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Endoscopic third ventriculostomy. Complications and avoidance

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Keywords
endoscopic third ventriculostomy, ETV complications, hydrocephalus

ABSTRACT

Introduction. Endoscopic third ventriculostomy (ETV) is the treatment of choice in obstructive hydrocephalus. It has become the main standard choice in management since 1962. However, there is scant data regarding the complications from clinical or multi-centre trials. This study highlights the specific complications and prevention methods related to ETV in Neurosurgical Teaching Hospital, Baghdad, Iraq.

Methods. It is a prospective case series study conducted on cases in the Neurosurgical Teaching Hospital in Baghdad, Iraq, from January 2014- October 2019. We selected ninety patients. The sample selection was convenient as any patients admitted in the study period who met the selection criteria were included. All included patients underwent a Computerized Tomography scan or Magnetic Resonance Imaging in the periprocedural management.

Results. Ninety cases have 59 (65.5%) females and 31 (34.5%) males. The most common cause of hydrocephalus is congenital causes (51 cases (56.6%), especially within the first decade of life. Aqueduct stenosis is the leading cause in 37 cases (72%). ETV complications were found in 32 cases (35.5%). The most common cause of complications is congenital cases of 14 (15%). Intraoperative complications include bleeding (mild, moderate, and severe) in 18 cases (20%). Mild bleeding constitutes 15 cases (16.6%) of all complicated cases.

Conclusion. ETV is a standard procedure in the management of obstructive hydrocephalus. The complication rate is found in around one-third of the cases in our study. Surgeons' selection of indicated patients and better surgical experience decrease the failure rate of ETV and complications.

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INTRODUCTION

Endoscopic third ventriculostomy (ETV) is considered to be the treatment of choice in obstructive hydrocephalus [1, 16, 17, 19, 21, 25]. Since 1962, the first ETV procedure was done by Gerard Guiot, ETV has become the primary standard option in obstructed hydrocephalus, but it has specific indications [9]. It is indicated in any patients with

obstructed hydrocephalus who exhibit signs and symptoms, and the anatomical features are allowed for procedure success [26]. However, there is scarce data from clinical or multi-centre trials regarding the complications and their efficacy. This study highlights the specific complications and prevention methods related to ETV in Neurosurgical Teaching Hospital, Baghdad, Iraq.

Methods

It is a prospective case series study carried out on cases in the Neurosurgical Teaching Hospital in Baghdad, Iraq, during the period January 2014-October 2019. We selected ninety patients. The sample selection was convenient as any patients admitted in the study period who met the selection criteria were included.

The selection criteria are patients with different etiologies of obstructive hydrocephalus, all had a Computerized Tomography (CT) scan or Magnetic Resonance Imaging (MRI), and all had ETV. We used Microsoft EXCEL sheets to conduct our data analysis.

Procedure

The endoscope device used is the GAAB® system by STORZ®. It was introduced through a burr hole in the Kocher point, but it may need to change laterally and anteriorly when there was a large fontanel to involve the frontal bone. After that, we introduce the endoscope through foramen Monro, with fenestration of the floor of the third ventricle by monopolar probe or forceps. Then it is easy to direct visualization of the basilar artery. The irrigating wash used was Ringer®, and its pressure was controlled through wash-in and wash-out valves. All cases had postoperative day-zero CT scan checking for hemorrhage. Follow-up CT scans two months later, checking for the function of the stoma and late complications.

We gained consent from all ninety patients (Children from the parents or guardians). The patients' data were put in a password-protected computer.

Results

The total number of patients was 90 cases, with 59 (65.5%) females and 31 (34.5%) males. The most common age group was 70% in the first decade. And all age groups are illustrated in Table 1. The most common cause of hydrocephalus is congenital causes (51 cases (56.6%), especially within the first decade of life. Aqueduct stenosis is the most common cause within the congenital 37 cases (72%). We found Tumors 25 cases (27.7%), Arachnoid cyst 8 cases (8.8%), Infections 3 cases (3.3%), Vascular 2 cases (2.2%), and Trauma 1 case (1.1%).

