

# To Determine Outcome of Lumboperitoneal Shunt in Patients of Normal Pressure Hydrocephalus

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## ABSTRACT

The patient presenting with gait disturbance, cognitive decline, or urinary incontinence represents a common clinical dilemma for the practicing neurologist and neurosurgeon. Although these symptoms are suggestive of normal pressure hydrocephalus (NPH), they are not specific to the diagnosis and commonly occur in neurodegenerative conditions or nonspecifically in advanced age. A lumbar peritoneal (LP) shunt is a technique of cerebrospinal fluid (CSF) diversion from the lumbar thecal sac to the peritoneal cavity. It is indicated under a large number of conditions such as communicating hydrocephalus, idiopathic intracranial hypertension and normal pressure hydrocephalus.

**Objective:** The objective of the study is to determine outcome of lumboperitoneal shunt in patients of normal pressure hydrocephalus.

**Study Design:** Case series study.

**Place and Duration of Study:** This study was conducted from December 19, 2012 to June 18, 2013 in the department of neurosurgery, Bahawal Victoria Hospital Bahawalpur.

**Subject and Methods:** 96 patients of normal pressure hydrocephalus, admitted in neurosurgery ward BVH Bahawalpur were included in the study. LP shunt procedure was done under general anesthesia. 3 weeks after operation complete clinical examination, urodynamic study and CT scan brain was done to see outcome of LP shunt.

**Results:** Total 96 patients were included in our study. The mean age of patients was 67.43 years with standard deviation of 5.395 years. Out of 96 patients, 47 (48.96%) were female and 49 (51.04%) patients were male. Out of 96 patients, 81 (84.38%) patients showed improved gait and 15 (15.62%) patients showed no improvement. Out of 96 patients, 49 patients showed improvement in incontinence while 47 patients showed no improvement. Out of 96 patients, 53 patients showed improvement in memory while 43 patients showed no improvement in memory.

**Conclusion:** Lumboperitoneal shunt placement is a safe and effective shunting for normal pressure hydrocephalus, resulting in significant symptomatic improvement with a low risk of over-drainage.

**Keywords:** Lumboperitoneal shunt, normal pressure hydrocephalus, outcome.

## INTRODUCTION

The patient presenting with gait disturbance, cognitive decline, or urinary incontinence represents a common clinical dilemma for the practicing neurologist and neurosurgeon. The diagnostic uncertainty in these patients is particularly problematic, given the invasive nature of treatment for NPH.<sup>1</sup>

It was our clinical impression that many of these

patients were ultimately not thought to have NPH, often because alternate diagnoses better explain their symptoms.<sup>2</sup>

A lumbar peritoneal (LP) shunt is a technique of cerebrospinal fluid (CSF) diversion from the lumbar thecal sac to the peritoneal cavity. It is indicated under a large number of conditions such as communicating hydrocephalus, idiopathic intracranial hypertension,

normal pressure hydrocephalus, spinal and cranial CSF leaks, pseudomeningoceles, slit ventricle syndrome, growing skull fractures which are difficult to treat by conventional methods (when dural defect extends deep in the cranial base or across venous sinuses and in recurrent cases after conventional surgery), raised intracranial pressure following chronic meningitis, persistent bulging of craniotomy site after operations for intracranial tumors or head trauma, syringomyelia and failed endoscopic third ventriculostomy with a patent stoma. In spite of the large number of indications of this shunt and being reasonably good, safe, and effective, very few reports about the LP shunt exist in the literature.<sup>3</sup>

It has an advantage over the VP shunt of being completely extracranial and can be used under conditions other than hydrocephalus when the ventricles are normal sized.<sup>4</sup>

Symptoms of NPH can also resemble those of other conditions affecting the elderly. For example, the cognitive deficits of NPH can resemble those associated with early Alzheimer's, and the gait disturbances of NPH can look similar to those of Parkinson's. More publications are required to establish its usefulness in the treatment of wide variety of indications. This article is aimed to review indications, complications, results, and comparison of the LP shunt with the commonly practiced ventriculoperitoneal (VP) shunt.<sup>5</sup>

## Material and method

### Study Design:

Case series study.

