DIFFERENTIATION OF PARS DISTALIS ADENOHYPOPHYSIS CEREBRI IN BUFFALO FOETII

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ABSTRACT

A total of 19 buffalo foetii ranging from 30 mm to 630 mm Crown-Rump (CR) length were subjected to serial histological sections to study the differentiation of the pars distalis adenohypophysis. The primitive pars distalis tissue appeared at 32 mm stage from the rostro-ventral wall of the Rathke's pouch as irregular projections of the proliferating cells outgrowing into the surrounding mesenchyme. The capillaries were seen entrapped within the adenohypophyseal tissue by 60 mm CR length. The relative proportions of the stromal tissue continued to decrease with age. The parenchymatous cells were predominantly arranged in form of thin cords; and follicular forms were relatively more frequent at 75 mm stage onwards. By 630 mm stage the parenchymatous tissue was arranged primarily in irregular cords and groups of cells with rare follicles.

INTRODUCTION

Of the domestic animals, the morphogenesis of the pars distalis adenohypophysis has been reported in horse (Harrison and Shryock, 1940), cattle (House, 1943) and goat (Singh and Dhingra, 1979). In buffalo, the pars distalis adenohypophysis during post natal life has been studied in detail including certain electron microscopic observations (Khan, 1995). No literature on its morphogenesis during post natal life could be traced in buffalo, and hence the present study was undertaken.

MATERIALS AND METHODS

Nineteen buffalo (*Bubalus bubalis*) foetii ranging from 30 mm to 630 mm in Crown-Rump (CR) length were collected from the slaughter house. Whole foetii up to 60 mm CR length were fixed in Bouin's Holland Sublimate (Humason, 1972) directly. For the larger foetii between 75 to 320 mm the pieces of head region including sellar areas were removed and fixed. From the foetii above 480 mm CR length, the hypophysis cerebri were removed and fixed in the above mentioned fixative. The tissues were processed for the paraffin blocks using cedar wood oil schedule (Luna, 1968). The serial sections of 5 μm thickness were stained with haematoxylin and eosin, Masson's trichrome and periodic acid Schiff (PAS) and alcian blue - PAS stain (Luna, 1968).