Table 1. The age groups of the patients and their percentages

Age group	No.	Percentage
1day-12 months	31	34.4%
2-10 years	31	34.4%
11-50 years	25	27.7%
51-above	3	3.3%
Total	90	100%

ETV complications were found in 32 cases (35.5%). Eight 8 of them (8.8%) had severe complications, which failed the ETV. The most common cause of complications is congenital cases which are 14 (15%), Tumor 8(8.8%), Arachnoid cyst 6 (6.6%), Vascular 2 (2.2%), and infections also 2 (2.2%).

Intraoperative complications include bleeding (mild, moderate, and severe) in 18 cases (20%). Mild bleeding constitutes 15 cases (16.6%) of all complicated cases. It was managed intraoperatively with wash and/or coagulation, stopping the bleeding. On the other hand, severe bleeding, 3 cases (3.3%) which was managed with extraventricular drain (EDV), Ommaya reservoir, and wash tamponade. The case that was managed with EDV ended in death, but the latter two patients survived.

Other intraoperative complications include bradycardia, the most commonly encountered complication in 20 cases (22.2%). The management stopped the shunt's wash-in and opened the wash-out.

Early complications include Diabetes insipidus (DI) in 11 cases (12.2%), cerebrospinal fluid (CSF) leak in 5 cases (5.5%), subdural collection in 1 case (1.1%), hemiparesis in 1 case (1.1%), and Fornix injury in 1 case (1.1%).

The success rate in our study is 96.6%. There are only three failed cases; one died, and the other two cases, one ends with VDS and the other with Ommaya.

Discussion

Obstructive hydrocephalus management includes different methods, and they have been established as a challenge in various studies [7,12,14]. ETV is the

preferred option in managing obstructive hydrocephalus, performed in different neurosurgical centers in the developing world with enough surgical experience [20]. ETV has growing popularity in management because it is safe, shunt-free, and treats the condition regardless of the etiology [20].

The overall complication rate is mainly related to the center experience and the surgeon in each procedure [23]. Most case series report rates range from 5% to 15% [6,11]. In recent meta-analysis showed that the overall complication rate was 8.5 %. In our study, the complication rate is 35.5%. Because we mentioned the significant complications of ETV in our research, we may have this lower rate number. As there are case series [5,24] reporting just major complications, their rate is 0%, and with series, even the minor complications, e.g., fever, are reported to be 31.2% [5].

In our study, we have a success rate of 96.6%. In Rahman et al. study of 34 cases, they had an overall 79% success rate ([20]. Duru et al. reported an 80% success rate in the overall 51 cases of children (<16 years) of all ages and etiologies [10]. Regarding specific complications, the rate of bleeding intraoperatively ranges from 0% to 8.5% in the literature [2-4,8,13,22]. The rupture of the basilar artery was reported in <0.2% of the cases [2,4,15,18]. Still, in this study, we report 20% of the cases complicated with intraoperative bleeding and 0% of cases of basilar artery rupture. In our study, one patient with medulloblastoma died due to severe bleeding intraoperatively. The counter-effort to stop the bleeding by EDV has been established, but he deteriorates postoperatively and ends with death. Another complication is CSF leak which is the most frequent encounter complication [6,8], and it ranges from 0% to 5.2% of the cases, with an overall complication rate of 1.7% [5]. Our CSF complication rate is 5.5%. We also had CSF leak as early complications, which were severe in 3 cases due to Aqueduct stenosis that was managed with ventriculoperitoneal shunt and survived without a sequalae. Otherwise, patients who were complicated with DI, Bradycardia (4 cases due to craniopharyngioma), and hemiparesis had an excellent outcome in our study.

The predisposing factors to ETV failure include the closure of ventriculostomy stoma by arachnoid granulation tissues, failure of CSF absorption, infection, and patients' improper selections [20].

The outcome from ETV may include CSF, leak, infection, hematoma, and bradycardia. The complications of ETV can happen. Good surgical experience and early intervention following the surgeon's selection of the patients can ensure the procedure's success and low complication rate.

Conclusion

ETV is a standard procedure in the management of obstructive hydrocephalus. But it has complications, including bradycardia, bleeding, CSF leakage, and infection. The complication rate is found in around one-third of the cases in our study. Surgeons' selection of indicated patients and better surgical experience decrease the failure rate of ETV and complications.

Abbreviations

Cerebrospinal fluid (CSF), Computerized Tomography (CT), Diabetes insipidus (DI), Extraventricular drain (EDV), Endoscopic third ventriculostomy (ETV), Magnetic Resonance Imaging (MRI).

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