

Magnetic resonance imaging determination of the ventriculus terminalis

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ABSTRACT

We report a case of ventriculus terminalis, presenting with specific neurological symptoms including low back pain and bilateral sciatica. Magnetic resonance images showed a cystic lesion with regular margins localized in the lumbar enlargement of the spinal cord. The lesion was an oval shape with no internal septa. Its dimensions were 9.6 mm craniocaudally, 3.5 mm mediolaterally and 3.5 mm anteroposteriorly. Intralesional fluid had the same signal as cerebrospinal fluid in all magnetic resonance sequences. Pericystic spinal cord intensity was normal, and the cyst did not cause additional enlargement of the distal cord. During spinal cord evaluations, ventriculus terminalis should be kept in mind as a normal anatomic developmental phenomenon that can be seen on magnetic resonance images.

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The ventriculus terminalis is a small cavity formed by the expansion of the ependyma-lined central canal at the distal end of the spinal cord.¹ This variant forms during secondary neurulation of embryonic development as a result of canalization and retrogressive differentiation.² In the current literature most of the authors use 'fifth ventricule' synonym with 'ventriculus terminalis'.²⁻⁸ However, cavum septi pellucidi, the narrow cavity between the 2 laminae of the septum pellucidum, is also identified as 'fifth ventricle'.^{9,10} In our study we used the term 'ventriculus terminalis' instead of the term 'fifth ventricle' for accuracy. A number of anatomical variants of the spinal cord can be detected with magnetic resonance imaging (MRI). Most of them are incidental findings without clinical symptoms and therefore do not represent pathologic conditions. One of the challenging examples of variants is the ventriculus terminalis. The following is a case report of an adult in which the lumbar MR images

showed the dilated ventriculus terminalis of the conus medullaris.

Case Report. The patient was a 41-year-old man with low back pain and sciatica. T1-weighted sagittal and axial spin-echo MR images of the lumbar spine were obtained at a 0.5 Tesla magnet field-strength MRI system (Philips Gyroscan T5, The Netherlands). Slice thickness for both sagittal and axial images was 4 mm with a 0.4 mm interslice gap. The images showed a cystic lesion with regular margins localized in the lumbar enlargement of the spinal cord (**Figure 1**). Its dimensions were 3.5 mm mediolaterally, 3.5 mm anteroposteriorly (**Figure 2**) and 9.6 mm craniocaudally (**Figure 3**). The lesion was an oval shape with no internal septa. Intralesional fluid showed the same signal as cerebrospinal fluid (CSF) on all MRI sequences. The pericystic spinal cord tissue signal was

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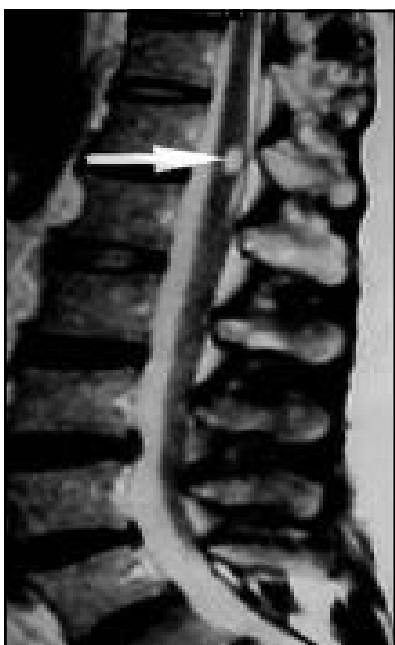


Figure 1 - Sagittal T1-weighted image of the spinal cord shows the ventriculus terminalis (arrow).

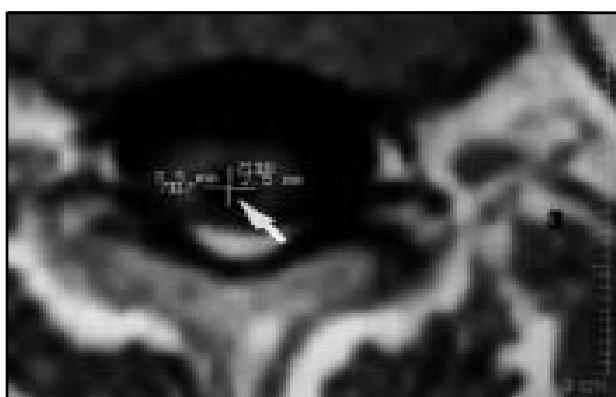


Figure 2 - Axial T1-weighted image of the spinal cord shows the ventriculus terminalis (arrow), measuring 3.5 mm mediolaterally and 3.5 mm anteroposteriorly.