### Duration

This study was conducted from December 19, 2012 to June 18, 2013.

### Setting

Neurosurgery ward, Bahawal Victoria Hospital Bahawalpur.

### Inclusion Criteria

- Age 60 – 80 years and both gender.
- Hydrocephalus diagnosed on CT scan brain by measuring Evan's ratio more than (0.3) and periventricular edema.
- Urine incontinence diagnosed by detrusor muscle over activity on urodynamic study.
- Duration of symptoms less than 6 months.

### Exclusion

- Systemic problem deferring operation (uncontrolled diabetes, uremia, hepatic failure, recent myocardial infarction).
- Hydrocephalus of other etiology like post infection.
- Gait disturbance due to other disorder of spine or joints and urine incontinence due to other disorders of urogenital disorders tract.

### Data Analysis

Data was entered and analyzed into statistical packages for social sciences (SPSS – 14). Frequency and percentages was computed for gender, improvement in dementia, gait disturbance, urinary incontinence. Mean and standard deviation was computed for quantitative variables like age and duration of symptoms.

The age, gender was stratified to see the effect of those on outcomes through chi-square test. P value less than 0.05 was taken as significant.

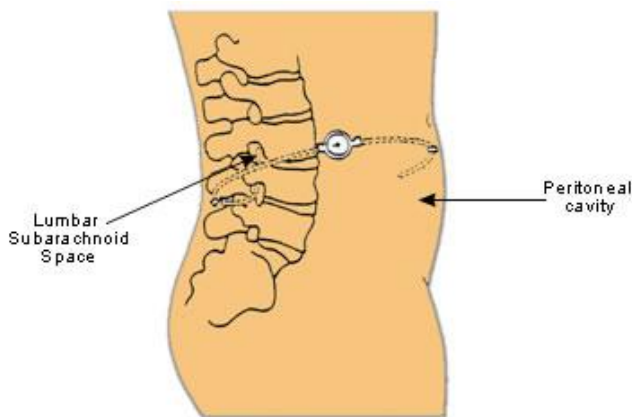
## RESULTS

Total 96 patients were included in our study. The mean age of patients was 67.43 years with standard deviation of 5.395 years. Minimum age of patients was 60 years. Maximum age of patients was 80 years, range of age of patients was 20 years, median age of patients was 67 years and mode age of patients was 62 years.

Out of 96 patients, 47 (48.96%) were female and 49 (51.04%) patients were male .45 patients were in 60 – 66 years, 38 patients were in 67 – 74 years of age group and 13 patients were in 75 – 80 years of age group. Out of 96 patients, 81 (84.38%) patients showed improved gait and 15 (15.62%) patients showed no improvement .43 male patients showed improvement in gait and 6 male patients showed no improvement in gait while 38 female patients showed improved gait and 9 female patients showed no improvement in gait with insignificant p value of 0.352 .37 patients in 60 – 66 years of age group showed improvement in gait while 8 patients showed no improvement in gait, 31 patients in 67 – 74 years of age group showed improvement in gait while 7 patients showed no improvement in gait and 13 patients in 75 – 80 years of age group showed improvement with insignificant p value 0.248.

Out of 96 patients, 49 patients showed improvement in incontinence while 47 patients showed no

improvement. 31 patients in 60 – 66 years of age group showed improvement in incontinence while 14 patients showed no improvement in incontinence, 13 patients in 67 – 74 years of age group showed improvement in incontinence while 25 patients showed no improvement in incontinence and 5 patients in 75 – 80 years of age group showed improvement in incontinence while 8 patients showed no improvement in incontinence with significant p value 0.004. 29 male patients showed improvement in incontinence and 20 male patients showed no improvement in incontinence while 20 female patients showed improvement in incontinence and 27 female patients showed no improvement in incontinence with insignificant p value of 0.103.