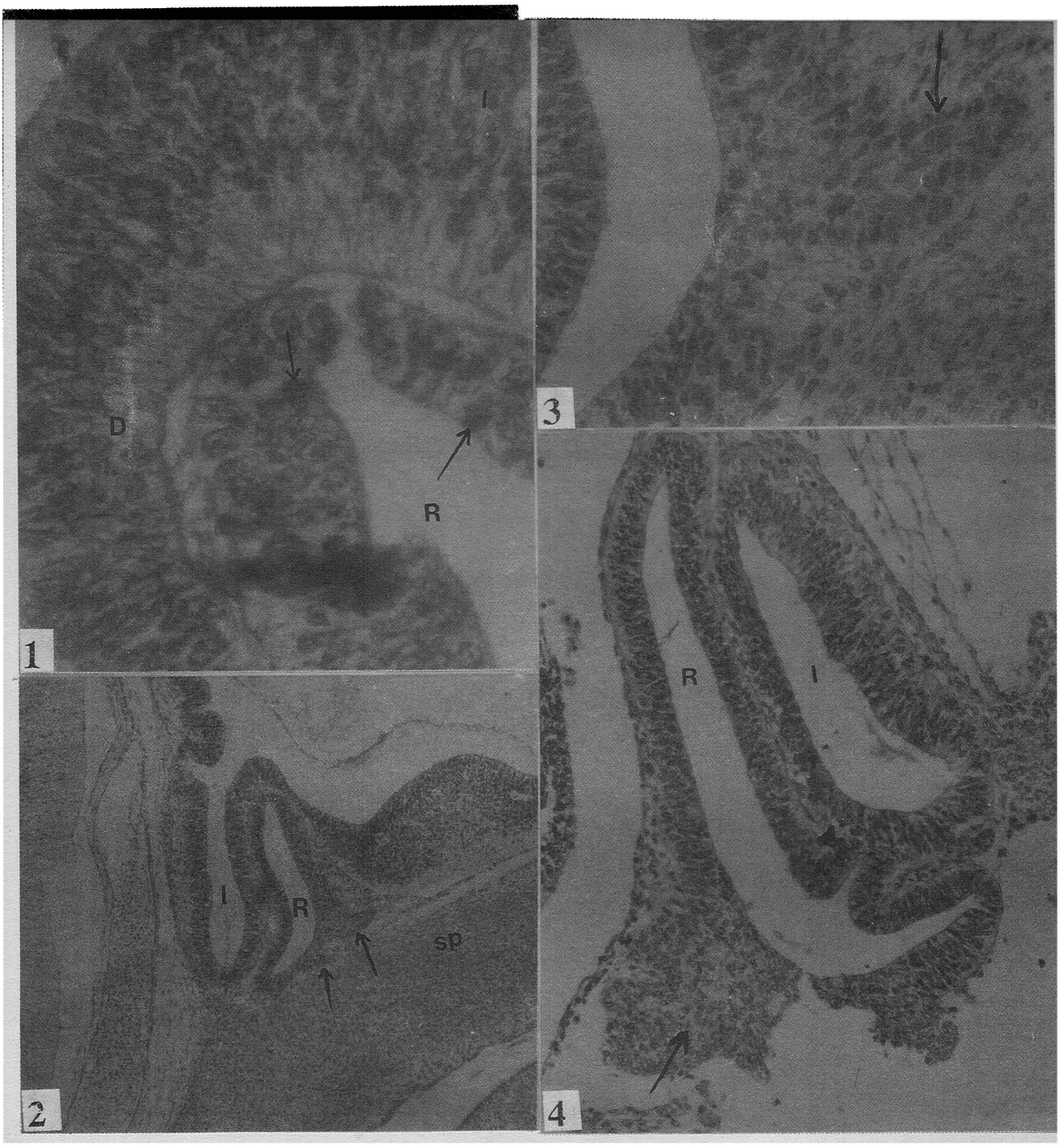
The sections stained with some specialized procedures for other purposes were also used in this study. These included - luxol fast blue - erythrocin - orange G - aniline blue staining, Elftman's paraldehyde fuchsin - PAS - orange G stain and Herlant's alcian blue - PAS - orange G staining (Girod, 1976).

