Role of Endoscopic 3rd Ventriculostomy & Ventriculoperitoneal Shunt in Idiopathic Normal Pressure Hydrocephalus: Preliminary Results of Randomized Clinical Trial

Fernando Pinto PhD; Felippe Saad; Matheus Oliveira MD; Renan Pereira; Fernanda de Miranda; Juliana de Tornai; Maria Romão; Eduardo Ribas; Emilia Valinetti; Manoel Teixeira

Division of Functional Neurosurgery, Hospital das Clínicas, Universidade de São Paulo, São Paulo, Brazil.

Introduction

Most performed treatment for idiopathic normal pressure hydrocephalus (INPH) is the ventriculoperitoneal shunt (VPS), mainly with programmable valve implantation. Endoscopic third ventriculostomy (ETV) is a treatment option, with the advantage of not needing prosthesis implantation. The aim is to compare functional neurological outcome after 12 months of INPH treatment through two different techniques: ETV or VPS.

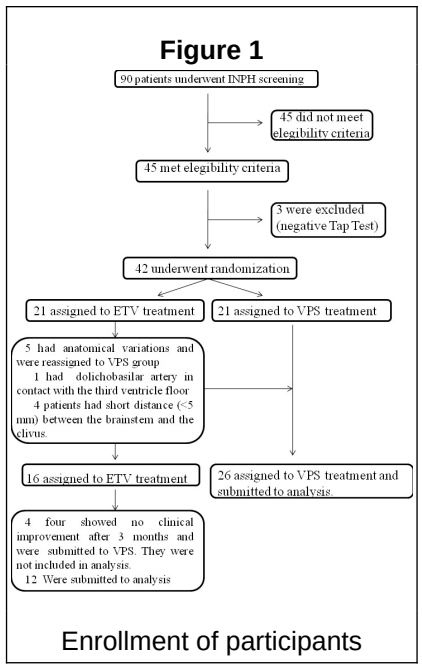
Methods

Randomised parallel, open label trial involving 42 patients with INPH and positive response to tap-test (TT), from January 2009 to January 2012. ETV was performed with rigid endoscope with 30° lens (Minop®, AESCULAP) and VPS performed with fixed-pressure valve (PS Medical®, MEDTRONIC). Outcome occurs 12 months after surgery. Comparison of neurological function outcome is carried out by six clinical scales: mini-mental, Berg scale, dinamic gait index, functional independence measure, timed up and go and NPH scale.

Results

Participant flow is evidenced in the diagram of Figure 1.

Figure 1



Enrollment of participants

Figures 2 and 3 show pre and post operative neuroimages of typical subjects in ETV and VPS groups, respectively.

Table 1 shows homogeneous values of the scores on six scales before and after TT and the postoperative follow-up period (3 to 12 months).

The only surgical complication observed in the follow-up was present in VPS group and was subdural hematoma. It happened in 5 of 26 patients, although with successful reoperation, valve replacement and favorable 12 -month outcome.

There was statistically significant difference between both groups after 12 months of follow-up, and VPS group had the best results (ETV = 50%, VPS = 76.9%).

Table 1

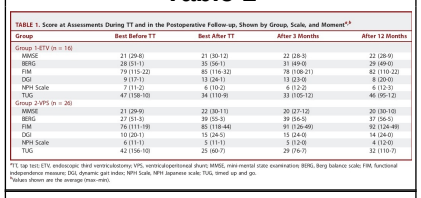


TABLE 1. Score at Assessments During TT and in the Postoperative Follow-up, Shown by Group, Scale, and Moment[a,b]

Group	Best Before TT	Best After TT	After 3 Months	After 12 Months
Group 1-ETV (n = 16)				
MMSE	21 (29-0)	21 (30-12)	22 (28-3)	22 (28-9)
BERG	28 (51-1)	35 (56-1)	31 (49-0)	29 (49-0)
FIM	79 (115-22)	85 (116-32)	78 (108-27)	82 (110-22)
DGI	9 (17-1)	13 (24-1)	13 (23-0)	8 (20-0)
NPH Scale	7 (11-2)	6 (10-2)	6 (12-2)	6 (12-3)
TUG	47 (158-10)	34 (110-9)	33 (105-12)	46 (95-12)
Group 2-VPS (n = 26)				
MMSE	21 (29-9)	22 (30-11)	20 (27-12)	20 (30-10)
BERG	27 (51-3)	39 (55-3)	39 (56-5)	37 (56-5)
FIM	76 (111-19)	85 (110-44)	91 (126-49)	92 (124-49)
DGI	10 (20-1)	15 (24-5)	15 (24-0)	14 (24-0)
NPH Scale	6 (11-1)	5 (11-1)	5 (12-0)	4 (12-0)
TUG	42 (156-10)	25 (60-7)	29 (76-7)	32 (110-7)

[a]TT, tap test; ETV, endoscopic third ventriculostomy; VPS, ventriculoperitoneal shunt; MMSE, mini-mental state examination; BERG, Berg balance scale; FIM, functional independence measure; DGI, dynamic gait index; NPH Scale, NPH Japanese scale; TUG, timed up and go.
[b]Values shown are the average (max–min).

