

# Immediate Post-operative Outcome of Ventriculoperitoneal Shunt Surgery in NPH Patients

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## Abstract:

**Background:** Normal pressure hydrocephalus is a benign condition characterised by dementia, incontinence and gait disturbance. Ventriculoperitoneal shunt is a treatment of NPH for relieve of symptoms.

**Objective:** The objective of this study is to see the improvement of symptoms following ventriculoperitoneal shunt surgery.

**Methodology:** This is an observational study extending from July 2013 upto December 2015. Six patients of NPH were operated on with ventriculoperitoneal shunt surgery. All patients were followed upto 15 days. They were evaluated for improvement of symptoms both as reported by patients and observed by the surgeons.

**Result:** All patients were treated with ventriculoperitoneal shunt. Gait disturbance was first symptom to improve, followed by dementia and incontinence. 100% patients had improved gait and dementia but only four patients (66.66%) had improvement of incontinence.

**Conclusion:** In these patients following ventriculoperitoneal shunt surgery, the sequence of improvements was gait disturbance then dementia and incontinence was the last.

**Keywords:** iNPH, VP shunt, dementia, autonomic involvement, gait disturbance, hydrocephalus, lumbar puncture, spinal tap.

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## Introduction:

Normal Pressure Hydrocephalus (NPH) is a benign condition characterized by presence of clinical triad of dementia, incontinence and gait disturbances.

The syndrome of idiopathic NPH was first introduced by Hakim and Adams in 1965, who described a unique triad of clinical symptoms including gait disturbance, dementia, and incontinence in patients with enlarged ventricles and occurring in the absence of raised ICP. They introduced the term “normal pressure hydrocephalus” to describe this condition and reported that these symptoms dramatically improved on shunt placement<sup>1</sup>. Suggested mechanisms include reduction of blood flow and metabolism, stretching of the periventricular white matter or increased “transmantle pressure”<sup>2</sup>. The incidence of iNPH is

between 2 and 6% among people affected by any dementia condition<sup>3</sup>.

The associated symptoms have been ascribed to ischemia, asymptomatic fibrosing meningitis, or insufficiency of the cortical extracellular space for CSF transit to the subarachnoid space. Others suggest that ventricular dilation may be unrelated to CSF malabsorption, and instead is secondary to periventricular microvascular disease that results in encephalomalacia and dilatation of the cerebral ventricles, an hypothesis supported by the observed association between iNPH and hypertension, ischemic heart disease, diabetes, and reduced high-density lipoprotein cholesterol<sup>4</sup>.

“Normal pressure” in the syndrome’s name refers to the lack of marked increase in intracranial pressure (ICP) in the majority of cases. Intracranial pressure averages 145 mm in iNPH<sup>5</sup>.

The International and Japanese guidelines recommend tests of CSF drainage (lumbar puncture[LP] or CSF drainage via spinal catheter; however, the International guidelines also recommend infusion testing<sup>6</sup>. iNPH can be difficult to diagnose accurately. Misdiagnosis and delayed recognition are

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two important causes of poor treatment outcome in INPH<sup>7</sup>. When a tap test is negative, there are three options: a repeat tap test; a drainage test; and reconsider the diagnosis, or observe further<sup>8</sup>. The most common shunt configurations used for INPH are ventriculoperitoneal (VP) and ventriculoatrial (VA) shunts<sup>9</sup>. Overall improvement occurred in 36%, substantial improvement in 21%. In the subgroup of idiopathic NPH (N = 127), marked improvement was only 15%<sup>10</sup>. It has been suggested that the one-year post-shunt period can be considered a determinant of long term results of the treatment<sup>11</sup>. Pujari et al has stated that VP shunt may need multiple revisions<sup>12</sup>.

### Materials and Method:

This is an observational study extending from July 2013 upto December 2015. Six patients were included in this study. They had lumbar puncture for three consecutive days following diagnosis of NPH. If there was positive response then they treated with VP shunt surgery. They were followed upto a period of 15 days post operatively. During this time they were assessed every day for signs of improvement of incontinence, gait disturbances and memory loss. This included both subjective feeling of the patient as well as objective assessment. All stitches were removed on tenth post-operative day. Gait disturbance was assessed by asking the patient to walk and their gait was observed. Dementia was assessed by mini-mental state examination (MMSE). Incontinence was assessed with asking the patient to void normally or, if catheterized, they were clamped regularly and see if they can control micturition.