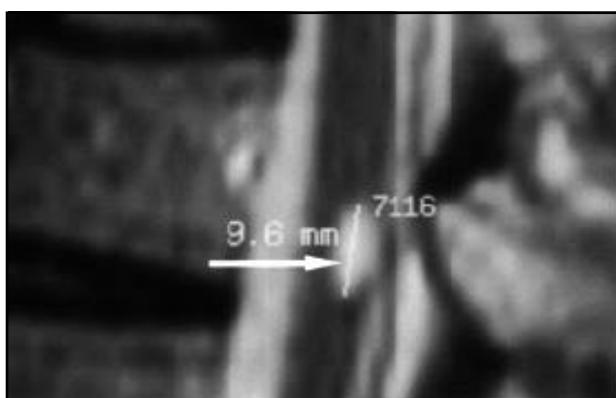


Figure 3 - Sagittal T1-weighted image of the spinal cord shows the ventriculus terminalis (arrow), measuring 9.6mm craniocaudally.

normal, and the cyst did not cause additional enlargement of the distal cord as compared to his previous MR images performed 3 years earlier following a lumbosacral traumatic injury.

Discussion. The ventriculus terminalis is a small cavity formed by the expansion of the central canal at the distal end of the spinal cord during embryonic development.^{1,2} The normal development of the fetal spinal cord has 2 distinct stages: neurulation and canalization with retrogressive differentiation. Neurulation, starting at the 3rd week of gestation (1.5 mm embryo) forms the neural tube by progressive closure of the neural plate. It is completed within the 4th week and forms most of the spinal cord. The caudal portion of the conus medullaris is formed during the second stage. After neurulation, the caudal end of the neural tube and the notochord blend to become an undifferentiated cell aggregate called the caudal cell mass. Small cysts develop within this cell mass, canalize, and eventually form an ependyma-lined tube that usually fuses with the central canal of the neural tube. This wide canal lined by ependyma is the ventriculus terminalis.

Stilling described the ventriculus terminalis for the first time in 1859.¹¹ Krause, as cited by Kernohan, identified it as a true ventricular structure enclosed by ciliated ependymal cells in 1875 and classified it as the 'fifth ventricle'.² He identified it in all adults but noted that it is smallest in middle age and largest in early childhood and old age. In 1924, Kernohan defined the details of the origin and evolution of this structure, which is normally present in all subjects during fetal development.² In children under 5 years it is rarely detectable as an asymptomatic variant which tends to regress; more often it presents as a virtual cavity or simply of residual ependymal tissue.^{2,3} There are many studies in which the ventriculus terminalis has been detected in asymptomatic patients, exclusively in the pediatric age by sonography^{4,8,12} and MRI.⁶ In pathological conditions, dilated ventriculus terminalis has been described in association with a tethered cord¹³ in children and Vacterl syndrome in infants.⁸

A cyst of the conus medullaris could be detected in adults whose clinical symptoms might consist of neurological disturbances such as low back pain, sciatica, and weakness of lower limbs, bladder dysfunction, or both.^{3,5,14-17} In some adult cases, this dilation could be associated with sacral lipoma⁵ and Chiari type 1 malformation.¹⁴ Our case showed a cystic dilatation in the conus medullaris which is probably the result of a persistent dilated ventriculus terminalis or an abnormal closure of the communication between the ventriculus terminalis and upper part of the central canal.^{3,5} It differs from the previous studies by having no bladder dysfunction as a symptom and no clinical entity associated such as Chiari type 1 malformation and lipoma. It is likely that the dilation of ventriculus terminalis must achieve a specific size to allow MR

visibility. In our case the dimensions of the cyst were 9.6 mm craniocaudally, 3.5 mm mediolaterally and 3.5 mm anteroposteriorly; and these are the lowest measurements reported of the ventriculus terminalis in adults. The cystic dilatation of conus medullaris diagnosed in adult age may present only mild symptoms and remain clinically and radiologically stable for a long term.

