NEUROLOGIA I NEUROCHIRURGIA POLSKA XXX (2017) XXX–XXX

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.elsevier.com/locate/pjnns

Original research article

Efficacy of endoscopic third ventriculostomy in old aged patients with normal pressure hydrocephalus

Young Sill Kang [a,b,1], *Eun-Kyung Park* [c,1], *Ju-Seong Kim* [c], *Dong-Seok Kim* [c], *Ulrich-Wilhelm Thomale* [b], *Kyu-Won Shim* [c,*]

[a] *Department of Neurosurgery, Universitätsmedizin, Mainz, Germany*
[b] *Division of Pediatric Neurosurgery, Charité Universitätsmedizin, Berlin, Germany*
[c] *Pediatric Neurosurgery, Severance Children's Hospital, Yonsei University College of Medicine, Seoul, Republic of Korea*

ARTICLE INFO

Article history:
Received 21 March 2017
Accepted 13 October 2017
Available online xxx

Keywords:
Normal pressure hydrocephalus
Endoscopic third ventriculostomy (ETV)
Aqueductal peak velocity

ABSTRACT

Normal pressure hydrocephalus (NPH) is a chronic disorder caused by interrupted CSF absorption or flow. Generally, shunt placement is first option for NPH treatment. Due to complications of ventriculo-peritoneal (VP) shunt placement, endoscopic third ventriculostomy (ETV) can be considered as an alternative treatment option. Here we report the efficacy of ETV especially in old aged patients with normal pressure hydrocephalus.

Total 21 old aged patients with communicating hydrocephalus with opening pressure, measured via lumbar puncture, less than 20 cm H_2O underwent ETV. 15 patients had primary/idiopathic NPH and 6 patients had secondary NPH. All patients were studied with a MRI to observe the flow void at aqueduct and the fourth ventricle outflow. And all of them underwent ETV. In a group with peak velocity was higher than 5 cm/s, nine patients (75%) were evaluated was 'favorable' and three of them (25%) was scored 'poor'. In another group with peak velocity less than 5 cm/s, three of them were scored 'poor' and two of them were scored 'stable'. None of them was evaluated as 'favorable'. We also evaluated the outcomes according to etiology: 12 patients (80% of the patients with primary NPH) were evaluated with 'favorable' after ETV treatment. Two patients (13.3%) were as 'stable'. And one patient was as 'poor' evaluated. Five patients (83.3%) among patients with secondary NPH were as 'poor' evaluated and one of them was stable and no patient was as 'favorable' evaluated. 4 patients, which was as 'poor' evaluated in the group with the secondary NPH, underwent additional VP shunt implantation. Overall, the outcomes of the group with the idiopathic NPH after ETV treatment were more favorable than of the group with the secondary NPH.

Our study suggest that ETV can be effective for selected elderly patients with primary/idiopathic NPH, when they satisfy criteria including positive aqueduct flow void on T2 Sagittal MRI and the aqueductal peak velocity, which is greater than 5 cm/s on cine MRI.

* *Corresponding author at*: Pediatric Neurosurgery, Severance Children's Hospital, Department of Neurosurgery, Yonsei University College of Medicine, Seoul, Republic of Korea.
E-mail address: shimkyuwon@yuhs.ac (K.-W. Shim).
[1] These authors contributed equally.

Abbreviations: NPH, normal pressure hydrocephalus; iNPH, idiopathic normal pressure hydrocehpahlau; sNPH, secondary normal pressure hydrocehpahlaus; VP shunt, ventriculo-peritoneal shunt; CSF, cerebrospinal fluid.

