

Endoscopic third ventriculostomy in infants

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Background: Endoscopic third Ventriculostomy (ETV) is one of the surgical options for obstructive hydrocephalus. There are varying opinions about results of ETV in infants. We are therefore presenting the results of ETV in 54 infants.

Materials and Methods: A prospective study of 54 infants undergoing ETV in our institution in the last 2 years was carried out. There were 48 cases of congenital hydrocephalus with aqueductal stenosis, 6 of post tubercular meningitis hydrocephalus. Average follow up was 18 months. **Results:** There was 83.3% (45 cases) clinical success rate in our study. Infection, persistent cerebrospinal fluid (CSF) leak and bleeding occurred in 4 (8%) cases each while blockage of stoma was observed in 8 (14.8%) patients. Majority of ETV stoma closure (6 out of total 8) occurred following infection (4) or bleeding during surgery (2). One patient (2%) had transient diabetes insipidus. Overall failure rate in our study was 16.7% (8 stoma blocks and 1 procedure abandoned). Low birth weight pre mature infants had higher failure rate (3 out of 5 infants 60%) compared to full term infants with normal birth weight (12.3%). Age did not have any impact on the success rate ($P>0.05$). Success rates were not significantly different in patients with aqueductal stenosis (85.4%) and TBM (66.6%) (Fisher's exact test, $P=0.3$). **Conclusion:** ETV was fairly safe and effective in full term normal birth weight infants while the results in low birth weight pre mature infants were poor.

Key words: Endoscopic third ventriculostomy, infants, hydrocephalus.

Introduction

Endoscopic third ventriculostomy (ETV) might be a better alternative to shunt surgery in obstructive hydrocephalus. Although some reports have shown poor success rate in infants as compared to older patients^[1,2] some authors advocate ETV in patients of all ages.^[3-5] We therefore are evaluating the result of ETV in infants.

Materials and Methods

This is a prospective study of 54 infants who underwent ETV in our institution during the period July 2003 to June 2005. A detailed history and physical examination was done in all the cases. CT scan was also done in all the infants. MRI could be done in 21 patients only. ETV was done in all cases of obstructive hydrocephalus. Out of a total of 54 patients, majority of patients ($n=48$) had congenital hydrocephalus with aqueductal stenosis and 6 had tuberculous meningitis [TBM].

Stoma of 5 mm or more was made in all the cases. In majority of the cases the floor was punctured with blunt instruments and the opening was enlarged using grasping forceps. Fogarty catheter was used in 15 patients to enlarge the opening.

All post operative complications like infections, CSF leak and failure of procedure were evaluated. Post operative CT scan [$n=8$] and MRI [$n=5$] were done in 13 patients who did not improve, deteriorated or had evidence of failure of ETV such as a bulging fontanelle or CSF leak from the operative site. ETV was considered clinically successful when anterior fontanelle was depressed or flush to the adjoining scalp and the patient improved clinically. Follow up ranged from 9 to 32 months with an average of 18 months.

Results

A total of 54 infants were studied, out of these 33 were male and 21 female. There were 10 infants of one month or less than one month of age. Out of these 5 were born prematurely and had a low birth weight while 5, 7, 14 and 18 infants were of more than one month to <2 months, 2 months to 3 months, 3 months to 6 months and 6 months to one year respectively. Forty five patients (83.7%) showed overall clinical improvement. The clinical improvement in infants of one month of age, > one month to 2 months, 2 months to 3 months, 3 months to 6 months and 6 months to one year was 6 (60%), 4 (80%), 6 (85.7%), 13 (92.8%) and 16 (88.8%) patients respectively. Only 2 (40%) pre mature low birth weight infants out of 5 cases in the age group of less than one month improved while 4 (80%) out of 5 cases in

one month age group full term normal birth weight infants showed clinical improvement. Age did not have any impact on the success rate. The mean age of the cases with success was observed 5.24 (± 3.18) months while the mean age of those in whom ETV failed was 4.5 (± 3.73) months ($P > 0.05$). There was no difference in the success rates ($P > 0.05$) when the patients were considered as two groups based on age (one neonates and another infants).