Patients who had other diseases (e.g. Parkinson's disease, Alzheimer's disease) were excluded from this study.

### Results:

A total of six patients ( $n=6$ ) were treated with ventriculoperitoneal shunt. If these patients, five patients were Male and one patient was female. They aged from 55 years up to 65 years. The patients were evaluated by clinical symptoms, signs and imaging.

Their improvements were followed everyday upto 15<sup>th</sup> post operative day. Stitches were removed and on 10<sup>th</sup> post operative day and discharged on the 15<sup>th</sup> day. Their improvement was recorded as follows:

Four patients showed improvement of gait on day 1. The proportion was 66.66%. One patient (16.67%) had improvement of gait on day 3, the other (16.67%) had improved gait on day 7.

Two patients (33.33%) had improvement of dementia on day 1. Four patients (66.66%) had improved dementia on day 3.

Incontinence improved on day 5 in three patients (50%), one patient (16.67%) improved on the 7<sup>th</sup> POD and two patients (33.33%) had not improved upto day 10. At the end of the 15<sup>th</sup> POD, gait and dementia improved in all patients and two patients remained incontinent.

So, in this study of six patients with NPH the symptom improved first was gait disturbance, then dementia and incontinence was the last.

**Table-I**  
*Follow up of patients*

	Day 1	Day3	Day 5	Day 7	Day 10	Day 15
Pt 1	Gait	Dementia	Incontinence	-	-	-
Pt. 2	Gait	Dementia	Incontinence	-	-	-
Pt. 3	Gait	Dementia	Incontinence	-	-	-
Pt. 4	Dementia	-	-	Gait	Incontinence remained	Incontinence remained
Pt. 5	Dementia	Gait	-	-	Incontinence remained	Incontinence remained
Pt. 6	Gait	Dementia	-	Incontinence	-	-

**Table-II**  
*Percentage of patients improved*

	1st POD	3 <sup>rd</sup> POD	5 <sup>th</sup> POD	7 <sup>th</sup> PO	10 <sup>th</sup> POD	15 <sup>th</sup> POD
Gait improved	Four patients (66.66%)	One patient (16.66%)	-	One patient (16.66%)	All patients (100%)	All patients (100%)
Dementia Improved	Two patients (33.33%)	Four patients (66.66%)	-	-	All patients (100%)	All patients (100%)
Incontinence improved	No patients	No patients	3 patients (50%)	One patient (16.66%)	Four patients (66.66%)	Four patients (66.66%)

### Discussion:

Gait disturbance is the most common symptom to improve (more than 80% to 90% of patients), followed by dementia and urinary disturbance<sup>13</sup>. According to Ishikawa 62 patients were given shunts for normal-pressure hydrocephalus of idiopathic type, 46.8% showed some improvement and 27.4% enjoyed virtually complete recovery<sup>12</sup>. Greenberg stated that the most likely symptom to improve with shunting is incontinence then gait disturbances and lastly dementia<sup>14</sup>. Black concluded that the best clinical predictor of good response was the complete triad of memory difficulty, gait disorder, and urine incontinence. 61.2% of patients with this combination of symptoms improved. Gait disturbance alone was also accompanied by improvement in two of three patients was also accompanied by improvement in two of three patients<sup>15</sup>. LPS is the treatment of choice because of its minimal invasiveness and avoidance of brain injury in elderly patients<sup>16</sup>. Aygok has also reported that gait and dementia improved and incontinence was the last to improve<sup>17</sup>. Marmarou stated that eleven of 17 patients had received shunts. Of these 11, seven experienced improvement in gait after shunt placement<sup>18</sup>. Our study also showed the improvement of gait comes first then there is improvement of dementia and lastly incontinence.

### Conclusions:

Normal pressure hydrocephalus is a condition which is debilitating to the patient. Ventriculoperitoneal shunt surgery is a treatment of choice. The outcome is variable. In this study most common improvement was gait disturbance followed by dementia and incontinence.

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