Original Article

Quality of Life Among Children Who Had Undergone Ventriculoperitoneal Shunt Surgery

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Background: Ventriculoperitoneal (VP) shunting is the most common neurosurgical treatment for hydrocephalus. In spite of significant developments in the technology and design of shunt systems, shunt surgery is still associated with morbidity. Aim: To identify the problems faced by children on VP shunt and assess their quality of life (QOL). Setting and Design: A cross-sectional exploratory study. Materials and Methods: A total of 31 children on VP shunt were selected through consecutive sampling technique, and hydrocephalus outcome questionnaire was used to collect the data, with the converted metric score ranging from 0 to 1. Hydrocephalus due to stroke, hemorrhage, and malignant tumors was excluded. Results: The mean age of patients was 11.51 ± 4.26 years. Headache and generalized pain were the common problems experienced (42%). The mean score of QOL was 0.67 ± 0.21. Among the three domains, cognitive domain was the most affected. Among the clinicoradiological factors, multiple surgeries (P = 0.02) had the most significant impact on QOL. Conclusion: Children who underwent VP shunt face various health-related problems in different domains and low QOL. Although cognitive domain was the most affected, multiple surgeries had the most significant impact on QOL. Appropriately focused interventions and holistic management are essential to improve the QOL of children undergoing VP shunt.

Keywords: Children, domains, hydrocephalus, QOL, ventriculoperitoneal shunt

INTRODUCTION

In spite of significant developments in the technology and design of ventriculoperitoneal (VP) shunt systems, shunt failure remains a significant problem in neurological surgery.[1,2] Malfunctioning of VP shunt and its complications have increased the morbidity.[3] Patients on VP shunt have reported to live with problems such as headache, epilepsy, cognitive impairment, and urinary incontinence.[4] This affects their activities of daily living and quality of life (QOL). Also, there is paucity of studies on QOL of children who had undergone VP shunt and burden among their caregivers. Hence, this study was undertaken to assess the problems experienced by children on VP shunt, their QOL, and factors influencing their QOL.

MATERIALS AND METHODS

Using consecutive sampling technique, 31 children on VP shunt between the age of 4 and 18 years and who were accompanied by the caregivers were enrolled. Patients with hydrocephalus (HCP) due to stroke, hemorrhage, and malignant tumor were excluded. Permission was obtained from the Institute Ethics Committee, Postgraduate Institute of Medical Education and Research, Chandigarh, India, and assent was taken from the subjects. Data were collected from caregivers of the children using standardized tool, i.e., HCP outcome questionnaire (HOQ). It is the first and only reliable and valid outcome measure designed specifically for HCP with Cronbach’s alpha 0.94. It is a 53-item questionnaire, divided into three domains namely physical with 15 items, social–emotional (25 items), and cognitive domain (13 items), which have

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to be completed by the caregivers of patients who had undergone VP shunt. HOQ is measured in five point Likert scale where four means not at all true and zero means very true. From total items, item no. 19, 20, 21, and 42 were scored in the reversed order as these were the positive aspects of health where zero means not at all true and four means very true. Maximum possible score of HOQ was 212 and minimum was zero. Domain-wise score was calculated by dividing the obtained score with the maximum score of each domain. To find the QOL of the children, obtained score was divided by the maximum score of the children. Analysis of data was performed in accordance with the objectives laid down for the study using descriptive and inferential statistics in SPSS software version 20 (SPSS, Chicago, IL) using independent t-test, analysis of variance (ANOVA) and Pearson correlation.[6]

**RESULTS**

As shown in Table 1, the mean age of the children was 11.51 ± 4.26 years with a range of 4–18 years. Three-fourth of the children were males (74.2%). More than three-fourth of the children belonged to nuclear family (80.6%). Majority of the children were diagnosed with idiopathic HCP (29%). More than half of the children underwent surgery for multiple times (54.8%). Right VP shunt was placed in three-fourth of the children (71%). Postsurgery duration for majority of the children was less than 1 year (67.7%).

As shown in Table 2, headache and generalized pain were the most common problem and each was experienced by 42% of children on VP shunt. They were followed by fatigue in all four limbs (32.25%), blurred/decreased vision (16.12%), diplopia, fever, and impaired speech (12.90%). Very few have experienced seizure, difficulty in walking, vision loss, infection at shunt site, increased head circumference, and gait ataxia (3.22%).