Eight patients developed CSF leak from the burr hole. Leak stopped in 5 days in 4 patients but 4 infants had a persistent CSF leak. MRI without flow study was suggestive of stoma closure in these cases. All these patients had evidence of infection also. Four patients had bleeding during surgery, which stopped after continuous irrigation. Procedure had to be abandoned in 1 patient due to poor visualization of floor of the third ventricle. The stoma was found to be closed in 8 cases. Out of these, 4 had concomitant infection and 2 had bleeding during surgery while the other two did not have infection or per operative bleeding. In 7 cases stoma closer occurred within 6 weeks time while in the remaining case this complication was seen within 3 months. When we analyzed stoma closure cases, we found that 3 out of 8 stoma closures were in low birth weight pre mature infants. Failure rate in low birth weight pre mature infants ($n=5$) was 60% compared to 12.3% in full term normal birth weight infants (Fishers exact test, $P=0.03$).

One of our patients developed transient diabetes insipidus (DI), which resolved on its own. Successful re-endoscopic surgery was done in 4 patients who had stoma closure, while four patients with associated infection were treated with ventriculo-peritoneal shunt after management of infection.

Four out of 6 [66.6%] cases of TBM had clinical success while it was 41 out of 48 [85.4%] cases in congenital hydrocephalus with aqueductal stenosis. This difference was not statistically significant (Fisher's exact test $P=0.3$)

Discussion

The clinical success rate of ETV in our study was 83.7%. These results are comparable to other studies.^[6-10] Success rate of 71%,^[6] 64%^[9] and 85%^[10] was observed in other studies done in infants while the success rate in other age group patients varied from 76%^[7] to 91.5%.^[8]

Failure of ETV was 16.7% in our study, including one procedure which was abandoned (2%) due to poor visualization of the floor of the third ventricle. This was a case of TBM hydrocephalus in which we could not see the mamillary bodies and the infundibular recess. Most of the stoma blockage (6 out of a total of 8) occurred following infection (4) and bleeding during surgery (2). Failure rate of ETV in low birth weight pre mature infants ($n=5$) was higher (60%) as compared to full term normal birth weight infants (12.3%). Ventriculitis developed in 4 patients (8%). Infection was also a common complication in other studies. 11% infants developed infection in Gorayeb^[9] series while 10%^[6] and 15%^[10] of patients developed infection in other series.

CSF leak occurred in 8 (16%) patients which stopped in 4

cases spontaneously. The cause of persistent leak in 4 patients (8%) was closure of stoma. Causes of temporary CSF leak could be due to failure of closure of dura, thinned out scalp and thin cortical mantle in patients with gross hydrocephalus. We therefore started closing dura in patients with gross hydrocephalus with thin cortical mantle, in the later part of our study. We opened dura in linear fashion which could be easily closed in these patients rather than using a cruciate dural opening. Incidence of CSF leak after ETV have varied between 2%^[11] to 7%.^[12]

Bleeding occurred in 4 patients (8%) during surgery which stopped after persistent irrigation. Two out of these 4 patients developed closure of stoma resulting in failure of ETV. Bleeding was also seen in about 5%^[7] and 3%^[8] of cases in other series. Aspiration of clots and thorough irrigation of ventricular cavity should be done after bleeding stops; this measure can reduce chances of stoma closure.

Clinical success in TBM was 66.6% while it was 84.5% in congenital hydrocephalus with aqueductal stenosis. Similar results of 77% success was reported by Singh *et al*^[13] while Jonathan *et al*^[14] reported long term successful results with ETV in both their cases with hydrocephalus secondary to TBM.

Eight patients (11%) had blockage of stoma, of these 4 had associated infection. Four of these patients who had stoma blockage underwent successful re-endoscopic surgery while 4 patients with infection were treated by ventriculo-peritoneal shunt after management of infection. Transient Diabetes insipidus (DI) was observed in 1 patient (2%), which resolved on its own by 7th postoperative day. Possible cause of this could be hypothalamic pituitary axis injury. Diabetes insipidus was also reported by Choi *et al*^[8] in 3% cases. Our complication rate is comparable to the above study.

The strength of our study is the large number of patients and prospective nature of the study. Limitation of this study is that the follow up is short with only 75% patients having follow up of more than 1 year. However all the complications in this study occurred within 3 months including those patients with follow up of 2 years and more. But delayed complications including failure can occur and a longer follow up is desirable.

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