Out of 96 patients, 53 patients showed improvement in memory while 43 patients showed no improvement in memory. 25 male patients showed improvement in memory and 24 male patients showed no improvement in memory while 28 female patients showed improvement in memory and 19 female patients showed no improvement in memory with insignificant p value of 0.339. 34 patients in 60 – 66 years of age group showed improvement in memory while 11 patients showed no improvement in memory, 13 patients in 67 – 74 years of age group showed improvement in memory while 25 patients showed no improvement in memory and 6 patients in 75 – 80 years of age group showed improvement in memory while 7 patients showed no improvement in memory with significant p value 0.001.

## DISCUSSION

Ventriculoperitoneal shunt placement was the standard of care for idiopathic normal pressure hydrocephalus

(NPH). Studies have reported shunt complication rates up to 38%, with subdural hemorrhage rates as high as 10%. Lumboperitoneal (LP) shunts are an alternative for cerebrospinal fluid (CSF) diversion that avoids direct cerebral injury and may reduce the risk of over-drainage. Lumboperitoneal shunts have long been used in the treatment of benign intracranial hypertension, postoperative pseudomeningocele, CSF leak and communicating hydrocephalus. Although they can provide a rapid and effective resolution of the symptoms there are major disadvantages associated with their use.<sup>6</sup>

Although cerebrospinal fluid shunting brings about the complete alleviation of NPH symptoms in some patients, it is more often the case that symptoms are only partially alleviated. In addition, the benefits of shunt treatment may persist for only a short period of time, partially as a result of the overall comorbidity of NPH patients. In light of this, the question has been raised as to whether or not cerebrospinal fluid shunting is worthwhile for all patients. Answering this question requires the development of reliable measures to predict the probability and the extent of clinical improvement with a shunt versus more conservative treatments.<sup>7</sup>

In our study 84.38% patients showed improved gait, 51.04% patients showed improvement in continence, 55.21% patients showed improvement in memory and 66.67% patients showed decrease in Evan's ratio. In our series, responses to lumboperitoneal shunting were quite promising. These results were comparable to the other studies done in different parts of world.

In a study conducted by Bloch O et al<sup>8</sup> showed that all 33 (100%) patients had pre-operative gait dysfunction, 28 (85%) had incontinence, and 20 (61%) had memory deficits. Mean follow-up time was 19 months. Following shunt placement, 33/33 (100%) patients demonstrated improved gait, 13/28 (46%) had improvement in incontinence, and 11/20 (55%) had improvement in memory. Shunt failures requiring revision occurred in nine patients (27%), with an average time to failure of 11 months. Infections occurred in two patients (6%). There were no neurologic complications, including no hemorrhages.

In another study conducted by McGirt MJ et al<sup>9</sup> showed that one hundred thirty – two patients underwent 179 shunt surgeries. Forty-four (33%), 79 (60%), and 99 (75%) patients demonstrated objective improvement 3, 6, and 24 months after shunt surgery, respectively. Gait improved first in 88 (93%) patients. Dementia and urinary incontinence were twofold less

likely to improve. Radiological evidence of corpus callosum distension, gait impairment as the primary symptom, and shorter duration of NPH symptoms predicted improvement. Duration of symptoms and gait as the primary symptom were independent predictors by multivariate analysis.

In the study by Vanneste and colleagues<sup>10</sup> demonstrated an overall improvement of 58% after shunt insertion. Data from other studies have shown that favorable responses to shunt placement based on clinical criteria alone ranges from 27 to 53%.<sup>11</sup>

In another study conducted by Klassen BT et al<sup>12</sup> showed that the incidence of sustained definite improvements at 3 years after shunting was only 0.36 / 100,000 / year. Definite gait improvement was documented in 75% at 3 – 6 months after shunt placement, although it dropped to 50% at 1 year and to 33% at 3 years. Only 1 of 8 patients with cognitive impairment and 1 of 6 patients with urinary incontinence had definite improvement in these symptoms at 3 years. No patient with moderate to severe postural instability experienced sustained definite improvement in any symptom. Complications occurred in 33% of patients including one perioperative death.