**QOL OF CHILDREN ON VP SHUNT**

The mean summated and converted score (to equalize the score of all domains) of QOL based on HOQ of children who had undergone VP shunt is shown in Table 3. The QOL score based on HOQ was 0.67 ± 0.21 out of one, which shows that QOL was diminished in children on VP shunt. The QOL was highest in physical domain followed by social–emotional domain and cognitive domain.

The association of selected variables with QOL of children on VP shunt is shown in Table 4. Low QOL

### Table 1: Socio-demographic and clinical profile of children on VP shunt

| Socio-demographic and clinical variables of the children | f (%) |
|--------------------------------------------------------|-------|
| Age (years) Mean ± SD | 11.51 ± 4.26 |
| Range | 4–18 |
| 4–6 | 5 (16.1) |
| 6–12 | 11 (35.5) |
| 13–18 | 15 (48.4) |
| Gender | Male |
| Male | 23 (74.2) |
| Female | 08 (25.8) |
| Educational status | Primary and less |
| Primary and less | 19 (61.3) |
| Secondary | 12 (38.7) |
| Economic status (Rs per month) | Less than 2500 |
| Less than 2500 | 24 (77.4) |
| 2500–5000 | 04 (12.9) |
| More than 5000 | 03 (9.7) |
| Type of family | Nuclear |
| Nuclear | 25 (80.6) |
| Joint | 06 (19.4) |
| Diagnosis | Idiopathic HCP |
| Idiopathic HCP | 09 (29) |
| Infective HCP | 08 (25.8) |
| Low-grade tumor | 07 (22.6) |
| ACM/syrinx | 03 (9.7) |
| Traumatic HCP | 01 (3.2) |
| Congenital HCP | 03 (9.7) |
| Type of surgery | Right VP shunt |
| Right VP shunt | 22 (71) |
| Left VP shunt | 06 (19.4) |
| Bilateral VP shunt | 02 (6.5) |
| ETV and VP shunt | 01 (3.2) |
| Number of surgeries | First surgery |
| First surgery | 14 (45.2) |
| Multiple surgeries | 17 (54.8) |
| Duration since surgery | Less than 1 year |
| Less than 1 year | 21 (67.7) |
| 1–6 years | 08 (25.8) |
| 6–12 years | 02 (6.5) |
| History of hospitalization postsurgery | Yes |
| Yes | 13 (41.9) |

ACM = Arnold–Chiari malformation

### Table 2: Problems experienced by children after VP shunt

| Chief complaints after VP shunt | f (%) |
|---------------------------------|-------|
| Headache | 13 (41.93) |
| Generalized pain other than headache | 13 (41.93) |
| Fatigue all four limbs | 10 (32.25) |
| Blurred/decreased vision | 05 (16.12) |
| Fever | 04 (12.90) |
| Impaired speech | 04 (12.90) |
| Diplopia | 04 (12.90) |
| Vomiting | 03 (09.67) |
| Dizziness | 02 (06.45) |
| Squinting | 02 (06.45) |
| Seizure | 01 (03.22) |
| Difficulty in walking | 01 (03.22) |
| Vision loss | 01 (03.22) |
| Infection at shunt site | 01 (03.22) |
| Increased head circumference | 01 (03.22) |
| Gait ataxia | 01 (03.22) |
was reported by the children who had undergone multiple surgeries and have received care for more than 8 hours per day.

**Discussion**

VP shunt has greatly improved the survival and QOL of children yet, but malfunctioning of shunt is a common problem experienced by them along with other complications. Considering the fact that QOL is the global well-being of the individual and HCP being a long-term illness, it is necessary for the health-care workers to have awareness about the QOL and various day-to-day problems of patients even after undergoing VP shunt. In this study, 31 children who underwent VP shunt for HCP were explored to assess their common problems perceived and QOL. The mean age of the children was 11.51 ± 4.26 years, and similar to other studies, most of them were males.
The most common cases of HCP in children include congenital anomalies, intracranial tumor, and trauma.\[10\] In this study, the main reasons for placing VP shunt were idiopathic HCP, infective HCP, and intracranial tumors.

