Lamina terminalis fenestration

To The Editor: We read with great interest the recent paper by Chohan et al.1 (Chohan MO, Carlson AP, Hart BL, et al: Lack of functional patency of the lamina terminalis after fenestration following clipping of anterior circulation aneurysms. Clinical article. J Neurosurg 119:629–633, September 2013). In their study, the authors injected, on postoperative Day 1 following clipping of anterior circulation aneurysms, an iodine-based contrast agent intraventricularly to assess, with CT imaging, the flow into the basal cisterns through a fenestrated lamina terminalis. They concluded that fenestration of the lamina terminalis (FLT) did not result in functional patency of the lamina terminalis when performed as part of surgical clipping for ruptured aneurysms.

We have some remarks and criticisms regarding this article, which leads to clear-cut conclusions. The findings of CT ventriculocisternography were impressive, but somewhat surprising. We do not find a convincing pathophysiological explanation to support the assertion that FLT per se is useless. Furthermore, endoscopic transventricular FLT has been shown to be feasible, effective, and a good alternative to standard endoscopic third ventriculostomy (ETV) in selected cases of hydrocephalus.

The explanation provided by the authors that the frontal lobe, in its normal anatomical position after clipping, seals off the lamina terminalis fenestration may appear rational, but is not fully convincing. An alternative interpretation of the results of Chohan el et al. is the possibility that the fenestration may not be fully functional in the very early postoperative period (Day 1) in patients without acute post–subarachnoid hemorrhage (SAH) ventricular dilatation. In this regard, the comparison with the hydrocephalus case treated by ETV could be misleading. Clearly, the patient with chronic hydrocephalus, included as a control in this study, had wide cisternal space and increased intraventricular pressure, whereas patients who have undergone surgery for SAH within the preceding 24 hours and are being treated with external ventricular drainage (EVD) may have a reduced intraventricular pressure and very tight cisternal spaces.

Fenestration of the lamina terminalis is, objectively, a ventriculocisternostomy. There are 2 fundamental requirements for its functioning: 1) the ventricular opening should be sufficiently wide; 2) the cisternal space must be sufficient.

Concerning the first point, maintenance of a large opening of the lamina terminalis should be assured through fine bipolar coagulation of its borders according to the technique originally described by Yaşargil et al.2 The explanation provided by the authors that the frontal lobe and sealing off the cisterns in selected cases reduced the shunt placement rate to 8.6%. In 1983, he modified his strategy by performing LTF in all patients and observed a reduction of the need for CSF shunting to 3% of 650 cases. In 1995, Yaşargil further modified his technique by sharply opening the lamina terminalis and briefly coagulating the opened rim to avoid subsequent closure due to adhesions.

The second point is equally important; FLT must be associated with generous subarachnoid dissection, clot removal, and opening of the Liliequist membrane to be functional. Beyond the above-mentioned considerations of Yaşargil about cisternal blood clearance, it has been demonstrated that it is important for functionality of the fenestration. Akyuz and Tuncer,3 in a randomized study comparing FLT alone and FLT combined with opening of the Liliequist membrane, suggested that this latter strategy reduced the incidence of shunt-dependent hydrocephalus (although the reduction was not statistically significant) and that this positive effect was particularly noticeable in patients in whom a cisternal “overflow” was observed at surgery on opening of the membrane. This corresponded to cases with clots within the fourth ventricle and ventricular dilatation.

Other studies have been focused on the potential advantage of combining FLT with cisternal clot clearance in reducing the incidence of shunt-dependent hydrocephalus.4,9 It is generally believed that hydrocephalus after SAH is of the communicating type.1 Nevertheless, chronic hydrocephalus after SAH may also be of the noncommunicating type. The type of hydrocephalus that develops after SAH may depend on the location of the ruptured aneurysm and severity of SAH. It is possible that severe SAH (Fisher Grade III and IV) resulting from posterior circulation aneurysms more commonly causes a noncommunicating hydrocephalus by blocking the foramina of Luschka and Magendie, whereas Fisher Grade I or II SAH resulting from anterior circulation aneurysms typically results in a communicating hydrocephalus by obstructing the arachnoid granulations over the cerebral convexities. In the former situation, FLT would potentially be beneficial by providing an alternate route of egress for ventricular CSF.

Finally, our unpublished data demonstrate through MRI techniques, including cine phase contrast MRI, the anatomical patency (Fig. 1) and functional CSF flow through the subarachnoid space in patients who have undergone FLT.

In 1999, we published the first clinical series (52 cases) on the role of FLT in preventing shunt-dependent hydrocephalus.11 Since then, we have treated more than 400 patients combining FLT, evacuation of blood from the basal cisterns, and opening of the Liliequist membrane.
This resulted in an incidence of shunt-dependent hydrocephalus of less than 4% (unpublished data) compared to reported values of up to 30%. The procedure has been demonstrated to be safe. Nevertheless, we recognize that this issue is still debated and there is no consensus on the efficacy of this procedure. We, and others, are still convinced about the necessity to organize a multicenter trial focused on the identification of specific factors that may influence the incidence of chronic hydrocephalus as well as vasospasm after SAH. This would be important information in the continuing debate between clipping versus endovascular treatment of ruptured aneurysms.

**Disclosure**

The authors report no conflict of interest.

**References**


**Response**

We thank Tomasello et al. for their commentary on our paper. We agree with their overall assessment in that 1) our data only relate to functional (and not anatomical) patency of fenestrated lamina terminalis, 2) this functional patency was only assessed on Day 1 after FLT, and 3) it may or may not have any bearing on the long-term patency (functional or anatomical) of the fenestrated lamina terminalis. Our choice of early ventriculocisternography was based on the assumption that the likelihood of a fenestrated lamina terminalis remaining patent would be the highest closest in time to the surgery. Moreover, since this procedure has been proposed by some as instrumental in preventing delayed ischemic neurological deficit (DIND), its patency is only relevant (at least for vasospasm) during the first few days after SAH, the time when patients are most susceptible to DIND.

Our technique of performing FLT is very similar to what Tomasello and colleagues describe in their commentary. After meticulous lavage of cisternal spaces and clearance of all visible blood, the external ventricular drain is closed. The lamina terminalis is then opened sharply and widely with an arachnoid knife. The opening is further expanded with microforceps to achieve as wide an opening as possible. In addition, as recommended by Professor Yaşargil, the Liliquist membrane is also opened, and blood within each compartment is carefully removed. We, too, believe that FLT is a safe procedure when performed by experienced surgeons.

The reported incidence of hydrocephalus after an-