Acta Veterinaria Hungarica 51 (4), pp. 433–437 (2003)

VASCULARISATION OF THE CEREBELLAR NUCLEI IN AKKARAMAN SHEEP

D. YILDIZ* and M. E. GULTIKEN

Department of Anatomy, Faculty of Veterinary Medicine, University of Kirikkale, 71450 Campus, Kirikkale, Turkey

(Received October 30, 2002; accepted June 19, 2003)

This study reports an anatomical study of the vascular supply in 20 Akkaraman sheep cerebelli from adult subjects of both sexes. The origin and branching pattern of the cerebellar artery vascularising the cerebellar nuclei were studied by gross dissection and vascular injection. Then dissection was performed and vessels nourishing the cerebellar nuclei were documented. Four bilaterally symmetrical cerebellar nuclei were determined as nucleus lateralis cerebelli, nucleus interpositus lateralis cerebelli, and nucleus interpositus medialis cerebelli and nucleus fastigii from lateral to medial side. It has been previously confirmed that vascularisation of the cerebellar nuclei is carried out by intermediary branches of the rostral cerebellar artery and the caudal cerebellar artery. However, this study has confirmed that the caudal cerebellar artery has no contribution in the vascularisation of the cerebellar nuclei.

Key words: Anatomy, blood supply, cerebellar nuclei, sheep

The most important cells of the cerebellar cortex are Purkinje neurons. Their axons mix with the cell groups in the corpus medullare which is formed by the substantia alba. This formation is also named as intracerebellar nuclei or cerebellar nuclei (Jenkins, 1972; Walter and Hendelman, 1994). These nuclei, which are located at the dorsal surface of the ventriculus quartus, are described as nucleus fastigii, nucleus interpositus medialis cerebelli (globose nucleus), nucleus interpositus lateralis cerebelli (emboliform nucleus) and nucleus lateralis cerebelli (dentate nucleus) from the medial to the lateral direction, respectively (Dede, 1990; International Committee on Veterinary Gross Anatomical Nomenclature, 1994; Walter and Hendelman, 1994; Crossman and Neary, 1995; Dursun, 2000). Nucleus interpositus medialis cerebelli and nucleus interpositus lateralis cerebelli have been reported to exist only in highly developed mammals and humans by some authors (Dyce et al., 1987; Dede, 1990).

Although it is known that the rostral cerebellar artery (arteria cerebelli rostralis) has a function in the supply of cerebellar nuclei, there is no exact clas-

*Corresponding author: Dr. Dincer Yildiz; Telephone: +90 (318) 3573301; Fax: +90 (318) 3573304; E-mail: dincer_yildiz@hotmail.com

sification. This vessel has been described as superior cerebellar artery (arteria cerebelli superior) in the human (Lister et al., 1982; Duvernoy et al., 1983; Amarenco and Hauw, 1989). The rhomboidal artery arises from the inner side of the superior cerebellar artery and then, following the crus cerebelli rostralis, it enters the cerebellum and gives off 2–4 branches. It supplies blood mainly to the nucleus lateralis cerebelli and the other nuclei (Icardo et al., 1982).

The interpretation of angiographic, neurological and clinical studies such as vascular surgery requires detailed anatomical knowledge. In the present study, cerebellar nuclei and their vascularisation in Akkaraman sheep were studied by gross dissection and vascular injection methods. There has been no study on the cerebellar nuclei of domestic mammals so far, and this necessitated the research reported here.

Materials and methods

The cerebellar arteries of 20 adult Akkaraman sheep of both sexes, obtained freshly from Kirikkale slaughterhouse, were studied. The arteries were washed with saline solution and then coloured-latex was injected by way of both the right and left common carotid arteries. The encephalon was removed from the cranial cavity, then immersed in 10% formalin solution for fixation. When the fixation was considered satisfactory after about 10 days, the cerebelli were examined by two different procedures.

(1) They were sectioned transversally or frontally approximately 1 cm thick. The sections, which were prepared to determine the localisation of nuclei, were stained by Thomset's technique (Thomset, 1956).

(2) The remaining cerebelli were dissected to establish the pattern of supply and the course of cerebellar arteries vascularising the cerebellar nuclei.

A microsurgery set and stereomicroscope were used. Measures were made by the use of ocular micrometer. The Nomina Anatomica Veterinaria (International Committee on Veterinary Gross Anatomical Nomenclature, 1994) was employed for the anatomical nomenclature.

Results

On the sections prepared from primary fissure, four bilaterally symmetrical cerebellar nuclei were determined as nucleus lateralis cerebelli, nucleus interpositus lateralis cerebelli, nucleus interpositus medialis cerebelli and nucleus fastigii from lateral to medial side. Nucleus fastigii, nucleus interpositus medialis cerebelli and nucleus interpositus lateralis cerebelli are too small and can be observed with great difficulty (Fig. 1).

Fig. 1. Transversal section of the cerebellum and cerebellar nuclei in Akkaraman sheep. (a) Nucleus lateralis cerebelli. (b) Nucleus interpositus lateralis cerebelli. (c) Nucleus interpositus medialis cerebelli. (d) Nucleus fastigii

It has been confirmed that the rostral cerebellar artery has an important role in the arterial supply of cerebellar nuclei. Besides, it has been observed that intermediary branches of the rostral cerebellar artery, which enter in the groove between the flocculus and the lobi laterales cerebelli, provide arterial vascularisation together with the branches arising from the terminal end of the caudal communicating artery and basilar artery. In all the cases, it was observed that there was no direct connection between the caudal cerebellar artery and the vascularisation of the nuclei. Only in two cases did we see anastomoses that occurred at the same site. No anastomoses were observed in the course of these vessels after they reached the nucleus lateralis cerebelli. Arterial blood coming by those anastomoses does not have an important role in the vascularisation.

