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Morphogenesis of neurohypophysis during prenatal development in buffalo

R S SETHI[1] and OPINDER SINGH[2]

Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab 141 004 India

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The morphogenesis of neurohypophysis had been reported in ox (House 1943), goat (Singh 1973), sheep (Perry *et al.* 1982), horse (Harrison and Shryock 1940), rat (Fink and Smith 1971) and chick (Hammond 1974). However, no reference is available on the morphogenesis of neurohypophysis in buffalo foetuses; hence the present study was undertaken.

Buffalo foetuses (19) ranging from 30 mm to 630 mm in crown-rump length (CRL) were collected from the slaughter house to study the morphogenesis of neurohypophysis. The CRL of the foetuses was measured in millimeters (mm) with a calibrated inelastic thread as described by Edward (1965). The approximate age of foetuses was determined on the basis of their CRL by using following formulae based on Soliman (1975)

$Y = 28.66 + 4.496 X$ [CRL < 20 cm]

$Y = 73.544 + 2.256 X$ [CRL ≥ 20 cm]

Where Y is the age in days and X is the CRL of foetuses in centimeters (cm). After measurement of CRL, whole foetuses up to 60 mm CR length were fixed in Bouin's Holland Sublimate (Humason 1972) directly. For the larger foetuses between 75 to 320 mm the pieces of head region including sellar areas were removed and fixed. The hypophysis cerebri from foetuses above 480 mm CR length were removed and fixed in the above said fixative. The tissues were processed to obtain the 5 mm thick paraffin sections by acetone benzene schedule (Luna 1968). The sections were stained with haematoxylin and eosin and Masson's trichrome staining (Luna 1968), Herlant's alcian blue-PAS-orange G staining and luxol fast blue-erythrocin-orange G-aniline blue staining methods (Girod 1976).

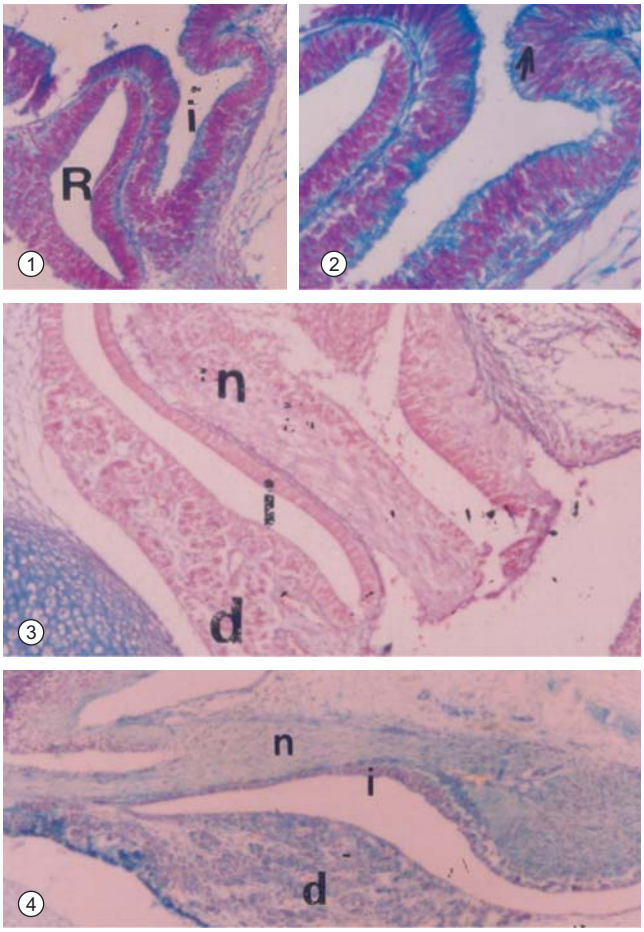
In the 35 mm CRL buffalo foetus the anlage of the posterior lobe of pituitary (neurohypophysis) appeared as a well marked hollow outgrowth (infundibulum) from the wall of the diencephalon. The infundibulum was closely related to the caudal wall of the Rathke's pouch (Fig. 1) with little mesenchymal tissue between them. The first appearance of the infundibulum was reported in the foetuses of 12 mm CRL in goat (Singh 1973), at 26 days of gestation in sheep (Perry *et al.* 1982), at 17 mm CRL in ox (House 1943), at 25 mm CRL in horse (Harrison and Shryock 1940), and on day 11 of gestation in mouse (Hashimoto *et al.* 1998). A middle ventral evagination from the neural tube appeared about 8–10 somites level stage in chick embryo (Hammond 1974).