https://doi.org/10.1016/j.pjnns.2017.10.004
0028-3843/

1. Introduction

NPH is a chronic disorder, which is caused by impaired CSF circulation. Hydrocephalus can be subdivided into communicating and non-communicating 'obstructive' hydrocephalus. The normal pressure hydrocephalus belongs to the communicating form in that the cause of CSF circulation is low brain compliance. The exact pathogenesis of normal pressure hydrocephalus has not been elucidated. NPH was first described by Hakim and Adams in 1965 [1,2]. It is characterized by the clinical triad of gait disturbance, dementia, and urinary incontinence [3,4]. The gait disturbance, which represents with a combination of motor deficits, failure of postural righting reflexes, abnormal smooth pursuit, and failed suppression of vestibuloocular reflexes [5,6] is usually the first symptom of normal pressure hydrocephalus to appear, followed by dementia and last by urinary incontinence [7]. Generally, VP shunt placement is considered as first option for NPH treatment. However, several complications, including shunt infection, over drainage and malfunction including obstruction [8–13] limit its application for treating NPH. Some studies report an overall shunt failure rate as high as 59%, with the majority of failures, occurring within the first 6 months after shunt placement [14]. Due to such complications, endoscopic third ventriculostomy (ETV) has emerged as a surgical intervention to treat hydrocephalus, as an alternative to shunt implantation. ETV has become as one of ideal treatment options generally for the most forms of obstructive hydrocephalus. In the last decade ETV has been proposed as an alternative surgical intervention for treating iNPH. However, debate over VP shunt implantation versus ETV for the treatment is still ongoing. Although reported therapeutic efficacy of ETV over shunt implantation reported in some studies [15,16], Chan et al. reported high complication rate associated with ETV intervention [17]. However, therapeutic effect without implanting any foreign material renders this method preferable to VP shunting for a large ETV population. Several studies reporting the efficacy of the ETV predominantly include the pediatric patient group [18–21] or combined pediatric and adult populations [22–27]. To our knowledge, there is no study, suggesting selecting criteria for ETV especially in old aged patients with normal pressure hydrocephalus. In this present study, we report on the follow up of ETV in a series of 21 patients (mean 70 years old) with normal pressure hydrocephalus and suggest patients selecting criteria for successful ETV intervention.

2. Materials and methods

In our present study, clinical data of 21 patients diagnosed with normal pressure hydrocephalus, who chose the endoscopic third ventriculostomy from January 2013 to January 2014 were reviewed (Table 1a). Patients were fully informed about their treatment options including surgical procedures, anticipated results, complications and anticipated benefits. The patients fulfilled following diagnostic criteria (Table 1b): (1) older than sixty years of age – age ranged from 60 to 82 years old (mean 70 years old). (2) Communicating hydrocephalus (flow void was observed at aqueduct and 4th ventricle outflow on cine MRI). (3) Positive results of CSF tap test. (4) Opening pressure less than 20 cm H_2O. 15 patients among them had iNPH and rest of them had sNPH. Causes for sNPH include cerebral infarction and cerebral hemorrhagic contusion.

All 21 patients presented with gait ataxia. 48% of them have urinary incontinency and 57% of them had memory deficiency. 63.6% of patients had more than two symptoms of NPH triad. Preoperatively all patients were studied with MRI to observe the flow void at aqueduct and the fourth ventricle outflow. All patients underwent ETV. The follow up period ranged from 1 month to 12 months (mean 6.4 months). Based on etiology, we separated the patients into two groups. The first group included 15 patients with iNPH, defined as primary communicating hydrocephalus. The second group included 6 patients with sNPH. Evaluation of the efficacy of ETV based on the postoperative patients' status was performed comprehensively by physician. It was evaluated as 'preferable' when the comprehensive postoperative status of patients indicates improvement. If there were no big differences between pre- and postoperative but only with a bit of improvement, we evaluated as 'stable'. When there was no improvement or worsening symptoms, we evaluated it as 'poor'. 'expire' was categorized as 'poor'.

3. OP procedure: endoscopic third ventriculostomy

Endoscopic third ventriculostomy was performed using rigid neuro-endoscope consisted of a 30-degree Hopkins pediatric telescope (Karl Storz, Tuttlingen, Germany) with an outside diameter of 2.7 mm, a sheath for the telescope with an outside diameter of 3.8 mm, and a stylet. For perforating the third ventricle floor, a monopolar-coagulating electrode was applied. This operation was performed under general anesthesia. The patient was positioned supine, and routine skin preparation and draping were performed. A burr hole was placed at Kocher's point. The right lateral ventricle was tapped using a ventricular catheter through the burr hole, and peel-away catheter was placed via a tract. The tip of a tapping catheter was directed to the glabella and tragus of the right ear. A telescope with sheath was advanced into the lateral ventricle through the peel-away catheter. Foramen of Monro was identified, and the telescope could be advanced through the foramen of Monro to visualize the floor of the third ventricle. The site for a third ventriculostomy was located halfway along the midline between the infundibular recess and the mammillary body. For penetration of the third ventricular floor, the coagulating electrode or forceps was advanced via a working channel in the sheath and electric coagulation with the monopolar electrode was used. As the third ventricular floor was perforated, a flow of CSF was seen. The hole could be enlarged with the insertion of the telescope or balloon dilator if needed. The telescope and its sheath were removed and the cortical incision was packed with a piece of gel-foam and sealed with fibrin glue.

4. Results

Peak CSF flow velocity at cerebral aqueduct on cine MR was measured from 17 patients pre-operatively (Table 2). 4 Rest