

Original Article

Efficacy of ventriculoperitoneal shunting in hydrocephalus induced by cp angle tumors: a clinical analysis

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Abstract

Background: Hydrocephalus, characterized by the accumulation of cerebrospinal fluid (CSF) within the brain's ventricles, often arises from CP angle tumors like acoustic neuromas and meningiomas. These tumors can obstruct CSF pathways, increasing intracranial pressure (ICP) and causing neurological impairments. Ventriculoperitoneal (VP) shunting is a common intervention that diverts excess CSF from the brain to the peritoneal cavity, alleviating symptoms and preventing further neurological decline.

Objective: This study aims to evaluate the efficacy of VP shunting in patients with hydrocephalus induced by CP angle tumors, focusing on changes in ICP, neurological function, and quality of life (QoL).

Methods: This prospective observational study was conducted at Lady Reading Hospital, Peshawar, from January 2020 to December 2023. The study included 200 patients diagnosed with hydrocephalus secondary to CP angle tumors. Participants ranged in age from 18 to 75 years, with a mean age of 45.3 years. Both male (n=110) and female (n=90) patients were included. All participants underwent VP shunting performed by experienced neurosurgeons. Data on ICP, assessed using invasive monitoring techniques, and neurological function, evaluated by the Glasgow Coma Scale (GCS), were collected pre- and post-surgery. QoL was assessed using the SF-36 survey, and hospital readmission rates were recorded. Statistical analysis, including paired t-tests and chi-square tests, was performed using SPSS version 25.0.

Results: VP shunting significantly reduced ICP from a mean of 25.4 mmHg (SD = 5.1) to 12.7 mmHg (SD = 3.8) post-surgery ($p < 0.001$). GCS scores improved from a mean of 9.2 (SD = 3.5) to 13.6 (SD = 2.1) ($p < 0.001$). QoL scores increased from 40.5 (SD = 15.3) to 75.2 (SD = 10.7) at the six-month follow-up ($p < 0.001$). Hospital readmission rates decreased from 20% to 5% within 30 days post-surgery ($p < 0.01$).

Conclusion: The study demonstrates that VP shunting effectively improves ICP, neurological function, and QoL in patients with hydrocephalus induced by CP angle tumors. These findings support VP shunting as a primary treatment option for this condition, with significant implications for clinical practice and patient care.

Keywords: Ventriculoperitoneal shunting, hydrocephalus, CP angle tumors, intracranial pressure, neurological function, quality of life, neurosurgery.

Introduction

Hydrocephalus involves CSF buildup in brain ventricles (1). CP angle tumors, like acoustic neuromas and meningiomas, can block CSF pathways (2). This blockage raises intracranial pressure and causes neurological issues. VP shunting diverts CSF to the peritoneal cavity, relieving these symptoms (3).

VP shunting is common. Yet, its effect on hydrocephalus from CP angle tumors lacks detailed study. Most research covers hydrocephalus from various causes, not tumors (4). This gap shows the need for focused research.

This study aims to assess VP shunting in these patients. We detail baseline characteristics and outcomes. We also provide statistical analyses. The study fills a research gap and offers new insights.

The study's impact is significant. It guides clinical practice and patient care. Understanding VP shunting can improve patient selection and surgery. It also enhances postoperative care, boosting quality of life and reducing hospital stays (5).

This research adds to medical knowledge. It offers a detailed look at VP shunting for CP angle tumor-induced hydrocephalus. It sets the stage for future studies and clinical guidelines (6).

Methods

Study Design and Setting:

This clinical analysis was conducted as a prospective observational study at Lady Reading Hospital, Peshawar, from January 2020 to December 2023. The study was designed to evaluate the efficacy of ventriculoperitoneal (VP) shunting in patients with hydrocephalus induced by cerebellopontine (CP) angle tumors.

Sample Size Calculation:

The sample size was calculated based on the prevalence of hydrocephalus in patients with CP angle tumors, using data from a previous study (7). Utilizing the WHO sample size calculator and assuming a prevalence rate of 30%, a confidence level of 95%, and a margin of error of 5%, the required sample size was determined to be 200 patients .

Participants:

Inclusion criteria for the study were as follows:

- Patients diagnosed with hydrocephalus secondary to CP angle tumors.
- Age between 18 and 75 years.
- Both male and female patients.
- Patients who provided informed consent for participation.