Figure 2

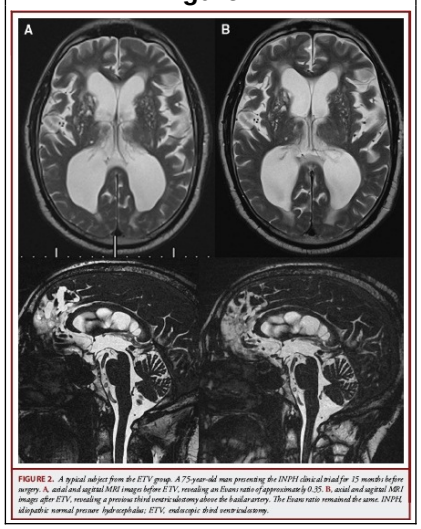


FIGURE 2. A typical subject from the ETV group. A 75-year-old man presenting the INPH clinical triad for 15 months before surgery. A, axial and sagittal MRI images before ETV, revealing an Evans ratio of approximately 0.35. B, axial and sagittal MRI images after ETV, revealing a previous third ventriculostomy above the basilar artery. The Evans ratio remained the same. INPH, idiopathic normal pressure hydrocephalus; ETV, endoscopic third ventriculostomy.

Figure 3

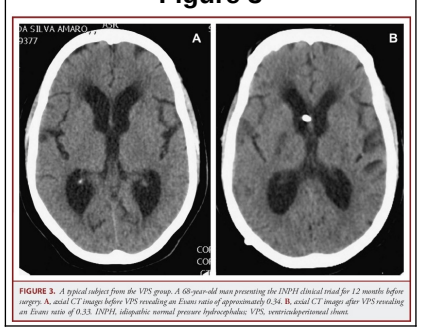


FIGURE 3. A typical subject from the VPS group. A 68-year-old man presenting the INPH clinical triad for 12 months before surgery. A, axial CT images before VPS revealing an Evans ratio of approximately 0.34. B, axial CT images after VPS revealing an Evans ratio of 0.33. INPH, idiopathic normal pressure hydrocephalus; VPS, ventriculoperitoneal shunt.

Discussion

Italian multicenter retrospective study showed a success rate of 69.1% of ETV in the treatment of 110 patients with INPH after a period of at least 2 years of follow-up.

However many criticisms are pertinent. We observed that the percentage of patients who improved in the first year of follow-up was different in both groups, with values similar to those found in the literature for VPS, ranging from 70 to 90%. However, patients treated with VPS showed a much more significant neurological functional gait improvement after 12 months than patients treated with ETV. Thus, we cannot indicate the ETV as the best option for initial treatment of INPH at all, as the VPS had better functional neurologic outcomes after 1 year. However, the neurosurgeon should know that ETV can be considered a treatment option for INPH, but with different clinical results than the VPS.

Conclusions

Compared to ETV, VPS is superior and has the best functional neurological outcome 12 months after surgery.

Learning Objectives

By the conclusion of this session, participants should be able to describe the importance of these two kinds of surgery (VPS and ETV) and identify an effective treatment for NPH.

References

1.Adams RD, Fisher CM, Hakim S, Ojemann RG, Swett WH: Symptomatic occult hydrocephalus with "normal" cerebrospinal-fluid pressure: a treatable syndrome. N Engl J Med 273:117-126, 1965. 2. Gangemi M, Maiuri F, Naddeo M et al: Endoscopic third ventriculostomy in idiopathic normal pressure hydrocephalus: an Italian multicenter study. Neurosurgery 63:62-67; discussion 67-69, 2008. 3.Mori K: Management of idiopathic normal-pressure hydrocephalus: a multiinstitutional study conducted in Japan. J Neurosurg 95:970-973, 2001. 4. Zemack G, Romner B: Adjustable valves in normal-pressure hydrocephalus: a retrospective study of 218 patients. Neurosurgery 62 Suppl 2:677-687, 2008. 5. Marmarou A, Bergsneider M, Klinge P, Relkin N, Black PM: The value of supplemental prognostic tests for the preoperative assessment of idiopathic normal-pressure hydrocephalus. Neurosurgery 57:S17-28; discussion ii -v, 2005. 6. Relkin N, Marmarou A, Klinge P, Bergsneider M, Black PM: Diagnosing idiopathic normal-pressure hydrocephalus. Neurosurgery 57:S4-16; discussion ii-v, 2005.