Original Research Article

A study of unusual presentations at the internal occipital protuberance

Sudeepa Das[1], Gyanraj Singh[2], Satya Narayan Shamal[3], Bikash Chandra Satapathy[4*]

[1,2]Assistant Professor, [3]Professor, Department of Anatomy, KIMS, Bhubaneswar, Odisha.
[4]Assistant Professor, Department of Anatomy, AIIMS Mangalagiri, Andhra Pradesh, INDIA.
Email: bikash.satapathy@gmail.com

Abstract

The dural venous sinuses contains the venous blood originating from most parts of the cranial cavity. In this study forty head and neck specimens with intact dural folds were studied over 3 years period. In 2 cases variation was noted at the internal occipital protuberance during the routine dissection in Anatomy department. After separating the dura mater from the occipital bone, two distinct internal occipital crests were apparent which then diverge near the foramen magnum. We encountered duplicated internal Occipital crest along with duplicated falx cerebelli and occipital sinus. Of both specimens the falces and the distance between them were recorded. Each of the falx cerebelli had an apex and base with a marked occipital venous sinus attached to its border. These sinuses were draining into their respective transverse sinuses. In both the cases there was wide posterior cerebellar notch and foramen of Magendie associated with large cisterna magna. There was neither any marginal sinus detected nor any defect was marked in the vermis. Knowledge of this variation of posterior cranial fossa would be helpful in suboccipital approaches.

Key Words: Variation, Duplication, Falx cerebelli, Internal occipital crest, Occipital sinus.

[*]**Address for Correspondence:**
Dr. Bikash Chandra Satapathy, Assistant Professor, Department of Anatomy, AIIMS Mangalagiri, Andhra Pradesh.
Email: bikash.satapathy@gmail.com

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INTRODUCTION

The falx cerebelli is a small, sickle shaped fold of dura mater, projecting forwards into the posterior cerebellar notch as well as projecting into the vallecula of the cerebellum between the two cerebellar hemispheres. The confluence of sinuses which is found deep to occipital protuberance is the junction of four sinuses occipital sinus being one of them. The occipital sinus, lies in the attached margin of the falx cerebelli, is the smallest of the sinuses which may be paired occasionally[1]. During posterior cranial surgeries occipital sinus may be affected by hemorrhage, embolism or thrombosis. Near the posterior margin of foramen magnum, the internal occipital crest which provides attachment to the falx cerebelli diverges to enclose a v-shaped area, called Vermian fossa; the occipital sinus may be double, lies in this attachment[1].There is rare evidence of reporting in variations of dura and dural folds[2,3].Amongst them presence of an accessory falx cerebri[4] duplicated, fenestrated or small falx cerebelli[2,3,5,6,7,8] duplication of the spinal dural sheath[9], duplication of the hemispheric convexity dura[10] are the few. Ossification or calcification of these falces may injure or hinder the movement of the cerebellum. These skull related variations are often encountered incidentally during the dissection hours. However these intracranial abnormalities may be associated with arachnoid cyst, Chiari II malformation agenesis of the corpus callosum and vermian agenesis. Developmentally at 14th week of gestation the dural partitions become evident. The mesenchymal cells of the nervous system induces the formation of the dura mater. As the dural folds development is contemporaneous with the intradural venous sinuses any change in the dural folds morphology is very likely to be associated with venous sinuses variations. In this study we looked for the unusual presentations at internal occipital protuberance which would enlighten the knowledge of surgeons operating the suboccipital region.

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MATERIAL AND METHODS

During regular dissection hours of MBBS teaching over a span of 3 years in the department of Anatomy KIMS, the skull of 42 cadavers were studied at internal occipital protuberance region for any abnormal presentation. Out of them 2 specimen showed double falx cerebelli with a marked venous sinus attached to their borders. Thereafter carefully separating the dura mater from the occipital bone, two distinct internal occipital crests were apparent which then diverge near the foramen magnum. The length of all the falces and the distances between them were also noted.