The common problems experienced by 30%-42% children on VP shunt in our study were headache, generalized pain, and fatigue. The prevalence of post-VP shunt headache is well reported and varies from 54% to 80%.\[9\] Though these symptoms are ignored by the parents and other caregivers, there are evidences to prove their effect on impaired functional status and disability.\[11\] Other problems experienced by 13%-16% of the children included blurred vision, speech difficulty, diplopia, and fever. Previous reports of early shunt-related symptoms included fever in 91.4% and seizures in 17%-20% of the patients.\[12\] But in our study, fever was reported by only 13% of the patients and seizures by only 3% of the patients, as approximately 30% of the patients were of more than 1-year postshunt duration. The symptoms present in the patients after VP shunt could be due to existing underlying pathology, shunt malfunction, infection, or most of the time remains unknown. The intensity, duration, and frequency of these symptoms may also affect the milestones and academic achievement of the children. Headache associated with shunt results in poor QOL and its management increases the cost of treatment.\[13\]

HOQ used in this study is a simple, valid, and reliable measure of QOL in children with HCP. Mean score of QOL of children was 0.67 ± 0.21, which was in line with previous reports.\[13,14\] Kulkarni et al.\[15\] reported a mean HOQ score of 0.68 in children with HCP in which majority of them had undergone VP shunt. HOQ score reported in our study was lower than 0.81 in patients who underwent endoscopic third ventriculostomy (ETV) as first treatment and 0.85 in patients who underwent shunt as first treatment.\[16,17\] Though VP shunt improves the health status of the patients postoperatively, the QOL remains affected due to various problems faced by the patients as shown in our study and related other literature.\[18\] There is also impairment in physical, socio-emotional, and cognitive status of the patients as the QOL of patients in these domains is affected. Similar to previous reports,\[17\] cognitive domain was most affected in children enrolled in our study that was followed by socio-emotional domain and physical domain. As per the previous evidences, cognitive domain was affected in 12%-50% of the children who underwent VP shunt.\[19\] Cognitive deficits increase the difficulties at school and impair the academic performance of the children.\[13\] Cognitive and socio-emotional aspects of the children also need to be addressed and managed like physical manifestations, during postsurgical management of these patients. Considerable attention must be given to improve the cognitive and socio-emotional aspects as that can improve the academic performance of the children, social functioning, and their mental health. Compared to physical deficit, neuropsychological symptoms\[20\] and cognitive deficits\[21\] affect the burden and QOL of caregivers of patients with intracranial tumors and other neurological illnesses. Although the physical symptoms are addressed during their follow-up visits, these aspects remain overlooked due to inadequate reporting by the caregivers and lack of monitoring by health professionals. But Kutscher et al.\[22\] reported that the health-related QOL of adult survivors of congenital HCP with regard to mental health and social functioning was similar to healthy controls, but physical impairment was the major factor that led to compromised QOL. Hence, it is imperative to consider cognitive, socio-emotional, and physical domain of patients who had undergone VP shunt. Impairment in cognitive dysfunction and behavioral changes are reported by patients with different neurological and neurosurgical diseases and are affected more than other domains.\[23,24\] These findings emphasize the need of team approach toward the holistic care of the patients who had undergone shunt.

Similar to other disorders,\[25-27\] QOL was comparatively worse among those in poor neurological status needing longer duration of care and those underwent multiple surgeries. Multiple surgeries were either due to shunt malfunctioning or complications. Kulkarni and Shams\[28\] have reported poor QOL in children who had shunt-related complications and prolonged hospital stay. Similarly, the underlying cause of HCP may also contribute to poor QOL and should not be ignored.\[28,29\] Hence, appropriate measures must be taken to improve the QOL of children undergoing treatment of HCP.

This study has excluded the children who underwent shunt for HCP due to stroke, hemorrhage, and malignant tumor so as to eliminate the influence of these comorbidities on QOL. Our findings suggest the monitoring of QOL of children who had undergone VP shunt during their follow-up in terms of cognitive, socio-emotional, and physical aspects. With advancements in endoscopic technology\[30\] and treatments for hydrocephalus, future studies need to compare QOL across treatment strategies. Children and their caregivers must be trained and instructed to identify and report various problems in different
domains to the health-care team so that appropriate interventions can be initiated. A protocol can be prepared regarding care and rehabilitation for children who had undergone VP shunt, and health-care team can be made more sensitive toward the assessment of the domains of QOL and providing care accordingly. Special attention must be emphasized to these children by the parents and school authorities to reduce the difficulties at school by helping them to overcome their cognitive deficits. Findings of this study also suggest the importance of long-term follow-up of children in terms of their academic performance, milestones, QOL etc.

**Conclusion**

Patients who had undergone VP shunt for HCP face various health-related problems in different domains and low QOL, especially in children who underwent multiple surgeries. Hence, appropriate monitoring as well as holistic management by health-care team is essential to improve the QOL of children undergoing VP shunt.

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**Conflicts of interest**

There are no conflicts of interest.

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