When a nonenhancing, ovoid, nonseptated cyst localized at the lower end of the spinal cord is seen on MR images, cystic dilation of the ventriculus terminalis should be considered. The differential diagnosis of a lumbosacral cystic lesion does include neoplasms such as ependymoma, astrocytoma and hemangioblastoma. Syringohydromyelia is unlikely given the confinement of the lesion of the conus medullaris, since a syrinx usually has superior extension. Intramedullary neoplasms would usually show contrast enhancement of a solid portion. As MR imaging becomes used more frequently for spinal cord evaluations, ventriculus terminalis should also be kept in mind as an anatomic developmental phenomenon that can be seen on MR images to avoid excessive or unnecessary surgery.

References

- Choi BH, Kim RC, Suzuki M, Choe W. The ventriculus terminalis and filum terminale of the human spinal cord. *Hum Pathol* 1992; 23: 916-920.
- Kernohan JW. The ventriculus terminalis: its growth and development. *J Comp Neurol* 1924; 38: 10-125.
- Celli P, D'Andrea G, Trillo G, Roperto R, Acqui M, Ferrante L. Cyst of the medullary conus: malformative persistence of terminal ventricle or compressive dilatation? *Neurosurg Rev* 2002; 25: 103-106.
- Kriss VM, Kriss TC, Coleman RC. Sonographic appearance of the ventriculus terminalis cyst in the neonatal spinal cord. *J Ultrasound Med* 2000; 19: 207-220.
- Matsubayashi R, Uchino A, Kato A, Kudo S, Sakai S, Murata S. Cystic dilatation of ventriculus terminalis in adults: MRI. *Neuroradiology* 1998; 40: 45-47.
- Coleman LT, Zimmerman RA, Rorke LB. Ventriculus terminalis of the conus medullaris: MR findings in children. *AJNR Am J Neuroradiol* 1995; 16: 1421-1426.
- Kriss VM, Kriss TC, Babcock DS. The ventriculus terminalis of the spinal cord in the neonate: a normal variant on sonography. *AJR Am J Roentgenol* 1995; 165: 1491-1493.
- Tuong BC, Shaw DW, Winters WD. Dilatation of the ventriculus terminalis: sonographic findings. *J Ultrasound Med* 1998; 17: 713-715.
- Aldur MM, Gürcan F, Basar R, Aksit D. Frequency of septum pellucidum anomalies in non-psychotic population: a magnetic resonance imaging study. *Surg Radiol Anat* 1999; 21: 119-123.
- Dandy WE. Congenital cerebral cysts of the cavum septi pellucidi (fifth ventricle) and cavum vergae (sixth ventricle). *Arch Neurol Psychiatr* 1931; 25: 44-66.
- Stilling B. In: Neue Untersuchungen über den Bau des Rückenmarks. Kassel: Hotop; 1859. p. 17-50.
- Unsinn KM, Kreczy A, Freund MC. Sonography of the ventriculus terminalis in newborns. *AJNR Am J Neuroradiol* 1996; 17: 1003-1004.
- Erkan K, Unal F, Kiris T. Terminal syringomyelia in association with the tethered cord syndrome. *Neurosurgery* 1999; 45: 1351-1360.
- Sign R, Denys A, Halimi P, Shapeero L, Doyon D, Boudghene F. Ventriculus terminalis of the conus medullaris: MR imaging in four patients with congenital dilatation. *AJNR Am J Neuroradiol* 1991; 12: 733-737.
- Agriollo U, Tirendi MN, Nardi V. Symptomatic cystic dilatation of V ventricle: case report and review of the literature. *Spine* 1997; 6: 281-283.
- Nassar SI, Correl JW, Housepian EM. Intramedullary cystic lesions of the conus medullaris. *J Neurol Neurosurg Psychiatry* 1968; 31: 106-109.
- Seror P, Keravel Y, Mortier JP, Moutonet J, Vacher H. Kyste syringomyélique isolé du cone terminale. *Presse Med* 1990; 19: 1590-1591.