A comparative study of Outcome in Ventriculoperitoneal Shunt and Endoscopic Third Ventriculostomy in Cases of Tubercular Meningitis with Hydrocephalus In Pediatric Patients

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Abstract

Introduction: Tuberculous meningitis (TBM) is becoming a rare illness in industrialized nations, but it is still widespread in underdeveloped nations. Ventriculoperitoneal shunt surgery is the GOLD Standard and is time tested procedure. Shunts, however, are associated with multiple problems.

Material and Method: This is an observational study that compares the outcome of Endoscopic Third Ventriculostomy (ETV) with Ventriculoperitoneal shunt in patients of TBM with hydrocephalus at a 6-month follow-up. This study was done at a single tertiary care center. Data was collected from the patient records as per selection criteria. 100 consecutive cases in each ETV and Shunt group fulfilling selection criteria were included in the study. The two procedures were compared for their clinical outcome based on modified Vellore grade at 6 months of follow-up.

Discussion: Evaluation of outcome at 6 months revealed an overall success rate of 68.5%. The success rate was higher for shunt (71%) as compared to ETV (66 %). However, the difference between the two groups was not significant statistically. For children with advanced TBM and elevated ICP, shunt surgery may not be necessary. While some authors have considered the potential of delaying surgery for these kids, others have argued that even a single positive outcome warrants shunt placement for every kid with tuberculous hydrocephalus.

Conclusion: In pediatric cases of TBM with Hydrocephalus ETV should be considered as a first-line treatment in lower grades of TBM. Though for definitive comparison, a long-term randomized study is needed, and the study to look into factors responsible for the failure of ETV in TBM cases needs to be identified to formulate an ETV success score.

Key words: Tubercular meningitis, hydrocephalus, VP shunt, ETV.

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Introduction

Tuberculous meningitis (TBM) is becoming a rare illness in industrialized nations, but it is still widespread in underdeveloped nations. The failure to alter the course of this illness has sparked a resurgence in research on any potential therapeutic side effects, like increased intracranial pressure (ICP) brought on by hydrocephalus. Since Whytt's the first description of TBM in 1768, postmortem and neuroradiological studies have shown that hydrocephalus occurs in 80–90% of children with stages II and III TBM.[1] Central Nervous System tuberculosis is the most critical form of tuberculosis in children. one of the commonest complications in such cases is hydrocephalus. The type of hydrocephalus in cases of TBM could be communicating type or obstructive type, the former being more common.

The medical management of TBM hydrocephalus consists of ATT (standard four-drug antitubercular therapy consisting of rifampicin, ethambutol, isoniazid, and pyrazinamide) as per weight, along with steroids (dexamethasone given if CT showed thick basal exudates and there was evidence of infarcts).[2]

Ventriculoperitoneal shunt surgery is the GOLD Standard in such cases and is time tested procedure. Shunts, however, are associated with multiple problems like infection, misplacement, disconnection, extrusion and shunt blockage, abdominal pseudocyst formation, intraventricular bleed, meningitis, multiple revisions, and skin erosions.[3]

As an alternative to VP shunt surgery, Endoscopic third ventriculostomy (ETV) has been established. Several studies have reported variable degrees of success with ETV in TBM with Hydrocephalus cases. ETV eliminates the dependence on mechanical shunt devices, eliminating the risk of associated complications, and is relatively safe. Although the challenge is thickened floor of the 3rd ventricle with thick exudates in the pre-pontine space in TBM cases. Some of the complications in patients who have undergone ETV include CSF leak, Intra ventricular bleed, blockage of stoma, the bulge at the ETV site, and meningitis.[4] We tend to compare the clinical outcome of ETV with VP shunt in TBM with hydrocephalus cases in the pediatric age group. [5-11]

The most commonly used system for clinical grading is the Vellore grading of TBMH (Table 1), proposed by Palur et al. [12] Alongside this, Table 2 briefly discusses the modified Vellore grading of patients with TBMH.

Methods and Materials

This study was conducted at the Department of Neurosurgery, King George Medical University, Lucknow, Uttar Pradesh, approved by the intuitional ethics committee, No: 1056/Ethics/R.Cell-18 Dated 16-07-2018 and is a single-center prospective comprehensive cohort study. 100 consecutive patients in each group that is shunt or ETV and who met the following criteria were included in the study.

Inclusion Criterion

The study included all patients diagnosed with TBM between the ages of 1 and 18 who also had radiological evidence of hydrocephalus and had had at least 6 months of follow-up.

Exclusion Criterion

All the Co-existing uncontrolled diabetes, uremia, and hepatic failure patients were excluded from the study. Any patient who has already undergone a CSF diversion procedure (shunt or ETV) or with TBM without radiological evidence of HCP, as well as if the patient denied consent for the shunt and age is more than 18 years such cases were excluded from the study.

Study design

Patients were allocated to shunt or ETV using a comprehensive cohort design. All essential per-operative and postoperative clinical and laboratory data were collected. the ventriculoperitoneal shunt intervention, medium pressure Chabbra's SHUNTS used in all VP shunt cases. All shunts were placed through the right keens point. In patients who underwent ETV, a Lotta Hopkins endoscope of 6° with a 6.1mm outer diameter was used. ETV was performed using a standard procedure or water jet dissection. All patients received standard antitubercular therapy (irrespective of the type of CSF diversion) based on WHO guidelines. Anticonvulsants were given in all cases until 6 months of follow-up. All the patients were evaluated at 1, 3, and 6 months in follow-up by thorough clinical and radiological assessment. They were assessed for the following Clinical outcome recorded as success or failure on the basis of clinical and radiological assessment at admission, discharge, and follow-up. The outcome was labeled as follows:

Successful—a patient showing improvement in his/her clinical and/or radiological profile (head CT scan)

Failure—a patient not improving or deteriorating and requiring another surgical intervention (shunt in case of ETV group or shunt revision/removal in case of shunt group) or expired during follow-up.

