THIRD VENTRICULOSTOMY THROUGH THE LAMINA TERMINALIS FOR INTRACRANIAL PRESSURE MONITORING AFTER ANEURYSM SURGERY

Technical note

Jorge L. Kraemer¹, Pedro L. Gobbato², Yuri M. Andrade-Souza³

ABSTRACT - Objective: A new ventriculostomy technique through the lamina terminalis is described. This technique is applied mainly during aneurysm surgery at the acute stage. Method: Thirteen patients were operated on intracranial aneurysms and, during the procedure, had the lamina terminalis fenestrated. A ventricular catheter was inserted into the third ventricle, left in place and connected to an external drainage system for further intracranial pressure (ICP) monitoring and/or cerebrospinal fluid (CSF) drainage. Results: ICP readings and CSF drainage were obtained in all cases. No complication was recorded. Conclusion: Third ventriculostomy through the lamina terminalis is a simple and easy technique that can be used as an alternative to conventional ventriculostomy. This procedure can be indicated in cases where the ventricle is not reached by means of another technique, and when the decision to perform ventriculostomy is made at the end of aneurysm surgery.

KEY WORDS: cerebral aneurysm, ventricular drainage, third ventricle, intracranial pressure, operative technique.

Early surgery for treatment of ruptured intracranial aneurysms is well established¹,². Intracranial pressure (ICP), monitoring, by means of a ventriculostomy, may improve the outcome as it decreases the incidence of ischaemic complications and hydrocephalus³-⁵. However, ventricular puncture in patients with acute Subarachnoid Hemorrhage (SAH) is neither atraumatic⁶ nor easy to be performed. Furthermore, opening the lamina terminalis influences a better outcome in patients with ruptured intracranial aneurysms⁷,⁸.

We present our preliminary experience with ICP monitoring by using a catheter placed directly in the third ventricle through the lamina terminalis. All patients were operated in the acute stage of a ruptured intracranial aneurysm.
METHOD

Thirteen consecutive patients harboring intracranial aneurysms were operated on in the acute stage of SAH.

A pterional approach was performed in all cases and the cisterns opened widely. After having clipped the aneurysm, a fenestration of the lamina terminalis was performed by using bipolar forceps. A ventricular catheter (Radio-paque silicone ventricular catheter. Codman External Drainage System II, Johnson & Johnson Professional, Raynham, MA, USA) was inserted into the third ventricle for approximately 20 mm (the fenestrated tip of the catheter was inserted) (Fig 1). The ventricular catheter was then connected to the external drainage system.

The drainage was accomplished continuously keeping the drip chamber at 20 cm height. ICP was measured every hour and recorded. Ventriculostomy was removed the day after ICP had stabilized.

RESULTS

The results are summarized on Table 1. There was no complication that could be attributed to the ventriculostomy.

DISCUSSION

In patients with SAH, ventriculostomy is useful for 1) ICP monitoring; 2) cerebrospinal fluid (CSF) drainage and 3) managing hydrocephalus2,3,5,9-11. Although the risk of aneurysmal rebleeding increases4, it is outweighed by the benefits5.

![Fig 1. Artist’s drawing of ventricular catheter in place.](image)

HH, Hunt & Hess; ICP, intracranial pressure; GOS, Glasgow Outcome Scale; A1, anterior cerebral artery; ACoA, anterior communicating artery; PCoA, posterior communicating artery; M1, M2, M3, middle cerebral artery; m, male; f, female.
this is generally considered a straightforward procedure, it may add time and trauma to aneurysm surgery.6

Alternatively, Paine et al.14 described an intraoperative ventricular puncture. This approach is very useful in most cases but the ventricle is not always reached through the first pass.

