Cerebellar Anatomy as Applied to Cerebellar Microsurgical Resections

Jaime Alejandro Ramos MD

Introduction

Alejandro Ramos; Feres Chaddad-Neto;Evandro de Oliveira; Diego González; Hugo Doria.

In this article, we have presented the microsurgical anatomy of the suboccipital and supracerebellar approaches to the cerebellar surfaces using comprehensives anatomic and functional relations with the final objective of performing better operations with less damage to the cerebellar nucli and important deep pathways. We define the anatomy of dentate nucleus and cerebellar peduncles, demonstrating the surgical application of anatomic landmarks in cerebellar resections

Methods

The dentate nucleus, cerebellar peduncles and their relationship with others cerebellar structures were studied in 20 adult cerebellar hemispheres, 12 male and 8 female corpses, obtained from São Paulo death verification service using X3 to X40 magnifications.

Learning Objectives

To define the anatomy of dentate nucleus and cerebellar peduncles, demonstrating the surgical application of anatomic landmarks in cerebellar resections.

Results

The dentate nucleus has a unique shape. It is oriented in craniocaudal direction and from lateral to medial. It is helpful to consider the dentate nucleus with upper and lower surfaces, and three segments. The upper surface is related medially to the superior cerebellar peduncle and faces the vermis at the junction of the cumen and declive. The upper surface is bordered laterally, anteriorly, and posteriorly by the fibers of the middle cerebellar peduncle. At the basal surface, the dentate nucleus is related anteriorly to the caudal segment of the flocculus, medially to the telovelotonsillar cleft and posteromedially to the superior pole of the tonsil and the lateral border of the uvula in its posterolateral third .

Results

The majority of dentate nucleus and cerebellar peduncles had demonstrated constant relationship to other cerebellar structures, which provided landmarks for surgical approaching. The lateral border is separated from the midline by 19.5 mm in both hemispheres. The posterior border of the cortex is separated 23.3 mm from the posterior segment of the dentate nucleus; the lateral one is separated 26 mm from the lateral border of the nucleus; and the posterior segment of the dentate nucleus is separated 25.4 mm from the posterolateral angle formed by the junction of lateral and posterior borders of cerebellar hemisphere.

Conclusions

In conclusion, the thorough knowledge of cerebellum anatomy has a tremendous neurosurgical importance. When dealing with the cerebellum, it is judicious to devise in advance a comprehensive plan of surgical approach where Navigation become just a simple tool and not the main instrument in the surgical procedure.

References

1. Carpenter MB. Core text of Neuroanatomy. Baltimore: Williams & Wilkins; 1991.
2. Rhoton AL Jr. Cerebellum and Fourth ventricle. Neurosurgery 2000;47(Suppl):S7-S27.
3. Lang J. Clinical anatomy of the posterior cranial fossa and its foramina. New York: Stuttgart, Georg Thieme; 1991.
4. Machado A. Neuroanatomia Funcional. Estrutura e funções do cerebelo. São Paulo: Atheneu; 1981, p. 179-186.
5. Brazis PW, Masdeu J, Biller J. Localization in Clinical Neurology. New York: Little, Brown; 1996. p. 365-379.
6. Rhoton AL Jr. The Posterior Fossa Veins. Neurosurgery 2000;47(Suppl):S69-S92.
7. Mussi A, Rhoton AL Jr. Telovelar approach to the fourth ventricle: microsurgical antomy. J Neurosurg 2000;92:812-823.
8. Rhoton Al Jr. Microsurgical anatomy of posterior fossa cranial nerves. In: Barrow DL (Ed). Surgery of the cranial nerves of the posterior fossa. Neurosurgical topics. Chicago: AANS; 1993: 1-103.
9. Youmans JR. Neurological surgery. Philadelphia: WB Saunders; 1996.
10. Yasargyl MG. Microneurosurgery Sttugart: Gerog Thieme Verlag; 1984.
11. Matsushina T, Fukui M, Inoue T, Natori Y, Baba T, Fujii K. Microsurgical and magnetic resonancia imagen anatomy of the cerebellomedulary fissure and its application during fourth ventricle surgery. Neurosurgery 1992;30:325-330.
12. Holmes G. The croonian lectures on the clinical symptoms of cerebellar disease and their interpretation. Lancet 1992;2:59-65,111-115.
13. Yasargyl MG. Microneurosurgery: CNS tumors-surgical anatomy, neurophatology, neuroradiology, neurophisiology, clinical considerations, operability, treatment options. Stuttgart: Georg Thieme; 1994.