A study conducted by Mori K<sup>13</sup> showed that 120 patients were identified as having idiopathic NPH and these patients underwent placement of shunts. Lumbo-peritoneal shunt with a programmable valve was used in two thirds of the patients. At the end of 3 months (early assessment), there was an 80% overall rate of clinical improvement, which dropped to 73.3% of the 105 patients who could be evaluated at the end of the 3 – year study. Of the three variables, gait disturbance was most improved, both at early and late testing periods. Shunt complications occurred in 22 (18.3%) of the patients.

In another study conducted by Pujari S et al<sup>14</sup> showed that there was an overall sustained improvement among all symptoms. Gait showed the highest maintenance of improvement over baseline (83% at 3 years and 87% at the last analyzed follow-up of 7 years), cognition showed intermediary improvement (84% and 86%, respectively), and urinary incontinence showed the least improvement (84% and 80%, respectively). Fifty – three percent of patients required shunt revisions. Indications for revision included shunt malfunction (87%), infection (10%) and change of shunt configuration (3%). Overall, 74% revisions resulted in clinical improvement. In this study the mean duration of follow-up was  $5.9 \pm 2.5$  years.

In a study conducted by Hebb AO et al<sup>15</sup> showed

that overall, 59% (range, 24 – 100%) of patients improved after shunting, and 29% (range, 10 – 100%) of patients experienced prolonged improvement. Complications occurred in 38% (range, 5 – 100%) of patients, additional surgery was required in 22% (range, 0 – 47%) of patients, and there was a 6% (range, 0 – 35%) combined rate of permanent neurological deficit and death. In this study furthermore it was found that clinical findings suggestive of shunt responsiveness were the complete triad (gait disturbance, urinary incontinence, and dementia) with early gait disturbance. Degree of hydrocephalus was not correlated with clinical improvement. Reduction of the subcortical low-blood flow area was correlated with improvement in three small studies. Clinical response to prolonged cerebrospinal fluid drainage predicted shunt outcome.

In another study conducted by Woodworth GF et al<sup>16</sup> showed that Improvement in 1, 2, or all 3 NPH symptoms was observed in 35 (69%), 28 (55%), and 11 (22%) patients, respectively, after CSF shunt implantation by 12 months after surgery. A positive response to CSF drainage was found to be an independent predictor of shunt responsiveness (relative risk, 0.30; 95% confidence interval, 0.09 – 0.98;  $P = 0.05$ ). There was no difference in Pcsf wave characteristics between the shunt – responsive and –nonresponsive groups, regardless of whether symptoms improvement was used to define response to shunting. To date, the literature available on this topic has been marked by disparate definitions of clinical improvement, varying post-operative follow-up protocols and periods, and substantial differences in postoperative management. Because specific criteria for defining clinical improvement are seldom reported, conclusions drawn about shunt outcome may be subjective. Further obfuscating an objective analysis of shunt outcome is the presence of comorbid factors. This holds particularly true for the long period of shunt treatment, although systematic studies of short-term versus long-term prognoses are few.<sup>17,18</sup>

Although there is no doubt that selected patients can make a remarkable and prolonged improvement after the placement of a shunt, others may not. For any individual patient, an assessment must be made with respect to risk – to – benefit ratio. The various factors that must be considered include the following. From a medical decision-making perspective, the probability of shunt responsiveness is a more important parameter because the patient and his or her family seek an improvement in functionality, not only a diagnosis. The patient must compare the risks of no treatment against

proceeding with the shunt procedure. It is important to consider that patients who are likely to improve only minimally may receive no practical benefit from treatment. In such cases, the risks of treatment may be too high, even though some might consider these patients “shunt responders.”<sup>19</sup>

## CONCLUSION

Lumboperitoneal shunt placement is a safe and effective shunting for normal pressure hydrocephalus, resulting in significant symptomatic improvement with a low risk of over-drainage. It should be considered as an option for the treatment of patients with normal pressure hydrocephalus who demonstrate clinical improvement following lumbar drainage.

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