Which is the best radiological technique to demonstrate spontaneous or endoscopic third ventriculostomy?

Dear editor,

I read the quite interesting article of Stachura and Moskala entitled *Spontaneous third ventriculostomy in obstructive hydrocephalus with composed aetiology: a case report* published in your journal [1]. In this case report, they reported a patient with chronic obstructive hydrocephalus secondary to aqueductal stenosis. Endoscopic third ventriculostomy (ETV) was planned, but during endoscopy spontaneous third ventriculostomy (STV) was detected. Since hydrocephalus and clinical symptoms of the patient did not improve in the postoperative period, a ventriculoperitoneal shunt (VPS) operation was performed [1]. In order to better discuss the report of Stachura and Moskala and help the future studies to be designed more efficiently, I would like to underscore some points and discuss them alongside the related data provided in the literature.

Endoscopic third ventriculostomy is the most common neuroendoscopic procedure for restoration of near physiological circulation of cerebrospinal fluid in obstructive hydrocephalus [1]. Spontaneous third ventriculostomy is a rare condition that occurs with the spontaneous rupture of a ventricle into the subarachnoid space in patients with chronic obstructive hydrocephalus, since chronic high-pressure cerebrospinal fluid (CSF) pulsation acts against thin regions of the ventricular wall and results in transmural penetration and rupture of the ependymal wall into the subarachnoid space [2,3]. Although it is rather difficult to establish the diagnosis of STV, accurate determination of STV bears importance in planning the most appropriate treatment [3]. In cases with STV, progression of the symptoms and hydrocephalus can regress, thereby rendering the operation unnecessary [2,3]. However, in the absence of STV, progressive obstructive hydrocephalus requires surgical treatment [3].

Frequently, conventional cranial magnetic resonance imaging (MRI) remains insufficient in detection of STV, aqueductal stenosis aetiology and ETV patency. It was understood from the paper of Stachura and Moskala that routine MRI was performed preoperatively. However, no further investigation was performed in order to detect the presence of STV.

Currently, there is no non-invasive testing procedure for the definite diagnosis of STV [3]. Although computed tomography (CT) and/or MR ventriculography are defined as gold standard procedures in evaluation of the aqueduct and third ventricle patency, they must be preserved for selected cases since both are invasive procedures and may cause serious complications including infection (1.5-33%), increase in ICP (intracranial pressure), brain injury (0.5-1%), and intracranial haemorrhage (1-6%) [4-8]. MR cisternography (MRC) can also be used in evaluation of third ventricular CSF flow, aqueductal stenosis aetiology, presence of STV and ETV patency in a less invasive manner [3,9]. It provides a high soft tissue resolution which allows multiplanar images without exposure to radiation, and intrathecal gadolinium has been reported to be safely applied in previous studies [3-7,10,11].

Phase-contrast cine magnetic resonance imaging (PC-MRI) is a successful imaging technique in evaluation of CSF flow and patency of ETV [4,12,13]. PC-MRI is also very useful in diagnosis of STV with some limitations such as leading to false positive results due to complex CSF flows secondary to pulsations of the arteries following a course close to the inferior wall of the third ventricle [3,4].

Three dimensional (3D) heavily T2-weighted (such as 3D-constructive interference in the steady state [3D-CISS] and 3D-driven equilibrium [3D-DRIVE]) sequences can be used to evaluate STV and ETV and provide anatomical information about the morphological relationships of the ventricles before surgery [3,13]. The heavily T2-weighted (W) effect and high spatial resolution of 3D-CISS and 3D-DRIVE sequences provide superiority to the conventional T2W sequences, and the aqueduct, ventricles, and cisterns can be assessed [3-5]. However, complex anatomy of the enlarged and very slim third ventricular walls due to hydrocephalus may hinder the visualization of the inferior wall, and thus may lead to false positive results. Obtaining images with thinner sections and higher resolutions with high-tesla MR devices may help to overcome this limitation.

As in the case of the patient reported in this paper, complex hydrocephalus may be the underlying cause in patients if hydrocephalus does not improve with ETV or STV. The presence of complex hydrocephalus should be further investigated with other testing procedures in these cases in order to prevent unnecessary ETV procedures. Patients with complex hydrocephalus see more benefit from ventriculoperitoneal shunts [13].

To conclude, proper preoperative evaluation to detect the underlying pathology in patients with hydrocephalus is of particular importance in selecting the most appropriate treatment option or operation procedure [9]. STV is a rare condition that occurs with the spontaneous rupture of a ventricle into the subarachnoid space in patients with chronic obstructive hydrocephalus. We assume that PC-MRI and 3D-CISS should be chosen as first choices in demonstration of STV since both are non-invasive procedures and should be applied after routine cranial MRI in obstructive hydrocephalus patients with spontaneous regression of clinical symptoms or ventricular sizes [3].

