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Research Article

TOPOGRAPHY OF THE SUBCOMMISSURAL ORGAN IN HORSE

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ABSTRACT

The subcommissural organ extended from recessus infrapinealis and habenular commissure to recessus mesocoelicus on the ventral aspect of posterior commissure and occupied roof of III ventricle and cranial part of cerebral aqueduct. The organ was comprised of a pseudostratified columnar ciliated ependyma towards free ventricular surface, a hypendyma adjacent to posterior commissure and a sub-ependymal glial zone sandwiched in between the two. Mid sagittal section revealed 4 sub-parts of the organ viz. pars-supracommissuralis, pars-precommissuralis, pars-subcommissuralis and pars-retrocommissuralis. However, the subcommissural organ appeared as a horizontal strip with its ventro-lateral limbs having all the cell layers. An abrupt transition was observed between modified ependyma of the organ and simple ventricular ependyma.

Key words: Subcommissural organ, pars-supracommissuralis, pars-precommissuralis, pars-subcommissuralis, pars-retrocommissuralis

The subcommissural organ (SCO) as one of the circumventricular organs (CVO) was considered an independent organ because of its structural and functional involvement in fluid circulation in the cerebral ventricles in Ammocoetes (Dendy, 1902, Dendy and Nicholls, 1910). The SCO is well developed in lower animals but rudimentary in man except the foetal period. A close relationship exists between the SCO and pineal body because of regression of both the organs in man during extra uterine life. The association of large pineal body with a small SCO concludes an inverse relationship between the two organs in domestic animals except horse and dog (Marburg, 1920). A recent study on the CVO demonstrated their involvement in autoimmune diseases including immuno-pathogenesis of experimental autoimmune encephalomyelitis (Schulz and Engelhardt, 2005). The lack of topographic and structural details and importance of the organ in horse led to pursue the present study.

MATERIALS AND METHODS

The present study was conducted on 6 young healthy horses of 8-12 months age sacrificed at University of Kentucky, USA. The brain tissues containing SCO were incised immediately after euthanasia and preserved in 10% neutral buffered formalin for 48 h. The tissues processed for paraffin technique were made to cut serial sections of 5-10 µ and stained with routine Harris hematoxylin and eosin stain (Luna, 1968). Filar micrometer was used to record micrometric observations.

RESULTS AND DISCUSSION

The SCO in the horse was present on the ventral aspect of the posterior commissure (PC) and extended from recessus infrapinealis and habenular commissures to recessus mesocoelicus forming the roof of III ventricle and the cranial part of the cerebral aqueduct as reported in buffalo (Ramkrishna and Saigal, 1985), goat and sheep (Kumar *et al.*, 1997, Saggar *et al.*, 2000) and camel (Kumar *et al.*, 1999). The cranial most portion of the SCO extended towards the dorsal aspect of PC attaching to habenular commissure whereas this portion formed the caudal wall of recessus infrapinealis in other domestic animals. The SCO

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Fig. 1. (a). Photomicrograph of scanned brain section in sagittal section showing extent of subcommissural organ (O), pineal gland (G) and habenula (H).
(H. & E. x 1)

Fig. 1. (b). Photomicrograph of section (a) at higher magnification showing ependyma (E), sub-ependymal glial zone (Z), hypendyma (D) and posterior commissure (T). Note pars-supracommissuralis (i), pars-precommissuralis (ii), pars-subcommissuralis (iii) and pars-retrocommissuralis (iv) subdivisions of the SCO.
(H. & E. x 25)

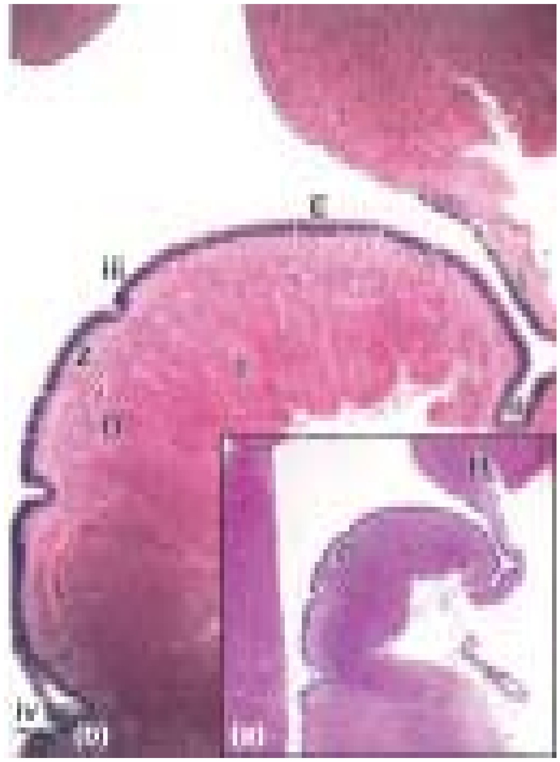

Fig. 2. (a). Photomicrograph of scanned brain section in sagittal section showing extent of subcommissural organ (O) and habenula (H).
(H. & E. x 1)

Fig. 2. (b). Photomicrograph of section (a) at higher magnification showing ependyma (E), sub-ependymal glial zone (Z), hypendyma (D) and posterior commissure (T). Note pars-supracommissuralis (i), pars-precommissuralis (ii), pars-subcommissuralis (iii) and pars-retrocommissuralis (iv) subdivisions of the SCO.
(H. & E. x 25)

measured 9.2 mm in sagittal sections and 4.1 mm in transverse sections. These values have been reported 2.3 - 8.7 mm and 2.76 - 3.0 mm in goat, 6.2 - 7.9 mm and 1.8 - 2.3 mm in sheep, respectively. The folds and curvature of the organ led to variation in extent of the organ in these species.