OBSERVATIONS

In our study in only 2 cases out of 42 cadavers where we encountered duplicated internal Occipital crest along with duplicated falx cerebelli and occipital sinus as in Figure 1and 2. Rest all showed normal anatomy at the internal occipital protuberance. Each of the falx cerebelli presented with distinct apex, base and marked occipital venous sinus attached to its border. In first case the length of right falx cerebelli was 3.7 cm and that of left was 3.9 cm. The distance between the two falces was 2.2cm. In the second case the length of right falx cerebelli was 4 cm and that of left was 4.1 cm. The distance between the two falces was 1.9cm.Average length of the left falces was 4cm and that of the right falces was 3.85cm.Mean distance between them is 2cm. There was neither any marginal sinus detected nor any defect was marked in the vermis of the cerebellum of these two specimens. However the brain showed signs of porencephaly (as in Figure 3) in one specimen while the appearance of other specimen was normal. In both the cases as in Figure 4 there was wide posterior cerebellar notch and foramen of Magendie associated with large cisterna magna.

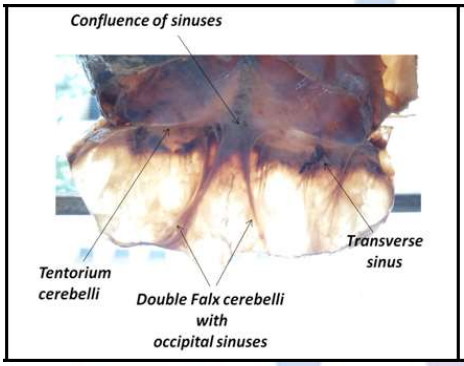

Figure 1

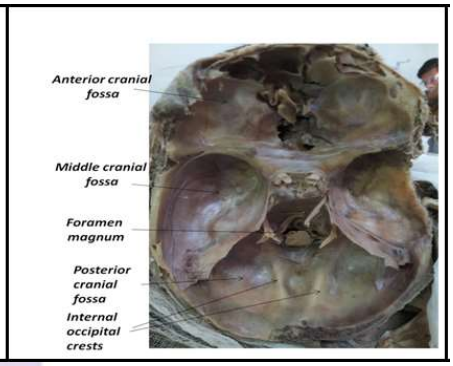

Figure 2

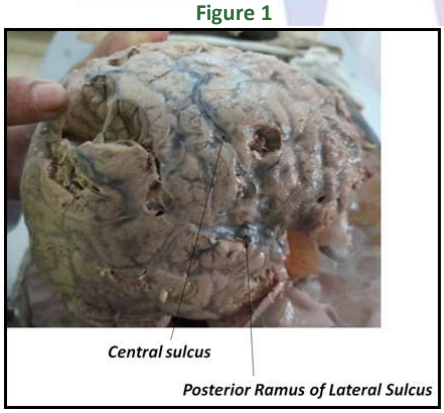

Figure 3

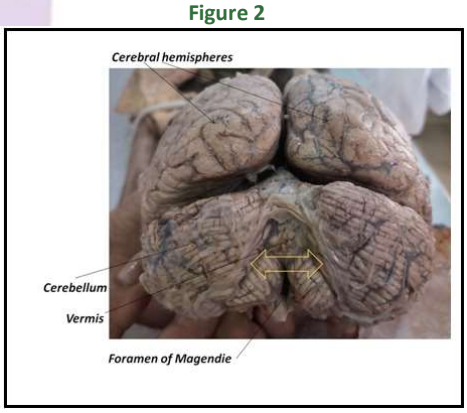

Figure 4

Figure 1: Anterior view of the duramater of posterior cranial fossa showing Falx cerebelli, tentorium cerebelli and associated dural venous sinuses; **Figure 2:** Superior view of the floor of cranial cavity after removing dura showing double internal occipital crests; **Figure 3:** Lateral view of right cerebral hemisphere showing Porencephaly; **Figure 4:** Posterior view of brain showing wide cerebellar notch