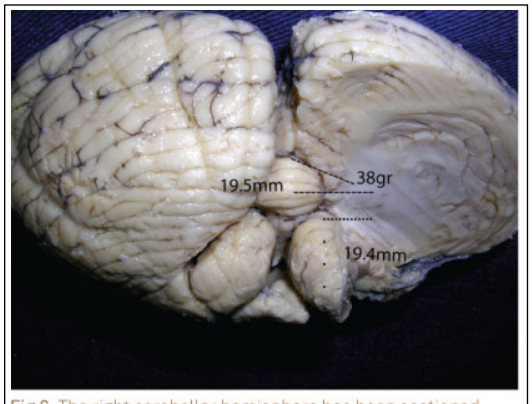

Fig 6. The right cerebellar hemisphere has been sectioned to show the different relationships of the dentate nucleus to the nearby structures. The distance from the lateral border of the dentate nucleus to the middle line is on an average of 19.5 mm; the distance from the inferior pole of the tonsil to the basal surface of the dentate nucleus is on average 19.4 mm and 38° is on average the angle of separation from the middle line to lateral border of the dentate nucleus.

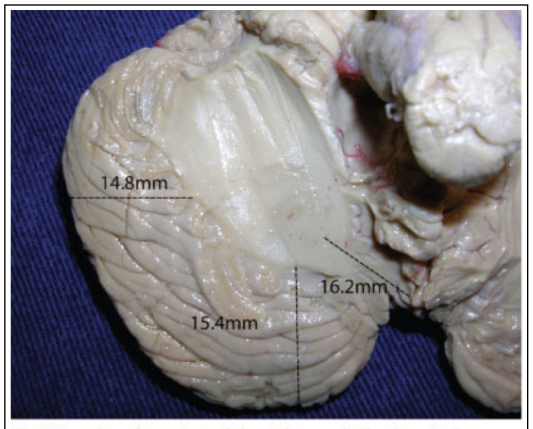

Fig 7. Basal surface view of the right cerebellar hemisphere. The cerebellar hemisphere has been partially sectioned to show the cortex and the subcortical area at the level of the dentate nucleus. The lateral border of the cerebellar cortex is separated on an average of 14.8 mm, at the level of the dentate nucleus from the subcortical white matter; and the posterior border of the cerebellar cortex is separated on an average of 15.4 mm from the subcortical white matter.

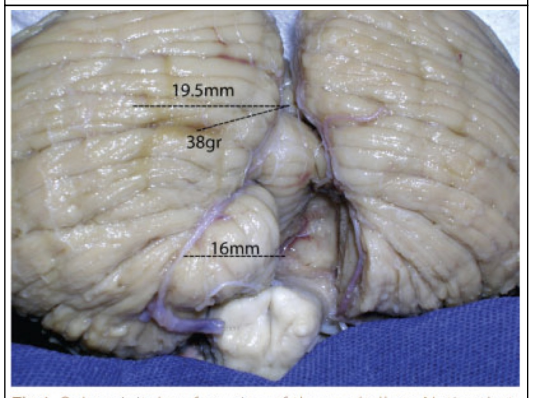

Fig 4. Suboccipital surface view of the cerebellum. Notice that the distance from the middle line to the lateral border of the dentate nucleus is 19.5 mm and 38° is the angle of separation from the middle line to avoid the dentate nucleus during the surgical resections. Also, the distance from the middle line to the lateral border of the tonsil is approximately 16 mm.