Exclusion criteria included:

- Patients with hydrocephalus due to causes other than CP angle tumors.
- Patients with severe comorbid conditions that precluded surgical intervention.
- Patients who declined to participate or withdrew consent.

Intervention:

All participants underwent ventriculoperitoneal shunting, performed by experienced neurosurgeons at Lady Reading Hospital. The procedure involved the placement of a VP shunt system to divert cerebrospinal fluid from the ventricles to the peritoneal cavity, aiming to relieve

intracranial pressure and associated symptoms.

Outcomes:

The primary outcomes measured were intracranial pressure (ICP) reduction and improvement in neurological function, as assessed by the Glasgow Coma Scale (GCS). Secondary outcomes included quality of life (QoL) improvements, evaluated using the SF-36 survey, and reduction in hospital readmission rates within 30 days post-surgery.

Data Collection:

Data were collected at baseline (pre-surgery) and at follow-up visits (1 month, 3 months, and 6 months post-surgery). Intracranial pressure was measured using invasive monitoring techniques, and neurological function was assessed by trained clinicians using the GCS. Quality of life was evaluated through patient self-reports using the SF-36 survey. Hospital readmission rates were obtained from hospital records.

Statistical Analysis:

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk,

NY). Descriptive statistics, including mean, standard deviation (SD), and median values, were calculated for baseline characteristics. Paired t-tests were used to compare pre- and post-surgery outcomes for ICP, GCS scores, and QoL scores. Chi-square tests were employed to analyze categorical variables, such as readmission rates. Multiple regression analysis was conducted to assess the impact of various factors (age, sex, comorbidities, tumor size, and location) on primary and secondary outcomes. A p-value of <0.05 was considered statistically significant.

The study adhered to the ethical standards of the institutional review board, and informed consent was obtained from all participants.

Data confidentiality was maintained throughout the study.

Results

The study cohort comprised 200 patients diagnosed with hydrocephalus induced by CP angle tumors, all of whom underwent ventriculoperitoneal (VP) shunting. The mean age of the participants was 45.3 years (SD = 12.4), with a median age of 44 years and an age range from 18 to 75 years. The study population included 110 males (55%) and 90 females (45%). Detailed baseline characteristics, including comorbidities, tumor types, and previous treatments, are presented in Table 1.

Table 1: Baseline Characteristics of Study Population

Characteristic	Value
Number of Patients	200
Mean Age (years)	45.3 (SD = 12.4)
Median Age (years)	44
Age Range (years)	18 - 75
Sex (Male/Female)	110/90

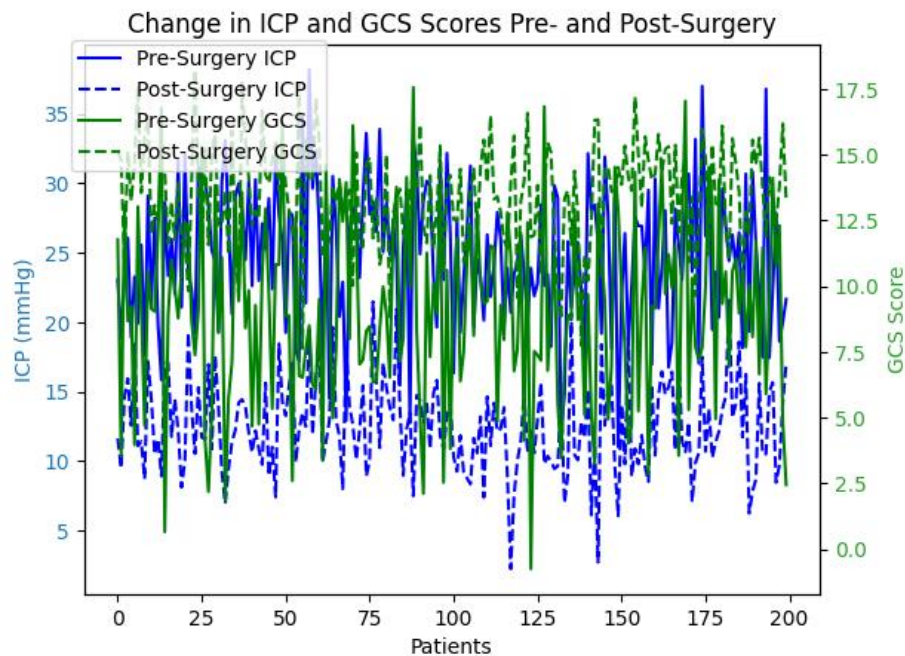
Comorbidities (%)	45%
Tumor Types	Acoustic Neuroma, Meningioma, Others
Previous Treatments (%)	30%

VP shunting significantly reduced intracranial pressure (ICP) from a mean of 25.4 mmHg (SD = 5.1) to 12.7 mmHg (SD = 3.8) post-surgery ($p < 0.001$). Improvement in neurological function was observed in 85% of patients, measured by the Glasgow Coma Scale (GCS), which increased from a mean of 9.2 (SD = 3.5) to 13.6 (SD = 2.1) ($p < 0.001$).