The branches of the rostral cerebellar artery supplied the nuclei following the rostral cerebellar peduncle and middle cerebellar peduncle, and reached the dorsal part of the fourth ventricle. At that point, the vessels go right through the white matter, enter the area of nuclei and divide into terminal branches in lateromedial direction (Fig. 2, arrow). It was observed that the blood coming that way mostly entered the nucleus lateralis cerebelli.

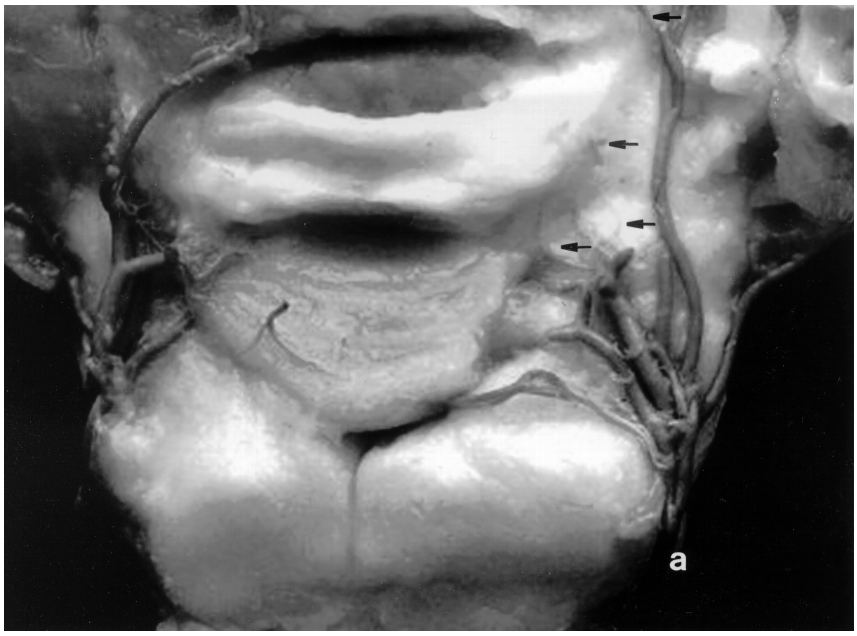

Fig. 2. The branches of the rostral cerebellar artery that supplies cerebellar nuclei in Akkaraman sheep (arrows). (a) Rostral cerebellar artery

Discussion

In this study, by the use of Thomset's brain staining technique we have established that there are four bilaterally symmetrical cerebellar nuclei in the sheep cerebellum. Nucleus fastigii, nucleus interpositus medialis cerebelli and nucleus interpositus lateralis cerebelli are hardly distinguishable from each other but, in contrast to the findings reported by Dyce et al. (1987), it has been determined that not only nucleus fastigii but also the others are independent nuclei.

In the human, it has been indicated that nucleus lateralis cerebelli and the other nuclei are supplied by the rhomboidal artery, which is the innermost branch of the superior cerebellar artery (Icardo et al., 1982). However, the rhomboidal artery is not defined in the Nomina Anatomica Veterinaria (International Committee on Veterinary Gross Anatomical Nomenclature, 1994). In the sheep brains used in this study, cerebellar nuclei were found to be supplied by the intermediary branches of the rostral cerebellar artery. This finding showed that there is no similarity between these intermediary branches and the rhomboidal artery.

Consequently, it has been confirmed that vascularisation of the cerebellar nuclei is carried out by intermediary branches of the rostral cerebellar artery. The caudal cerebellar artery has no contribution in this vascularisation. We hope that this study will be the source for related studies.

Acknowledgement

This study has been supported by the National Research Council of Turkey (TUBITAK).

References

Amarenco, P. and Hauw, J. J. (1989): Anatomy of the cerebellar arteries. Rev. Neurol. **145,** 267–276.

Crossman, A. R. and Neary, D. (1995): Neuroanatomy. Churchill Livingstone, Manchester. pp. 85–93, 153–161.

Dede, F. (1990): Neuroanatomy and Functional Neurology (in Turkish). Okullar Pazari Publishing Company, Adana. pp. 219–228, 309–324.

Dursun, N. (2000): Veterinary Anatomy III (in Turkish). Medisan Publishing Company. Ankara, Turkey, No: 47. pp. 41–42.

Duvernoy, H., Delson, S. and Vanson, J. L. (1983): The vascularization of the human cerebellar cortex. Brain Res. Bull. **11,** 419–480.

Dyce, M., Sack, O. and Wensing, J. G. (1987): Textbook of Veterinary Anatomy. W. B. Saunders Company, Philadelphia. pp. 277–280.

Icardo, J. M., Ojeda, J. L., Garcia-Porrero, J. A. and Hurle, J. M. (1982): The cerebellar arteries: Cortical patterns and vascularization of the cerebellar nuclei. Acta Anat. **113,** 108–116.

International Committee on Veterinary Gross Anatomical Nomenclature (1994): 'Nomina Anatomica Veterinaria'. 4th edition, Gent (Belgium).

Jenkins, T. W. (1972): Functional Mammalian Neuroanatomy. Lea and Febiger, Philadelphia. pp. 209–371.

Lister, J. R., Rhoton, A. C., Matsushima, T. and Peace, D. A. (1982): Microsurgical anatomy of the posterior inferior cerebellar artery. Neurosurgery **10,** 170–199.

Thomset, D. H. (1956): Brain macroscopic staining. Anatomical Techniques. Livingstone, Edinburgh. pp. 228–230.

Walter, J. and Hendelman, M. D. (1994): Student's Atlas of Neuroanatomy. W. B. Saunders Company, Philadelphia. pp. 143–159.