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Structure of superior medullary vellum with special reference to neuronal tissue

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ABSTRACT

The superior medullary velum is a thin membrane connecting the two superior cerebellar peduncles. It is located caudal to the exit of the fourth cranial nerve and is covered by the lingula of the cerebellum. Textbooks of histology do not give any description of the superior medullary velum (SMV) as such. No specific work on the histology of Superior medullary vellum has been reported. Most of the standard textbooks of histology have only cared to mention the general histology of cerebellar cortex with no specific reference to Superior medullary vellum. Aim and objective of our study to observe the Structure of Superior Medullary Vellum with special reference to Neuronal tissue. The present study was carried out in department of Anatomy Govt. Medical College Ambedkar Nagar and Integral Institute of Medical Sciences Lucknow U.P. India. The materials used for present study comprises 32 human cadaveric brain. Dissection will be performing of human cadavers for collection of Superior medullary vellum. Results show that different types of cells in which neuroglial cells and some are neuron-like cells and organized structures were observed. The study brings out the salient features of Superior medullary velum in the form of definite layers of neuroglia, white matter and nerve cells underneath the ependyma.

Keywords: Superior medullary velum, histological structure and neuronal tissue.

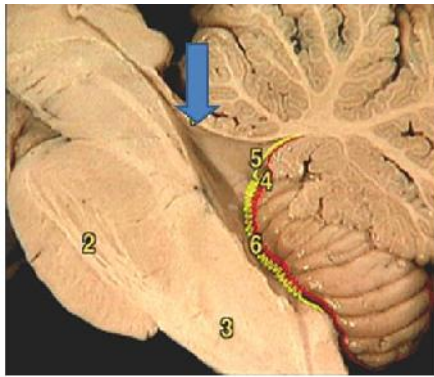


Figure 1

Showing location of superior medullary vellum with arrow

1. INTRODUCTION

The superior medullary velum (anterior medullary velum, valve of Vieussens) is a thin transparent, lamina of white matter, which stretches between the superior cerebellar peduncles on the dorsal surface of its lower half the folia and lingula are prolonged. It forms, together with the superior cerebellar peduncle, the roof of the upper part of the fourth ventricles; it is narrow above, where it passes beneath the facial colliculi, and broader below, where it is continuous with the white substance of the superior vermis. Blood is supplied by branches from the superior cerebellar artery.

Venous drainage is by the superior cerebellar peduncle veins, which unite superiorly at the emergence of the trochlear nerve from the brainstem, to form the vein of the cerebello-mesencephalic fissure. The frenulum of superior medullary velum, also known as the frenulum veli medullaris superioris, cerebellar frenulum is a slightly raised white band passing from the inferior end of medial longitudinal fissure, through the groove between the quadrigeminal bodies, and down to the superior medullary velum. On either side of this band the trochlear nerve emerges, and passes forward on the lateral aspect of the cerebral peduncle to reach the base of the brain. The present study has been undertaken because of sketchy descriptions in the textbooks of anatomy. It is merely described as "an exceedingly thin sheet, entirely devoid of nervous tissue and formed by the ventricular ependyma (Davies and Davies, 1962) or as "a thin sheet of white matter" reported by (McMinn, 1990). Hara et al (1981) reported a large intracranial lipoma, located on the superior medullary velum. Textbooks of histology do not give any description of the SMV as such. Objectives of present study are to find out the histological Structure of Superior Medullary Vellum with special reference to Neuronal tissue in human brain.

2. MATERIALS AND METHODS

The present study was carried out in department of Anatomy Govt. Medical College Ambedkar Nagar and Integral Institute of Medical Sciences Lucknow U.P. India. The materials used for present study comprises 32 human cadaveric brain. Dissection will be performing of human cadavers for collection of Superior medullary vellum. The dissection was done starting with skin incision on scalp and followed by opening of the cranial cavity. The cadaver's brains were dissected and Superior medullary vellum collected and removed for histological processing. The Superior medullary vellum placed in 10% neutral formalin solution for 24-48 hours and thoroughly washed with water before further processing dehydration, clearing, and embedding by automatic tissue processor (Thermo scientific Germany) at histology and research lab of Anatomy department. Serial section of blocks of embedded tissue will be cut at 5µm, 7µm thickness by Rotary microtome (Thermo scientific Germany) and mounted on glass slides and stained. The sections will be evaluated with H&E and cresyl fast violet staining to determine and observed under microscope. Specific histological structure of Superior medullary vellum will be evaluated and recorded.