Lamina terminalis fenestration is indicated as an adjunct to aneurysm repair7,8 and has been a routine procedure in our clinic in the last years without noticeable complication. Previous experience with a shunt system using the third ventricle15 proved that catheterization is well tolerated. In the present study, we describe a simple way to get a reliable ventriculostomy for CSF drainage and ICP monitoring. The catheter placement is done under direct vision to ascertain that the whole fenestrated catheter tip is actually in the ventricle. Both ICP readings and pressure curve are extremely sensitive, and CSF drainage is very easy. Due to simultaneous CSF drainage, the pressure values recorded in our cases may be lower than the actual ones16, but this fact does not undermine the efficacy of the procedure. The midline ventricular position of the catheter warrants the best ICP reference (Fig 2). The disadvantage of the method is that the surgeon has to dissect the cisterns before he or she obtains CSF ventricular drainage. Although this procedure is simple and safe, it needs more clinical experience; yet, it may become an alternative to ventricular diversion during an aneurysm surgery.

CONCLUSIONS
Third ventriculostomy through the lamina terminalis is a simple and easy technique for the skilled neurosurgeon. Preliminary experience suggests that it can be used as an alternative to conventional ventriculostomy. This procedure can be indicated in cases in which the ventricle is not reached by means of another technique, and the decision to perform ventriculostomy is made at the end of aneurysm surgery. No complications directly attributable to this approach were observed in our cases. However, it deserves further study.

REFERENCES
1. Awad IA, Carter LP, Spetzler RF, Medina M, Williams FW Jr. Clinical vasospasm after subarachnoid hemorrhage: response to hypervolemic hemodilution and arterial hypertension. Stroke 1987;18:365-372.
2. Bailey JE, Spetzler RF, Hadley MN, Baldwin HZ. Management morbidity and mortality of poor-grade aneurysm patients. J Neurosurg 1990;72:599-606.
3. Auer LM, Mokry M. Disturbed cerebrospinal fluid circulation after subarachnoid hemorrhage and acute aneurysm surgery. Neurosurgery 1990;26:801-809.
4. Paré L, Defino R, Leblanc R. The relationship of ventricular drainage to aneurysmal rebleeding. J Neurosurg 1992;76:422-427.
5. Rajeshkar V, Harbaugh RE. Results of routine ventriculostomy with external ventricular drainage for acute hydrocephalus following subarachnoid haemorrhage. Acta Neurochir (Wien) 1992;115:13-14.
6. Raftopoulos C, Baleriaux D, Brotchi J, Voordecke P. The traumatic aspect of ventricular catheterization demonstrated by magnetic resonance imaging. Clin Neurol Neurosurg 1998;90:47-52.
7. Sindou M. Favourable influence of opening the lamina terminalis and Lilliequist’s membrane on the outcome of ruptured intracranial aneurysms: a study of 197 consecutive cases. Acta Neurochir (Wien) 1994;127:15-16.
8. Tomasello F, d’Avella D, de Divitiis O. Does lamina terminalis fenestration reduce the incidence of chronic hydrocephalus after subarachnoid haemorrhage? Neurosurgery 1999;45:827-832.
9. Heinsoo M, Eelmäe J, Kuklane M, Tomberg T, Tikk A, Aser T. The possible role of CSF hydrodynamic parameters following in management of SAH patients. Acta Neurochir 1998;71(Suppl):13-15.
10. Nowak G, Schwachenwald R, Arnold H. Early management in poor grade aneurysm patients. Acta Neurochir (Wien) 1994;126:33-37.
11. Sakaki S, Ohta S, Kuwabara H, Shiraishi M. The role of ventricular and cisternal drainage in the early operation for ruptured intracranial aneurysms. Acta Neurochir (Wien) 1987;88:89-94.
12. McComb JG. Methods of cerebrospinal fluid diversion. In Apuzzo MJ (Eds.). Surgery of the third ventricle. Baltimore: Williams & Wilkins 1998:607-633.
13. Aoki N. Rapid bedside technique for percutaneous ventricular drainage in patients with severe subarachnoid haemorrhage. Acta Neurochir (Wien) 1991;113:184-185.
14. Paine JT, Batjer HH, Samson D. Intraoperative ventricular puncture. Neurosurgery 1988;22:1107-1109.
15. Gutierrez-Lara F, Hakim S. Experience with a shunt system using the third ventricle. J Neurosurg 1975;42:104-107.
16. Wilkinson HA, Yarzebski J, Wilkinson EC, Anderson FA Jr. Erroneous measurement of intracranial pressure caused by simultaneous ventricular drainage: a hydrodynamic model study. Neurosurgery 1989;24:348-354.