DISCUSSION

The falx cerebelli is usually a sickle-shaped dural fold harboring occipital venous sinus near its attachment posteriorly.The length of cerebelli is between 2.8 to 4.5 cm and is around 1to 2 mm thick.[11] In most cases there is one falx cerebelli enclosing single sinus at the posterior end. However various litereature is suggestive of anatomical deviations in formation and occurrences of these dural venous sinuses like duplication of hemispheric convexity dura, duplication of spinal dural sheath,

presence of accessory falx cerebri, duplicated, fenestrated or small falx cerebelli and triplicated falx cerebelli and aberrant venous sinus.[12] During development the dural sinuses shows varied plexiform pattern instead of luminal appearance as seen in most cases. They emerge as venous plexuses. Dora and Zileli[13] studied the different positions of the occipital sinus and its duplication which may be associated with surrounding structures related to it. In 2007 Shoja MM *et al*. reported two different cases of triplicate falx cerebelli and duplicated falx cerebelli with aberrant venous sinus (12).The maximum width was 25mm with two occipital sinuses draining to their respective transverse sinuses having two separate internal occipital crests. In 2008 Sujatha D'Costa *et al*[14] reported duplication of falx cerebelli in 8 out of 52 (15.4%) cadavers in south Indian population. The mean length of right and left side falces was 38 mm and 41 mm whereas the average distance was 20mm. its. Comparing our study with the above one it showed duplication only in 2out of 42 cadavers (4.8%) in eastern Indian population which is not at par with regards to its incidence. However the average distance between the two falces and their lengths were at par with the results of Sujatha D'Costa *et al*. The literature is suggestive that these posterior cranial anomalies are associated with other intracranial disease complications. In 2006, Shoja MM *et al*[3] reported a case of duplication of the falx cerebelli along with sequence of intracranial variations like Menelfe type 1 accessory middle cerebral artery, a persistent intracranial (olfactory) artery and a duplicated anterior communicating artery. In 1982 Hassler W and Schlenker M[5] reported posterior fossa arachnoid cyst associated with falx cerebelli on its both sides. In 2005, Loughenbury PR *et al*[9] reported duplication of spinal dural sheath. However there was presence of arachnoid cyst in between the two falces but no comment regarding the occipital sinus was made. The occipital sinus is sometimes large replacing the sigmoid sinus, in these cases the marginal sinus play role in draining the blood from it. In some cases though both sigmoid and transverse sinuses are normal there may be abnormality seen in occipital sinus. There are cases where the occipital sinus is found passing through jugular foramen instead of being midline in its position. There are reported cases where the occipital sinus is doubled or varies in it size following an aberrant course. Such type deviations of occipital sinus offers definite risk in posterior cranial fossa approach.[15] In 1975 Browder J*et al*.[16] had mentioned the occipital sinuses duplication in adults is the result of preexisting venous routes of suboccipital dura. Here also the study did not mention any type of falx duplication. Developmentally at 14th week of gestation the dural partitions become evident. The mesenchymal cells of the nervous system induces the formation of the dura mater. Development of dural folds is in line with the evolution of dural venous sinuses. Any alteration in its morphology will directly affect either the number or course of the sinuses.[12] Double falx cerebebelli is quite often related with double occipital sinus. During craniotomies and intracranial surgeries the surgeons are needed to be aware of these extra added variations of posterior cranial fossa to exclude any iatrogenic cause.

CONCLUSION

Though the duplication of falx cerebelli or double occipital sinus and internal occipital crest are rare anatomic entity it cannot be excluded out completely. The understanding of such venous anomalies are important in dealing with embolism and thrombosis of these sinuses. Knowledge regarding these variations will not only prevent the erroneous interpretation of the posterior cranial fossa imaging but also be helpful in checking a potential source of hemorrhage in suboccipital approaches by the surgeons.