3. RESULTS /OBSERVATION

The literature review indicates that there is paucity of finding on structure of Superior Medullary Vellum. In our present study we found Structure of Superior Medullary Vellum showing different types of cells in which neuroglial cells and some are neuron are present showing in figures 2,3,4 and 5. The location of Superior Medullary Vellum is shown in figure 1 with arrow. Histologically the superior medullary velum consisted of cuboidal layer of ependymal cells on the anterior surface related to fourth ventricle. Subependymal layer contains hypocellular fibrillary zone with few glial cells, and the outer layer consists of thin layer of fibroblasts. Neuron-like cells and organized structures were observed. Under the hypocellular fibrillary zone, abundant axons and organized structures were observed. The study brings out the salient features of SMV in the form of definite layers of neuroglia, white matter and nerve cells underneath the ependyma. Cellular layer consists of rounded cells with usual nerve processes passing out from them, similar to the cells of granular layer of cerebellar cortex.

4. DISCUSSION

No specific work on the histology of Superior medullary vellum has been reported. Most of the standard textbooks of histology have only cared to mention the general histology of cerebellar cortex with no specific reference to SMV.

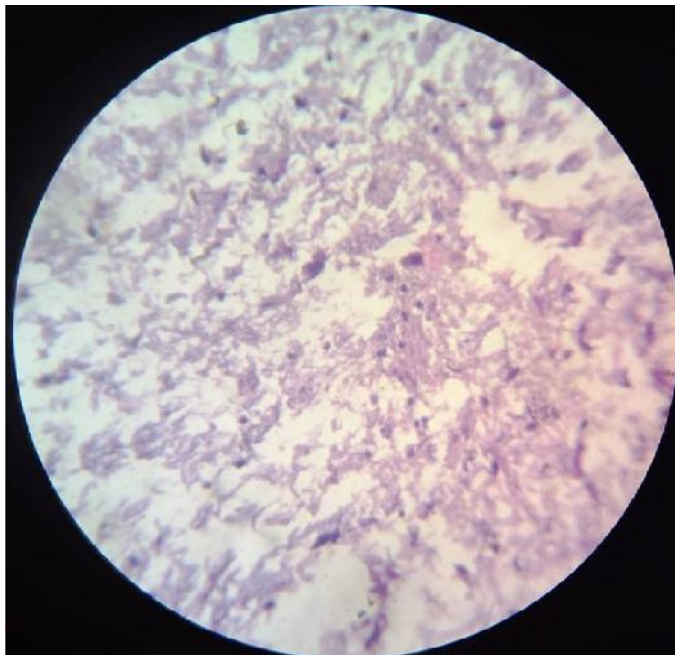


Figure 2

Showing histology of superior medullary vellum with different types of cells and fibres H & E 100X

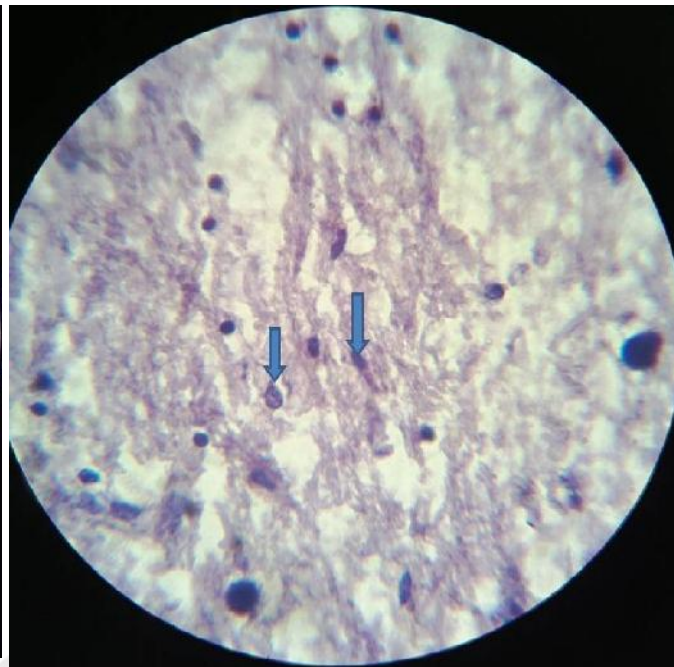


Figure 4

Showing histology of superior medullary vellum with different shape & size cells with arrow H & E 1000X