RESULTS AND DISCUSSION

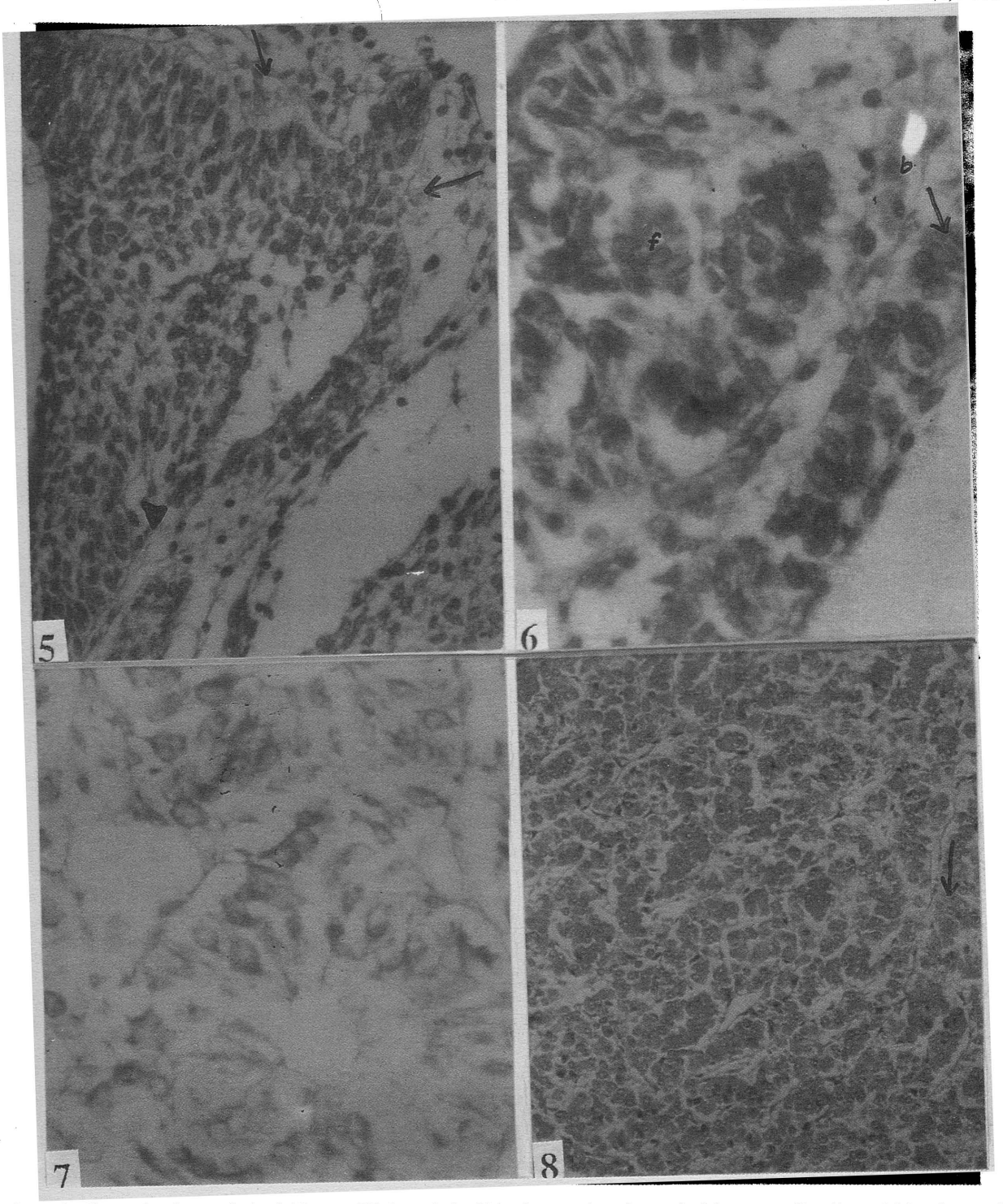
In buffalo foetii of 30 mm CR length, the wall of the Rathke's pouch was uneven in thickness. The wall was thinner and had greater nuclear density at the cephalic end (wedged between the infundibulum and diencephalon) of the tubular Rathke's pouch (Plate 1). The wall of the pharyngeal end was thickest with relatively larger number of cell layers and less nuclear density. The cytoplasm of the cells was not prominent, nuclei were mostly oval or round, some being elongated. Mitotic figures were seen.

At 32 mm CR length, the rostral border of the Rathke's pouch in its nearly median sections was irregular with two of the prominent limb like projections at its ventro-rostral end close to the sphenoidal area which marked the primitive pars distalis tissue (Figs. 2,3).

At CR length 35 mm, this limb like projections into the surrounding mesenchymal tissue became extensively proliferative pars distalis tissue (Plate 4). On the infundibular side nearly in the median sections a projection with lumen extending from the wall of the pouch was seen. At CR length 32 as well as 35 mm, the wall of the pouch had a greater cellular density on the infundibular side than that on opposite to it (Figs. 2,4).



Plates 1) The cephalic end of the Rathke's pouch (R) from a 30 mm CR length buffalo foetus, wedged between the infundibulum (I) and diencephalon (D). Mitotic figures (arrows) are seen in the wall of the Rathke's pouch. Massons's trichrome stain x 700. 2) Nearly mid sagittal section through the head of 32 mm CR length buffalo foetus showing prominent limb like projections (arrow) at the ventro-rostral end of the Rathke's pouch (R) close to the sphenoidal tissue (Sp). H. & E. stain x 70. 3) A part of Plate 2 at higher magnification showing cellular details of the limb like projection (arrow) extending into adjacent mesenchyme. H. & E. stain x 350 and 4) Nearly mid sagittal section of hypophyseal primordia of 35 mm CR length buffalo foetus showing the proliferation of limb like projections from the Rathke's pouch (R) marking the primordial pars distalis tissue (arrow). Also seen is a projection with lumen (arrow head) from the wall of the Rathke's pouch towards the infundibulum (I). Masson's trichrome stain x 175.