The infundibulum was tubular in shape with thick walls and was communicating with the cavity of the diencephalon in the buffalo foetus of 35 mm CRL. The wall of the infundibulum was lined by the tall ependymal cells resembling the pseudostratified epithelium (Fig. 2). In the serial sections maximum length of the tubular infundibulum was estimated 0.45 mm. The rostro-caudal and side to side diameters were 0.213 mm and 0.25 mm, respectively. The thickness of the wall in the median section was minimum (51.98 µm) on the Rathke's pouch side and maximum (65.28 µm) on its free side.

In the buffalo foetus of 43 mm CRL, the infundibulum changed the direction; the long axis became more or less perpendicular to the long axis of the foetus. The infundibular wall opposite to the Rathke's pouch showed cellular proliferation and foldings representing the beginning of formation of the posterior pituitary. The distal part of the infundibulum (primitive neurohypophysis) showed considerable reduction in the lumen size as compared to the total increase in size. The cellular differentiation and aggregation was more marked along the lumen at 60 mm CRL stage. Thus the development at this stage had clearly evidenced the differentiation of neurohypophysis, pars distalis and pars intermedia (Fig.3) as reported earlier by Sethi and Saigal (1998). The pars nervosa was first time observed in the foetuses of goat at 48.5 mm CRL (Singh 1973), 40 days of gestation in sheep (Perry *et al.* 1982), and 18th foetal day in rat (Fink and Smith 1971). In the present study the maximum length and width of neurohypophysis were 0.763 mm and 0.195 mm, respectively, at this stage of development.

In the 75 mm and onwards CRL buffalo foetuses the

Present address: [1]Associate Professor (e-mail: sethi116 @gmail.com), [2]Associate Professor, Department of Anatomy and Histology.



Figs 1–4. Neurohypophysis of buffalo foetus showing: **1**. infundibulum (i) in close contact with the Rathke's pouch (R) at 35 mm CRL. Luxol fast blue –erythrocin- orange G- aniline blue stain × 70; **2**. part of Fig 1 at higher magnification showing infundibulum lined with tall ependymal cells (arrow) at 35 mm CRL × 175; **3**. well differentiated pars distalis (d), pars intermedia (i) and neurohypophysis (n) at 60 mm CRL. Herlant's alcian blue-PAS-orange G × 100; **4**. neurohypophysis (n), pars intermedia (i) and pars distalis adenohypophysis (d) at 120 mm CRL. Luxol fast blue –erythrocin- orange G- aniline blue stain × 70.

neurohypophyseal tissue continued to expand and neurohypophysis was nearly equal in size to pars distalis adenohypophysis. The infundibular lumen within the neurohypophysis could be traced up to 80 mm CRL stage, whereafter, it disappeared due to marked cellular growth. In the present study, the maximum length and width of the neurohypophysis were 0.688 mm and 0.625 mm, respectively, at this stage of development. By the 120 mm CRL stage, the neurohypophysis was smaller than the pars distalis adenohypophysis and the infundibular recess could be seen quite deep into the neural stalk (Fig. 4). There was further increase in the length of the neurohypophysis to 1.475 mm at this stage. In the transverse sections from 120 mm and 190 mm CRL stages the hypophyseal cleft and pars intermedia along with the adenohypophyseal tissue was seen enwrapping the neural stalk laterally as in adult buffalo.

SUMMARY

The study was conducted on 19 buffalo foetuses ranging from 30 mm to 630 mm crown rump length (CRL). The tubular infundibulum evaginated from the diencephalon at 35 mm CRL. It was in close contact with the caudal wall of the Rathke's pouch and was lined with tall ependymal cells. At 43 mm CRL infundibulum became perpendicular to long axis of the foetus and showed cellular proliferation and foldings which resulted in the differentiation of neurohypophysis at 60 mm CRL. The lumen of the infundibulum disappeared at 80 mm CRL stage. The pars distalis, pars intermedia and hypophyseal cleft were seen enwrapping the neurohypophysis at 120 mm CRL and onward stages.

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