REFERENCES

1. Williams PL, editor. Gray's Anatomy. 38th Inter. Edinburgh: Churchill Livingstone Elsevier; 1999. 583,872,1210–1211, 1280, 1584–1585.
2. Shoja MM, Tubbs RS, Khaki AA, Shokouhi G. A rare variation of the posterior cranial fossa: duplicated falx cerebelli, occipital venous sinus, and internal occipital crest. Folia Morphol (Warsz) [Internet]. 2006 May [cited 2019 Dec 28];65(2):171–3. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16773610
3. Shoja MM, Tubbs RS, Shokouhi GH, Ashrafian A, Oakes WJ. A triple dural-venous variation in the posterior cranial fossa: A duplicated plus accessory falx cerebelli and an aberrant venous sinus. In: 23rdAnnual Meeting of the American Association of Clinical Anatomists, Milwaukee, Wisconsin. Milwaukee, Wisconsin; 2006.
4. Krauß J, Sörensen N, Lang J. A case of "accessory falx cerebri." Child's Nerv Syst. 1990;6(5):275–6.
5. Hassler W, Schlenker M. Double falx cerebelli. Case report. Acta Neurochir (Wien) [Internet]. 1982 [cited 2019 Dec 28];62(3–4):265–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/7102390
6. Naidich TP, Pudlowski RM, Naidich JB, Gornish M, Rodriguez FJ. Computed tomographic signs of the Chiari II malformation. Part I: Skull and dural partitions. Radiology. 1980;134(1):65–71.
7. Michaud J, Mizrahi EM, Urich H. Agenesis of the vermis with fusion of the cerebellar hemispheres, septo-optic dysplasia and associated anomalies. Report of a case. Acta Neuropathol [Internet]. 1982 [cited 2019 Dec 28];56(3):161–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/7072487
8. Tubbs RS, Dockery SE, Salter G, Elton S, Blount JP, Grabb PA, *et al.* Absence of the falx cerebelli in a Chiari II malformation. Clin Anat. 2002;15(3):193–5.
9. Loughenbury, P. R., Wadhwani S., Soames RW. Unusual variant of the dural sheath: A case report. In: 23rd Annual

Meeting of the American Association of Clinical Anatomists and the British Association of Clinical Anatomists, New York. New York; 2005.
10. Sargon MF, Brohi RA, Özeksi P, Tonak AK, Cumhur M. Agenesis of the corpus callosum and septum pellucidum together with a multiple layered duramater. Neuroanatomy. 2002;1:2–4.
11. Lang J. Clinical Anatomy of the Posterior Cranial Fossa and Its Foramina. New York: Thieme Medical Publishers; 1991. 112 p.
12. Shoja MM, Tubbs RS, Loukas M, Shokouhi G, Oakes WJ. A complex dural-venous variation in the posterior cranial fossa: a triplicate falx cerebelli and an aberrant venous sinus. Folia Morphol (Warsz) [Internet]. 2007 May [cited 2019 Dec 28];66(2):148–51. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17594675
13. Dora F, Zileli T. Common variations of the lateral and occipital sinuses at the confluens sinuum. Neuroradiology. 1980 Aug;20(1):23–7.
14. D'costa S, Krishnamurthy A, Nayak SR, Madhyasta S, Prabhu L V., Jiji PJ, *et al*. Duplication of falx cerebelli, occipital sinus, and internal occipital crest. Rom J Morphol Embryol. 2008;50(1):107–10.
15. Hollinshead WH. Anatomy for surgeons. Vol. 1.The Head and Neck. 2nd Editio. New York: Harper and Row; 1969. 84–85 p.
16. Browder J, Kaplan HA, Krieger AJ. Venous lakes in the suboccipital dura mater and falx cerebelli of infants: surgical significance. Surg Neurol [Internet]. 1975 Jul [cited 2019 Dec 28];4(1):53–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/1166404

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