PC-MRI and 3D-CISS are useful in assessment of the patency of ETV or detection of STV [3,4,9]. 3D-CISS appears to be superior to PC-MRI in detection of STV [4]. MRC should be preserved for patients with suspected STV findings on PC-MRI and 3D-CISS sequences. MRC may prevent false positive results [3]. Intrathecal gadolinium can also be safely applied [10,11].

Ozgur Tosun, Evrim Kilic Ozmen, Gokce Akgunduz, Mustafa Karaoglanoglu

Ankara Ataturk Education and Research Hospital,
Mustafa Kemal. Mah. baris Sitesi 2091.sok
No: 11 Bilkent, 06800 Ankara, Turkey
e-mail: drozgurtosun@gmail.com

References

1. Stachura K., Moskała M. Spontaneous third ventriculostomy in obstructive hydrocephalus with composed aetiology: a case report. *Neurol Neurochir Pol* 2010; 44: 87-90.
2. Parmar A., Aquilina K., Carter M.R. Spontaneous third ventriculostomy: definition by endoscopy and cerebrospinal fluid dynamics. *J Neurosurg* 2009; 111: 628-631.
3. Algin O., Hakyemez B., Parlak M. Phase-contrast MRI and 3D-CISS versus contrast-enhanced MR cisternography for the detection of spontaneous third ventriculostomy. *J Neuroradiol* 2010; doi: 10.1016/j.neurad.2010.03.006.
4. Algin O., Hakyemez B., Parlak M. Phase-contrast MRI and 3D-CISS versus contrast-enhanced MR cisternography on the evaluation of the aqueductal stenosis. *Neuroradiology* 2010; 52: 99-108.
5. Algin O., Hakyemez B., Gokalp G., et al. The contribution of 3D-CISS and contrast-enhanced MR cisternography in detecting cerebrospinal fluid leak in patients with rhinorrhoea. *Br J Radiol* 2010; 83: 225-232.
6. Algin O., Hakyemez B., Ocakoglu G., et al. MR cisternography: is it useful in the diagnosis of normal-pressure hydrocephalus and the selection of "good shunt responders"? *Diagn Interv Radiol* 2010; doi: 10.4261/1305-3825.DIR.3133-09.1.
7. Algin O., Hakyemez B., Gokalp G., et al. Phase-contrast cine MRI versus MR cisternography on the evaluation of the communication between intraventricular arachnoid cysts and neighbouring cerebrospinal fluid spaces. *Neuroradiology* 2009; 51: 305-312.
8. Bekar A. Nöroşirürjide yoğun bakım. In: Aksoy K., Palaoglu S., Pamir N., Tuncer R. [eds.]. Temel Nöroşirürji. Türk Nöroşirurji Derneği Yayınları. Ankara 2005, pp. 65-81 (in Turkish).
9. Algin O. Role of aqueductal CSF stroke volume in idiopathic normal-pressure hydrocephalus. *AJNR Am J Neuroradiol* 2010; 31: E26-27.
10. Algin O., Taskapilioglu O., Zan E., et al. Detection of CSF leaks with magnetic resonance imaging in intracranial hypotension syndrome. *J Neuroradiol* 2011; doi: 10.1016/j.neurad.2010.11.002
11. Tali E.T., Ercan N., Krumina G., et al. Intrathecal gadolinium (gadopentetate dimeglumine) enhanced magnetic resonance myelography and cisternography: results of a multicenter study. *Invest Radiol* 2002; 37: 152-159.
12. Algin O., Hakyemez B., Parlak M. The efficiency of PC-MRI in diagnosis of normal pressure hydrocephalus and prediction of shunt response. *Acad Radiol* 2010; 17: 181-187.
13. Algin O. Role of complex hydrocephalus in unsuccessful endoscopic third ventriculostomy. *Childs Nerv Syst* 2010; 26: 3-4.

Dear Editor,

Thank you for the forwarded comments. I have attentively read a commentary on the article *Spontaneous third ventriculostomy in obstructive hydrocephalus with composed etiology: a case report*. The observations included in this commentary, assisted by the latest reports, are a valuable supplement of the investigated problem. The diagnosis of spontaneous third ventriculostomy based on routine neuroimaging (CT, MRI) is extremely difficult. The proper qualification of patients for advanced diagnostics still remains an essential issue. According to this, the algorithm presented by the authors of the letter seems to be very useful. Nevertheless, we should be aware that we cannot forget that any kind of imaging proposed by the authors has its own limitations and can give false negative and false positive results. It happens that retrospection only lets us see subtle differences important from a diagnostic point of view.

In the presented case, lack of data on the previous disease course, especially disease duration, and convincing clear symptoms of three-ventricle obstructive hydrocephalus led us to the decision to perform third ventricle ventriculostomy. We had not had any premises of the composed hydrocephalus etiology before we made our decision. Performing PC-MRI would have changed our approach, but it was temporarily out of service at that time.

Krzysztof Stachura, MD, PhD

Department of Neurosurgery and Neurotraumatology
Jagiellonian University Medical College, Kraków
e-mail: kkstach@poczta.onet.pl