ORIGINAL ARTICLE

Normal Pressure Hydrocephalus: Selection of Patients for Shunt Placement

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ABSTRACT

Objective: *To determine the criteria in our setup, for patients with normal pressure hydrocephalus (NPH), based on clinical and radiological findings.*

Material and Methods: *This is multiple center study, including departments of Neurosurgery at LGH, Lahore / KEMU, Lahore. Over 25 years, 240 patients were included purely on clinical criteria of poor memory, sphincter loss, gait apraxia and Evan's ratio ≥ 0.30 on CT or MRI. All patients had shunting procedures.*

Results: *Hundred and ninety patients were improved and all of them had significant reduction in Evan's ratio i.e. ≥ 0.06. Only 10 patients had infection out of whom 8 lost to follow up while 2 had shunt revision.*

Conclusion: *Shunting procedures especially VP shunt shows good results if selection is stringent and no co-morbidity is associated.*

INTRODUCTION

Normal pressure hydrocephalus was first diagnosed in 1964 but it still has three unresolved issues, physio-pathogenesis of ventriculomegaly, differentiation from compensatory dilatation and outcome after shunting.[1]

The outcome of shunting cannot be predicted with diagnostic tools available to date,[2,3] inspite of the fact that many selection criteria have been proposed based on pathogenesis and empirical consideration.

Considering the empirical method, of external lumbar drainage (ELD), Marmarou et al [4] claimed a positive predictive value of 90.5%. In this series of 151 patients 22.3% did not improve after ELD but they had good outcome after shunting procedures. Same observation was noticed by Walchenbach et al.[5] They concluded that patients who showed no response to ELD should be offered shunting procedure.

Considering the pathogenetic factors CSF outflow resistance (R-out) or conductance should be measured to segregate patients between negative and positive response after shunting procedures.[6] Many studies have shown no definite relation between NPH and pre-operative R-out value.[7] It has also been shown that when R–out cut off level is chosen too high this can increase the risk of deselecting patients who can otherwise be benefitted from shunting.[8] Some investigators have suggested CSF pulse pressure amplitude monitoring during ICP monitoring[9] and they have fixed criteria as: mean ICP wave amplitude equal or more than 4 mmHg for at least 70% of ICP monitoring time, 5 mmHg for at least 40% or 6mmHg for not less than 10% of the monitoring time. By this criteria they claim positive predictive value of 90% and negative value of 100%.

Analysis of biomarkers such as sulfatide, β–amyloid etc give no prognostic value. Same is the result with other tests e.g.; perfusion weighted MRI, quantitative local cerebral blood flow changes, MRI imaging intracranial compliance assessment.[10,11]

In this paper we are presenting our 25 year experience identifying factors which help to select patients with NPH, who will respond positively with shunting procedures.

MATERIAL AND METHODS

This is multiple center study, including departments of Neurosurgery at LGH, Lahore / KEMU, Lahore. This study was carried out between January 1990 to December 2014. NPH was suspected in 240 patients presented in our out-patient department. NPH was suspected in patients who had poor memory, incontinence and gait apraxia associated with hydrocephalus when the Evan's ratio was above 0.30 on CT or MRI brain imaging. All patients underwent shunting procedures. Out of 240 patients 230 patients (95.8%) and 10 patients (4.2%) had VP and LP shunts respectively. All patients had medium pressure shunts. All VP shunts were on the right side and LP shunts at L_{4-5} space under third generation cephalosporin antibiotic cover. All patients were evaluated preoperatively and compared postoperatively at 3, 6 and 12 monthly using Stein-Langfitt scale (Table 1).[14] No patient was operated below Stein – Langfitt score 2. Post operative assessment was again on Stein-Langfitt scale, with 1 score decreased at 3, 6 and 12 months was considered as improvement or positive outcome and static score was considered as negative outcome or wrong diagnosis.

Table 1: *Stein and Langfitt Scale for assessment of shunt outcome.*

Grade 0	No neurological deficit, able to work
Grade 1	Minimal deficit, able to function independently at home
Grade 2	Some supervision required at home
Grade 3	Custodial care required despite considerable independent function
Grade 4	No practical capacity for independent function

All the patients at follow-up had CT scan brain to look at the ventricle size, position of catheter and evidence of over drainage. Decrease in Evan's ratio of ≥ 0.06 was considered significant but reduction of 0.05 or less was considered insignificant.

In 24 unimproved patients (10%) shunt malfunctioning was excluded. Among these 4 (16.7%) were from LP shunt and 20 (83.3%) were from VP shunt group respectively.

RESULTS

Preoperative Clinical Findings

No significant difference was found in different age, sex and Stein – Langfitt score. The duration of symptoms was longer in patients from far flung areas, probably due to unawareness of this disease among health care providers in smaller cities.

Post-operative Outcome

A significant reduction of the Evan's ratio ≥ 0.06 was observed in 190 patients, 6 from LP shunt group and 184 from VP shunt group. No significant improvement was observed in 50 patients, 4 and 46 patients from LP and VP shunt groups respectively.

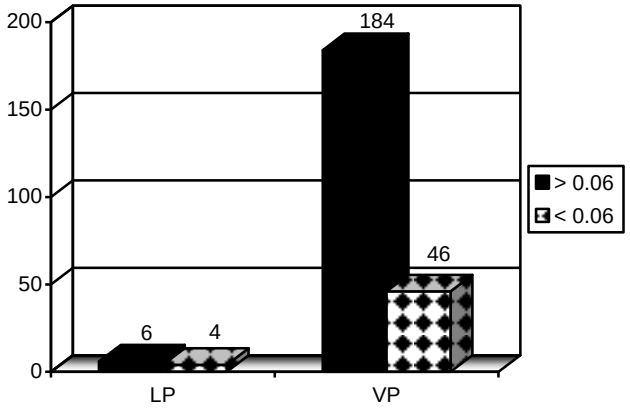

Fig. 1: *Outcome of patients in relations to decrease in Evan's ratio.*

Complications

No mortality occurred but 10 patients had infection with Staph. epidermidis in whom shunts were removed. Eight patients lost to follow up and 2 patients had shunt revision after 3 months.

DISCUSSION

This study does not involve prognostic CSF dynamic tests like R-out value and International Elastance index which are recommended for NPH patients in the International literature but still this study can be considered reliable because it is prospective study and operated purely on clinical and radiological findings.

In literature any CSF dynamic test is not definitive criteria for 100% guarantee to improvement after shunting. The consensus is that shunt responsiveness is necessary parameter for diagnosis.[13] This appears that

we still have insufficient criteria to predict who will get benefit from shunting.

As for as clinical improvement is concerned, our results demonstrate that NPH is treatable with good results when cerebral micro-angiopathy and other co-morbidities are not associated.

With relation to Evan's ratio no significant decrease was observed in non responders and nearly 50% of responders showed significant reduction in Evan's ratio. Reduction in ventricular size has no linear relation with degree of improvement but reduction never happen in the absence of improvement.[14,15]

The expected and actual outcome discrepancies may be due to:

a. The available shunting devices are unable to control pathogenesis underlying both ventricular enlargement and clinical history.

b. Irreversible changes in brain parenchyma associated with reversible changes in brain function.

CONCLUSION

Shunting procedures show good results if patients have triad in clinical history and positive radiological findings with Evan's ratio ≥ 0.30 on CT or MRI brain scan.

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