Plates 5) Hypophysis cerebri of 43 mm CR length buffalo foetus showing primitive pars distalis and blood vessels penetrating into the glandular tissue (arrow head) with the mesenchyme in its vicinity (arrow). H. & E. stain x 350. 6) Pars distalis adenohypophyseal tissue from a 60 mm CR length buffalo foetus showing group of parenchymatous cells arranging in follicles (f) and cords (arrow) with abundant mesenchymal tissue and frequent blood vessels (b) penetrated in the gland. H. & E. stain x 700. 7) Pars distalis adenohypophyseal tissue from a 75 mm CR length buffalo foetus showing cells arranged in follicular form, some of which have little alcianophilic cytoplasm. Alcian blue - periodic acid Schiff's stain x 700 and 8) Pars distalis adenohypophyseal tissue from a 630 mm CR length buffalo foetus showing the parenchymatous tissue mostly arranged as irregular cords and groups of cells with rare follicular arrangement (arrow). H. & E. stain x 175.

At 43 mm CR length, the pars distalis primordium showed extensive cellular proliferation extending into the adjacent parenchyma overlying the sphenoidal cartilage. The cellular details were similar to those of the younger foetii. The mesenchyme in the vicinity of this tissue contained frequent blood vessels, which could be seen penetrating into it (Plate 5).

At CR length 60 mm, the adenohypophyseal tissue had spread along and closely contacted with the developing pars nervosa. The primordial tissue of the pars distalis had further proliferated. The development at this stage had clearly evidenced the differentiation of pars distalis and pars nervosa. The pars distalis tissue showed groups of parenchymatous cells arranged in follicles and cord with the abundant stromal (mesenchymal) tissue and frequent blood vessels penetrating in between them (Plate 6). The grouping or cord formation was not prominent along the hypophyseal cleft.

From the present observations it is evident that the primitive pars distalis tissue in buffalo was first marked at 32 mm CR length stage in form of limb like projections of the proliferating tissue from the rostral wall of the Rathke's pouch expanding into the surrounding mesenchyme. In goat, the outgrowths from the outer surface of the rostral wall of the Rathke's pouch were reported at 24.8 mm CR length (Singh and Dhingra, 1979). An active cell proliferation in the rostral wall of the Rathke's pouch in cattle was noticed at 17 mm stage (House, 1943). In 48-80 mm stage of cattle foetii, the proliferation of cords or groups of cells and branchings and anastomoses in the cords were freely seen with blood vessels contained within the meshwork of these cords or cell groups (House, 1943). In horse, the capillaries were seen in the developing pars distalis at 44 mm stage (Harrison and Shryock, 1940). In buffalo, however, the blood vessels were frequently seen in the mesenchyme in the vicinity of the primordial adenohypophyseal tissue which could be seen penetrating into it at 43 mm CR length; but the blood vessels within the adenohypophyseal tissue were noted at 60 mm stage. It was at this stage which marked clearly the evidence of differentiation of pars distalis from pars intermedia with considerable reduction in their hypophyseal lumen. In goat, by the rearrangement of the proliferating parenchymatous tissue, the formation of the body of the pars distalis had been reported by CR length 42.5 mm (Singh and Dhingra, 1979).

The mesenchymal tissue between the groups of parenchymatous cells, which was abundant at 60 mm CR length, continued to decrease in relative proportions through 75 mm stage onwards in buffalo foetii. Further, it was observed that the grouping or cord formation that appeared at 600 mm stage, was not well prominent and the overall cellular density was greater in the upper half of the pars distalis than in the lower regions in 75 mm buffalo foetii (Plate 7). This could be appreciated in all the older foetii as well. The parenchymatous cells, which were in the larger groups in the foetii upto 120 mm stage, predominantly arranged in the form of thin cords running primarily in the caudo-ventral direction. The follicular forms were relatively more frequent at 75 mm stage onwards (Plate 7). At 600 mm stage, the pars distalis cells, in general increased in size significantly. By 630 mm stage, the parenchymatous tissue was arranged primarily in the irregular cords and in groups of cells with some follicles (Plate 8). At this stage histomorphologically the pars distalis appeared similar to that of neonatal buffalo calf (Khan, 1995).

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