The SCO was comprised of a modified pseudostratified columnar ciliated ependyma towards the free ventricular surface, a subependymal glial zone and a hypendyma close to the PC (Figs 1, 2). However, subependymal glial zone was lacking in description on the SCO of horse (Talanti, 1958). The SCO can be divided into 4 parts in sagittal sections due to presence of infrapineal recess, a groove toward ventricular surface of the ependyma and recessus

Fig. 3. Photomicrograph of the SCO in transverse section showing its horizontal strip (J) and ventro-lateral limbs (L). Note an abrupt change of SCO ependyma into simple cuboidal ependyma of the III ventricle (V).
(H. & E. x 45)

mesocoelicus. These parts have been named pars-supracommissuralis (PSC), pars-precommissuralis (PPC), pars-subcommissuralis (PSU) and pars-retrocommissuralis (PRC) cranio-caudally (Fig 2) as reported earlier in ruminants (Ramkrishna and Saigal, 1985, Kumar *et al*., 1997, Saggar *et al*., 2000).

The PSC constituting second largest component (1065.6 µ) of the SCO was convex shaped and extended from cranio-dorsal aspect of PC to its junction with pineal gland and habenula. The PSC has been reported smallest portion in goat and sheep (Kumar *et al*., 1997, Saggar *et al*., 2000) and a thin median band covering the posterior part of pineal stalk in buffalo (Ramkrishna and Saigal, 1985). The convex shaped PPC, a caudal continuation of the PSC, was smaller (732.6 µ) than PSC and extended up to the medial groove lining the cranial part of the PC. In contrast, this portion was longer than PSC in goat and sheep (Kumar *et al*., 1997, Saggar *et al*., 2000). The PSU was strongly convex shaped and its strip was further subdivided into 3 subparts due to presence of two small folds. However, this pattern has not been reported in any of the species studied till date. The PSU (7059.6 µ) occupied majority of the ventral surface of the PC and formed the roof of the III ventricle. The free ependymal surface towards ventricle was regular in the horse but reported irregular in buffalo, ox, dog and sheep due to presence of folds and crypts however, these folds were less extensive in pig (Talanti, 1958, Ramkrishna and Saigal, 1985, Saggar *et al*., 2000).

The PRC was the smallest (366.3 µ) and caudal continuation of the PSU extending from the level of recessus mesocoelicus to caudal level of PC and adjacent cranial part of the cerebral aqueduct. The modified ependyma and other cell layers were distinct and of uniform thickness up to the point where PRC transitioned into ventricular ependyma. However, there was a gradual change in thickness of PRC up to the point of termination where hypendyma and brain tissue were not discernible in goat (Kumar *et al*., 1997). This portion presented extensive folds and deep lateral grooves in its cranial part in buffalo (Ramkrishna and Saigal, 1985). The SCO in transverse sections appeared in the form of a horizontal strip having all the three cell layers as reported in goats and sheep (Kumar *et al*., 1997, Saggar *et al*., 2000). The ventral projections on either sides of horizontal strip were called as ventro-lateral limbs which formed lateral walls of the III ventricle cranially and then of cerebral aqueduct caudally (Fig 3). The pseudostratified columnar ciliated ependyma of the SCO abruptly changed into simple cuboidal ventricular ependyma. However, these limbs considered as an additional part were reported to be present only in PPC region of the SCO in buffalo (Ramkrishna and Saigal, 1985).

REFERENCES

Dendy, A. (1902). *Proc. Royal Soc. B* **69**: 485. (cited by Dendy and Nicholls, 1910).

Dendy, A. and Nicholls, G.E. (1910). On the occurrence of mesocoelic recess in the human brain and its relation to the subcommissural organ of lower vertebrates with special reference to the distribution of RF in the vertebrate series and its possible function. *Proc. Royal Soc. B* **82**: 515-529.

Kumar, Pawan, Kumar, S. and Singh, Y. (1997). Subgross structure of the subcommissural organ of goat. *Indian J. Anim. Sci.* **66**: 1062-1063.

Kumar, Pawan, Nagpal, S.K., Kumar, S. and Gupta, A.N. (1999). Histomorphology of the subcommissural organ of camel. *J. Camel Prac. Res.* **6**: 311-316.

Luna, L.G. (1968). Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology. (3rd edn.), McGraw Hill Book Co., New York.

Marburg, O. (1920). *Arb. Neurol. Inst. Wien. Univ.* **23**: 3-27. (cited by Talanti, 1958).

Ramkrishna, V. and Saigal, R.P. (1985). Topographic organization of the subcommissural organ in buffalo (*Bubalus bubalis*) calves. *Indian J. Anim. Sci.* **55**: 311-315.

Saggar, D., Kumar, Pawan and Kumar, S. (2000). Topography of subcommissural organ of sheep. *Indian J. Vet. Anat.* **12**: 141-144.

Schulz, M. and Engelhardt, B. (2005). The circumventricular organs participate in immunopathogenesis of experimental autoimmune encephalomyelitis. *CSF Res.* **2**: 8-13.

Talanti, S. (1958). Studies on the subcommissural organ in some domestic animals with reference to secretory phenomena. *Ann. Med. Exp. Biol. Fenn.* **36**: 1-97.