Aqueductoplasty

Endoscopic aqueductoplasty with stenting presents a safe procedure. In well selected patients, it provides a long-term, stable clinical course. Aqueductoplasty alone has a high reclosure rate and should be avoided.

Aqueductoplasty with stenting is the procedure of choice for the treatment of isolated fourth ventricle. Membranous and tumor-related aqueductal stenosis should be treated by endoscopic third ventriculostomy [1].

The development of neuroendoscopy has dramatically changed the outcome of these patients and the literature review suggest that endoscopic trans-fourth ventricle aqueductoplasty and stent placement is a minimally invasive, safe, and effective technique for the treatment of TFV and should be strongly recommended, especially in patients with supratentorial slit ventricles [2].

Aqueduct stent placement is technically feasible and can be useful in selected patients either with endoscopy or open surgery [3].

Essentially, the main cause of a TFV, namely, the aqueductal obstruction, is addressed using an endoscopic technique, and hence it is the most rational of all surgeries for this condition. The aqueduct can be dilated and kept open using a stent either through a transfrontal (trans-third ventricle) route or through a trans-fourth ventricular route. The latter is a shorter route, but is less commonly used probably due to the lack of familiarity with the endoscopic anatomy of the region of the fourth ventricle.

With either route, the surgeon has to decide whether a simple dilatation of the aqueduct will suffice or to leave a stent in place. The advantage of a stent is that the patency of the aqueduct is ensured in the postoperative period unless the stent migrates. The major disadvantage is that of infection due to the presence of a foreign body. Gallo et al., placed a stent whenever the dilated aqueduct was narrower than the width of the stent. Although theoretically it is possible to produce additional neurological deficits by introducing a wider stent through a narrower aqueduct, in the authors' series, the complications (two patients with ophthalmoparesis) were equally distributed between those who had a stent placed and those who underwent aqueductoplasty alone. Hence, it appears that fear of additional deficits should not deter a surgeon from using a stent [4].

Longatti et al., suggest a very simple method of steering the tip of standard ventricular catheters by using materials commonly available in all operating rooms. The main advantage of this method is that it permits less invasive transaqueductal drainage of trapped fourth ventricles, especially in cases of narrow third ventricle, because the scope and catheter are introduced in sequence and not in a double-barreled fashion. Two illustrative cases are reported [5].

Case series

2016

Marx et al., retrospectively reviewed a prospectively maintained clinical database for endoscopic

stent placement performed in adults between 1993 and 2013.

Of 526 endoscopic intraventricular procedures, stents were placed for treatment of CSF disorders in 25 cases (4.8%). The technique was used in the management of arachnoid cysts (ACs; n = 8), tumor-related CSF disorders (n = 13), and hydrocephalus due to stenosis of the foramen of Monro (n = 2) or aqueduct (n = 2). The mean follow-up was 87.1 months. No deaths or infections occurred that were related to endoscopic placement of intracranial stents. Late stent dislocation or migration was observed in 3 patients (12%).

Endoscopic intracranial stent placement in adults is rarely required but is a safe and helpful technique in select cases. It is indicated when reliable and long-lasting restoration of CSF pathway obstructions cannot be achieved with standard endoscopic techniques. In the treatment of tumor-related hydrocephalus, it is a good option to avoid reclosure of the restored CSF pathway by tumor growth. Currently, routine stent placement after endoscopic fenestration of ACs is not recommended. Stent placement for treatment of CSF disorders due to tumor is a good option for avoiding CSF shunting. To avoid stent migration and dislocation, and to allow for easy removal if needed, the device should be fixed to a bur hole reservoir [6].

2004

Fritsch et al., retrospectively reviewed the medical histories of 18 patients with an isolated fourth ventricle. Surgical procedures included endoscopic aqueductoplasty, endoscopic aqueductoplasty with a stent, endoscopic interventriculostomy (lateral ventricle or third ventricle to fourth ventricle), and endoscopic interventriculostomy with a stent. Operations were performed between July 1997 and June 2002. The mean age of the patients at the time of surgery was 3 years. The mean follow-up was 29 months. All patients had a supratentorial ventriculoperitoneal shunt.

Clinical symptoms (impairment of consciousness, tetraparesis, and ataxia) improved in all patients. Reduction of the size of the fourth ventricle was observed in all patients. Seven patients required reoperation because of restenosis (39% revision rate). Restenosis occurred between 2 weeks and 7 months after surgery (average, 3 mo). Four patients underwent reoperation with stent placement, and three patients underwent reaqueductoplasty. We had the following complications: one infection, one asymptomatic subdural hygroma, one transient oculomotor paresis, and one permanent oculomotor paresis (4 [22%] of 18 patients).

The significant failure rate of fourth ventricle shunts has led to the development of alternative treatment methods. Endoscopic aqueductoplasty or interventriculostomy presents an effective, minimally invasive, and safe procedure for the treatment of isolated fourth ventricle in pediatric patients. Compared with suboccipital craniotomy and microsurgical fenestration, endoscopic aqueductoplasty is less invasive, and compared with fourth ventricle shunts, it is more reliable and effective [7].

A series of 39 endoscopic aqueductoplasties was performed in 33 patients harbouring a hydrocephalus caused by aqueductal stenosis. In 13 patients, a third ventriculostomy was simultaneously performed. There was no endoscopy-related mortality. One aqueductoplasty had to be abandoned. In 7 patients, reclosure of the restored aqueduct required an endoscopic revision. In 25 patients (76%), the hydrocephalus-related symptoms resolved or improved. The condition was unchanged in 8 patients. Four patients needed to be shunted. The ventricles decreased in size in 22

patients (67%), were larger in 2, and unchanged in the remaining 9 patients.

Endoscopic aqueductoplasty is a treatment option in patients with hydrocephalus caused by membranous aqueductal stenosis. Unfortunately, the reclosure rate is higher than initially expected. More experience and longer follow-up are necessary to determine the value of endoscopic aqueductoplasty in the treatment of hydrocephalus caused by aqueductal stenosis [8].

1999

A series of 17 patients who underwent endoscopic aqueductoplasty is reported. Rigid rod-lens scopes were used for inspecting the aqueductal entry and performing balloon aqueductoplasty. With the aid of a 2.5-mm flexible endoscope, the aqueduct and fourth ventricle were explored and aqueductal membranous obstructions were perforated. Third ventriculostomies were performed simultaneously in nine patients. One aqueductal stent was inserted. In six patients, frameless computerized neuronavigation was used for an accurate approach to the aqueduct. The average duration of the endoscopic procedures was 59 minutes (range, 25-100 min).

There was no endoscopy-related mortality. Surgical complications included an asymptomatic fornix contusion and two injuries to the aqueductal roof, which resulted in permanent diplopia due to dysconjugate eye movement (one patient) and transient trochlear palsy (one patient). In addition, two patients developed transient dysconjugate eye movements, and one patient had an asymptomatic epidural hematoma. Eleven patients showed improvement in their symptoms. The conditions of five patients were unchanged. One patient died of stroke 1 month after the operation. No patient required shunting. The ventricles decreased in size in nine patients and were unchanged in the remaining eight patients.

Endoscopic aqueductoplasty is an effective alternative to third ventriculostomy for the treatment of hydrocephalus caused by short aqueductal stenosis. However, longer follow-up periods are necessary to evaluate long-term aqueductal patency after aqueductoplasty [9].

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