Fate of Otic and Nasal Capsules in Buffalo (Bubalus bubalis)

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ABSTRACT

The present work was undertaken on 55 buffalo embryos and foetii ranging from 26 to 310 days. The otocyst development was recognized first at 26 days and surrounded by an otic capsule at 27 days. The otic and nasal capsules were in cartilaginous form at 45 days. The otic capsule had formed the tympanic bulla at 62 days and petrous temporal at 111 days. The ethmoid, turbinates, nasal septum and nasal cartilages were derived from the mesenchyme of nasal capsule. Distinct nasal cartilages were observed at 61 days. Ossification of nasal capsule was evident first in perpendicular plate of ethmoid at 85 days.

Key words: Buffalo, Nasal capsule, Otic capsule

The fate of otic and nasal capsules in buffalo skull had received very little attention at different embryonic and foetal stages; hence the present study was taken up with sequential developmental stages and anomalies.

MATERIALS AND METHODS

The present study was conducted on 55 buffalo foetii ranged from 26 to 310 days. The curved crown rump length (CVRL) of specimens was measured and the age of the specimens was calculated by formula coined for buffalo (Soliman, 1975) i.e. Y = 28.66 + 4.496 X if CVRL is < 20 cm and Y = 73.544 + 2.256 X if CVRL is > 20 cm where Y is the age in days and X is the curved crown rump length in centimeters.

All the specimens and heads of foetii from 50 days were fixed either in 10% buffered neutral formalin or 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 formic acid-sodium citrate method after fixation. The sections were subjected to Mayer’s hematoxylin and eosin method (Singh and Sulochana, 1997), Alcian blue and Von Kossa staining methods (Humason, 1967) to study the fate of otic and nasal capsules. The foetal heads above 101 days (16.1 cm CVRL) were stained by Alizarin red S method for studying extent of bone formation (Humason, 1967).

RESULTS AND DISCUSSION

Otic capsule: Otocyst formation was first noticed in the buffalo head at 26 days and was surrounded by mesenchymal otic capsule at 27 days. The pre-cartilaginous otic capsule showed the vesicle formation at 38 days (Fig. 1) and otic capsule appeared in cartilaginous form at 45 days. The cartilaginous form of petrous temporal was reported during 9th week in human by Larsen (1998). The union of otic capsule with basal plate cartilage was observed at 49 days. The otic capsule formed tympanic bulla (Fig. 2) first and later formed the petrous temporal. The otic capsule was reported to form only petrous temporal in bovines (Matthews, 1972). The petrous temporal was developed from multiple centers of ossification as reported by Soana et al. (1996) in bovines. The petrous temporal showed ossification first at 111 days, which was recorded variably during 4th to 6th month in human (Larsen, 1998; Effery and Spoor, 2004). The temporal bone attained the fundamental shape similar to that of adult by 126 days.

The development of tympanic bulla was observed as a pre-cartilaginous process grew from the lateral part of the otic capsule at 49 days as reported by Noden and deLahunta (1985) and Latshaw (1987) in domestic animals. It was cartilaginous at 55 days and showed early ossification at 62 days (Fig. 2). While it was reported to
be developed at 97 days of gestation in bovines (Soana et al., 1996) and postnatally in domestic animals (Noden and deLahunt, 1985). The compressed tympanic bulla had gradually changed to convex form at 144 days and attained the characteristic adult features at 225 days.

Nasal capsule: The paired nasal capsules were open cranially while fused caudally with prechondral part in forming cribriform plate of ethmoid. The nasal capsule was pre-cartilaginous at 43 days and cartilaginous at 45 days. It was in the form of an inverted ‘U’ shaped longitudinal continuous plate of hyaline cartilage from fronto-nasal region to tip of upper jaw forming the roof, side wall and medial wall of nasal cavity (Fig. 3). The ethmoid, turbinates, nasal septum and nasal cartilages were derived from the nasal capsule. The anterior portion of nasal capsule gave rise to nasal cartilages, which were distinct at 61 days. The turbinates were developed as longitudinal in growing shelves from the lateral wall of the nasal capsule (Fig. 3) as mesenchymal condensations at 43 days, while they were in pre-cartilaginous form at 45 days and cartilaginous form at 47 days. However, condensed mesenchymal form of dorsal turbinate was reported at 56 days in human by Vidic (1971) and chondrification of turbinates was reported earliest by 46 days in bovines by Matthews (1972). The dorsal and ventral turbinates were developed endochondrally from single ossification centres. In contrary to this, Soana et al. (1996) reported the development of bovine turbinates by intramembranous ossification.

Ossification was observed first in ventral turbinate
at 148 days, while the earliest ossification in turbinates was reported at 120 days (Matthews, 1972) and 117 days (Soana et al., 1996) in bovines. At 180 days, the dorsal turbinate was completely cartilaginous, while the ventral turbinate showed ossification only at the posterior portion. The dorsal turbinate was the last bone of the skull to ossify and showed ossification at 193 days. Well marked ossification was observed at the posterior portion of dorsal turbinate at 238 days. Complete ossification of turbinates has not taken place in the prenatal period, as the anterior portion of turbinates and basal lamina of dorsal and ventral turbinates were in cartilaginous form even at 310 days. In contrary to this, Vidic (1971) reported distinct bony skeleton of human turbinates at 30 weeks of prenatal life, while Soana et al. (1996) recorded well mineralization of turbinates between 188 to 212 days in bovines.

The cribriform plate and perpendicular plate of ethmoid were in the pre-cartilage stage at 43 days and cartilaginous stage at 45 days, respectively. The ethmoid bone was developed from three ossification centres, one for each lateral mass (ethmoturbinates) and one for the perpendicular plate. However, Sisson (1975) reported five ossification centers for ethmoid of ox. The perpendicular plate of ethmoid showed early signs of ossification at 85 days in the ventral part of the posterior portion of the nasal septum and it was well marked at 209 days. Soana et al. (1996) reported beginning of intramembranous ossification in ethmoid of bovines at 130 days. The ethmoturbinates developed from nasal capsule (Fig. 4) and were pre-cartilaginous at 45 days and cartilaginous at 55 days. The first ossification of lateral masses was observed in great ethmoturbinate at 150 days and was completed at 238 days in all ethmoturbinates. The cribriform plate was the last part of the ethmoid that showed ossification first at 170 days.

REFERENCES