Statistical Analysis

Descriptive statistics of age and sex were present in tabular form. Clinical outcomes of SHUNT and ETV were present in proportion and percentage over a period of 6th months. Chi-square tests were used to check the association between type of surgeries and Modified Vellore Grade. Z-test was used to compare the success rate of Modified Vellore Grade between SHUNT and ETV surgery, and also compared the MVG between pre- and post-operative of both surgeries. Statistically, significance was checked at 5% level of significance (If the p-value < 0.05 then it is considered statistically significant). All statistical analyses were performed in SPSS and Microsoft Excel software.

Results

As per the table, no 3, Both the ETV and Shunt groups were comparable in age and gender. There was statistically no significant difference found. As per Table no 4, In the shunt group, over 6 months of follow up it can be noted that as time passes the failure rate increases. On immediate postoperative day 7, the success rate was 86%

which dropped to 71% after 6 months. Table no 5, In ETV group the success rate was best in the immediate post-operative period which was 85% which dropped to 75% at 1 month and was 66% at 6 months of follow-up. In table no 6, Comparing the Modified Vellore grade at 6 months of follow-up between Shunt and ETV groups, there was statistically no significant difference found.

As per table no 7, When the success rate was compared grade-wise Between shunt and ETV, the grade-wise success between the two groups was seen to be comparable. Though the success was less in grade 2 and grade 3 in cases in the ETV group as compared to the shunt group which was statistically insignificant. As seen in the shunt group in Table no 8, there was a significant improvement in MVG in postoperative follow-up at 6 months. Similarly, in the ETV group, the improvement in MVG was statistically significant at postoperative follow-up at 6 months as compared to preoperative MVG.

Discussion

The communicating type of hydrocephalus, one of the most frequent side effects of tuberculous meningitis, is brought on by the development of thick, gelatinous basal exudates around the interpeduncular and pontine cisterns in the acute stage and adhesive leptomeningitis in the chronic stage. This is reportedly more prevalent in children and is typically correlated with the overall length of symptoms. [14] Diverting ventricular CSF through a VP shunt does not, however, significantly improve the health of many patients with tuberculous meningitis and hydrocephalus, and many of them still pass away. [13]

For both the shunt and the ETV groups, data were obtained prospectively and compared for age and sex. The overall success rate in cases of VP shunt surgery was 71 % at 6 months which is comparable to that reported in many studies in the literature.[15-16] Similarly, the overall success in cases of ETV surgery was 66% at end of 6 months. There was statistically no difference between outcomes of both procedures at 6 months. When compared, there was statistically no difference found between the outcome of both procedures at 6 months. The success rate in both groups decreased over 6 months of follow-up. The success rate was highest on postoperative day 7 in both shunt and ETV groups i.e., 86% and 85% respectively. The overall success at 6-month follow-up in shunt and ETV groups decreased to 71% and 66% respectively. Various studies have reported success rates between 41% to 77% in TBMH cases who underwent ETV. Similarly, various published studies predict a success rate for shunt surgery in cases of TBMH between 50% to 71% depending on the follow-up time. [17-18]

Clinical improvement in modified Vellore grading at 6 months post-operative showed a similar trend in the ETV group as compared to the Shunt group. Both ETV and SHUNT groups showed significant improvement in modified Vellore grading at 6 months post-op**.** A good correlation between poor grades and poor outcomes was witnessed in both the shunt and ETV groups. The success of ETV in TBM with Hydrocephalus depends on successful stoma formation, establishing flow across the stoma, avoiding hemorrhage, and the experience of the surgeon. The ETV is technically difficult in the post-infectious acute phase of disease due to the presence of inflammation, and the thick and opaque floor of the third ventricle. ETV over Shunt avoids placement of foreign body avoiding infection, blockage, abdominal complications, extrusions, and disconnection. For children with advanced TBM and elevated ICP, shunt surgery may not be necessary. While some authors have considered the potential of delaying surgery for these kids (Chitale and Kasaliwal 1982),[19] others have argued that even a single positive outcome warrants shunt placement for every kid with tuberculous hydrocephalus (Bullock and Van Dellen 1982).[20] These latter authors also made the suggestion that it would be helpful to employ ICP monitoring to identify which kids would benefit from CSF shunting. In our study, the very limitations Follow-up up was only for 6 months and No Intra cranial pressure monitoring was done.

Conclusion

The present study compares two alternate procedures for treating hydrocephalus in pediatric cases of TBM, although the follow-up was up to 6 months. ETV must be attempted in all TBMH patients before proceeding to shunt in view of comparable long-term outcomes and the advantage of avoiding implantation of a foreign body, its complications, and the cost along with the psychological burden of having a foreign material. More randomized studies with a larger sample size and longer follow-up monitoring are required to critically evaluate the efficacy of ETV in comparison to shunt and its predictive factors in outcome in TBMH.

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