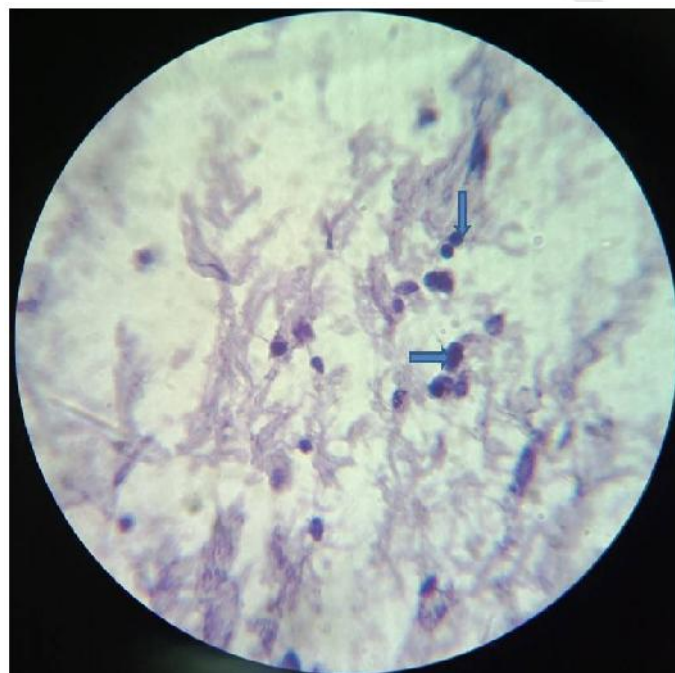


Figure 3

Showing histology of superior medullary vellum with different size cells with arrow H & E 400X

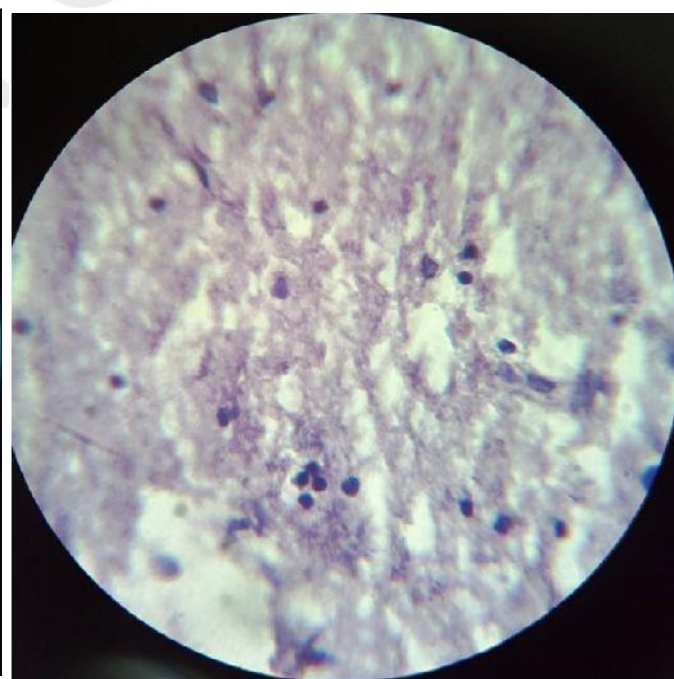


Figure 5

Showing histology of superior medullary vellum with different types of cells – cresyl fast violet 400X

Standard textbooks of neuroanatomy have, however, given a detailed account of the histology of the cerebellar cortex but no reference could be found in these books, specifically about the histology of SMV. Arora, (2002) studied on Microscopic Anatomy of Inferior Medullary Velum of Cerebellum. A study of the inferior medullary velum (IMV) has been done using two routine histological staining techniques viz. Weigert's haematoxylin and eosin, and PTAH. An interesting finding of this study is the presence of a rich cellular layer deep to the neuroglial layer. Majority of the cells in this layer are more or less like the cells of the granular layer of the cerebellar cortex. Even the cursory description of SMV in most books differs widely in the concept of this layer.

Williams et al., (1995) in Gray's Anatomy, describes it as follows: "over most of its extent it consists of an exceedingly thin sheet, entirely devoid of nervous tissue and formed by ventricular ependyma (Davies and Davies, 1962) and the description is essentially the same in its later editions by Williams et al., (1989). Last's Anatomy simply describes it as "a sheet of white matter" (McMinn, 1990) even this sketchy reference has been deleted in its latest edition by (Sinnatamby, 1999). Tomita et al., (2013) observed tumors of the superior medullary velum in infancy and childhood: report of 6 cases. The SMV has not previously been described as the primary location of a posterior fossa tumor, although it can be secondarily invaded by a tumor from the cerebellum or quadrigeminal plate. Trasimeni et al., (2008) studied midline medulloblastoma versus astrocytoma: the position of the superior medullary velum as a sign for diagnosis. The superior medullary velum is a relatively avascular thin structure, roofing the fourth ventricle. This structure allows entrance to the fourth ventricle and visualization of its floor once divided. The trochlear (or fourth cranial) nerve is the smallest of the cranial nerves, and yet has the longest intracranial course. It arises from the dorsal midbrain, just above the superior medullary velum, and its fibers decussate in the anterior medullary velum to end in the contralateral superior oblique muscle.

5. CONCLUSION

Textbooks of histology do not give any description of the SMV. The literature review indicates that there is paucity of finding on structure of SMV. This study is first of its kind as we could not find any previous study from India or abroad reporting the structure of SMV. In the structure of Superior Medullary we found neural tissue showing different types of cells in which neuroglial cells and some are neuron-like cells and organized structures were observed. Further studies as human cadaveric brain on superior medullary velum in future Immunohistochemistry, electron microscopic and fiber tractographic investigations are needed.

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