLeod (1958).

Interparietal: The interparietals were triangular median bones located between membranous portion of squamous occipital and parietal bones. The occurrence of interparietals was inconstant as about 40 specimens aged between 98 days to 209 days never showed the development of interparietals,

which agree with the reports of Nickel *et al.* (1986) and Soana *et al.* (1996) in domestic animals. It was developed from single intramembranous ossification center as reported in bovines (Matthews 1972). The first sign of ossification of interparietals was observed at 64 days, while Matthews (1972) observed the same at 60 days in bovines. The ossification of interparietal was complete by 93 days. The interparietals were fused with the respective parietals variably during 193 days to 215 days. However Mc Leod (1958) reported the fusion of interparietals with the parietals and squamous occipital shortly before birth in ox.

Upper part of squamous occipital: The upper part of squamous occipital was developed from intramembranous ossification center above the foramen magnum, while lower part by endochondral ossification (Fig. 5). The ossification in upper part of squamous occipital was observed first at 64 days and complete by 132 days. A raised prominence in the middle portion of external surface of membranous portion of squamous occipital was evident in ages between 132 days to 193 days which decreases thereafter.

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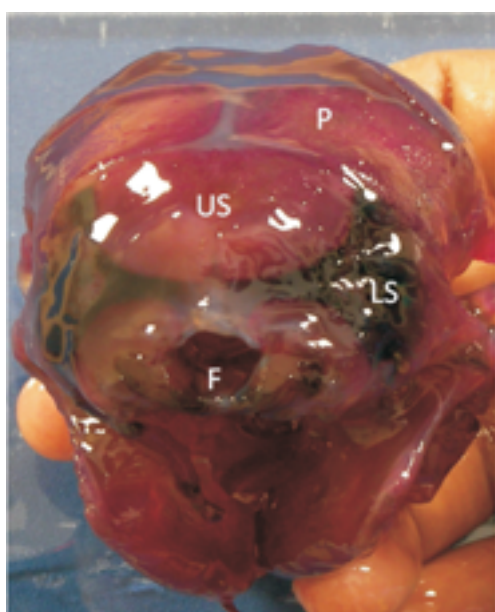


Fig. 5. Alizarin Red S stained head of 126 day foetus (posterior view) showing intramembranous ossification in the upper part (US) and endochondral ossification in the lower part (LS) of squamous occipital. F, Foramen magnum; P, parietal.

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