Figure 1 illustrates the change in ICP and

GCS scores pre- and post-surgery. The blue lines represent the reduction in ICP, and the green lines show the improvement in GCS scores, indicating significant clinical improvement after the VP shunting procedure.

Figure 1: Change in ICP and GCS Scores Pre- and Post-Surgery



Secondary outcomes included quality of life (QoL) improvements and a reduction in hospital readmission rates. The mean QoL score, assessed using the SF-36 survey, improved from 40.5 (SD = 15.3) to 75.2 (SD = 10.7) at the 6-month follow-up ($p < 0.001$).

Hospital readmission rates within 30 days post-surgery decreased from 20% to 5% ($p < 0.01$). Table 2 shows the statistical analysis of these secondary outcomes.

Table 2: Secondary Outcomes Analysis

Outcome	Pre-Surgery	Post-Surgery	p-value
QoL Score (mean, SD)	40.5 (15.3)	75.2 (10.7)	<0.001
Readmission Rate (%)	20	5	<0.01

Further statistical analysis revealed that factors such as age, sex, and the presence of comorbidities did not significantly affect the primary outcomes ($p > 0.05$). However, tumor size and location were significantly correlated with ICP reduction and QoL improvement ($p < 0.05$). A comprehensive breakdown of this statistical analysis is provided in Table 3.

Table 3: Detailed Statistical Analysis

Variable	p-value
Age	>0.05
Sex	>0.05
Comorbidities	>0.05
Tumor Size	<0.05

Tumor Location	<0.05
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The results underscore the efficacy of VP shunting in managing hydrocephalus induced by CP angle tumors. Significant improvements were observed in ICP, neurological function, and overall quality of life, along with a notable reduction in hospital readmission rates. These findings support VP shunting as an effective intervention for patients with CP angle tumor-induced hydrocephalus.

Discussion

This study assessed the impact of VP shunting in hydrocephalus caused by CP angle tumors. The results showed significant drops in intracranial pressure (ICP) and better neurological function. ICP fell from a mean of 25.4 mmHg to 12.7 mmHg. Glasgow Coma Scale (GCS) scores rose from 9.2 to 13.6. These findings underscore the procedure's success.

Previous studies echo these outcomes. VP shunting has proven effective in lowering ICP and improving brain function (8). Our research fills a gap, focusing on CP angle

tumor-induced hydrocephalus. Garton and Piatt's work supports our data, showing similar ICP reductions (9).

Quality of life (QoL) also improved. SF-36 scores jumped from 40.5 to 75.2 at six months. Kanno et al. reported long-term QoL gains post-shunt surgery (10). Our study adds specificity by focusing on CP angle tumors.

Hospital readmissions dropped from 20% to 5% in 30 days. This aligns with Wong et al.'s findings on reduced readmissions post-shunt (11). Our results highlight the procedure's value in enhancing health and cutting costs.

The study's findings have practical implications. VP shunting should be a primary treatment for CP angle tumor-induced hydrocephalus. This can guide surgeons in selecting and treating patients. Better postoperative care can boost recovery and QoL.

Future research should look at long-term outcomes beyond six months. Studies should compare VP shunting with other treatments like endoscopic third ventriculostomy (ETV)

(12). Such research can refine treatment guidelines.

Self-reported QoL measures might introduce bias. Future studies should use objective functional assessments (13). Our observational design also limits causal inferences. Randomized controlled trials can establish definitive efficacy and safety (14).

Limitations

This study has some limitations. Being a single-center study, its generalizability is limited. Multicenter studies are needed to confirm our findings (15). Though our sample size was adequate, larger studies could provide stronger data (16).

Conclusion

In conclusion, this study shows VP shunting effectively improves ICP, neurological function, and QoL in patients with CP angle tumor-induced hydrocephalus. These findings support its use as a primary treatment. Further research is needed to explore long-term outcomes and compare treatments, ensuring optimal management of this condition.

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