DISCUSSION

Nowadays ETV is an alternative treatment to CSF catheter shunt therapy in patients with obstructive hydrocephalus due to its better long-term benefits and infrequent complications as compared to shunt insertion.

The procedure is considered to be highly safe and fast in experienced hands. [48] The success rate of the procedure is based on different variables. These variables can be independent of the procedure like age, sex, race, cause and type of hydrocephalus, history of previous surgery performed while; the dependent variables including ETV failure and complications, which needs additional treatment protocols to treat hydrocephalus. [48, 49]

The success rate varies from 30 – 90% among different studies. The difference in results depends on difference in the dependent and independent variables. [50]

The pre-operative assessment score predicts the success rate hypothesized by Kulkarni *et al*, [51, 52] which is based on analysis of 15 published ETV studies. This score predict the failure within two to six months. Late failure can occur later and rarely. [53, 54] Any patient where ETV remains successful after 6 months is usually cured. [54]

Our study was conducted upon 20 patients with hydrocephalus of different causes treated with ETV. The study was to evaluate role of imaging by CT in following up patients one month after ETV. Comparing the ventricular index and detecting any associated complications were done.

Patients were collected from neurosurgery department of Alexandria university hospital. Diagnosis of cause of hydrocephalus known from patient history, imaging and their laboratory investigations.

The study was conducted upon 20 patients, 9 of them were males and 11 were females of different age groups ranging from months shortly after birth till fifties. 14 patients were in first decade. Three patients were in second decade with only 1 patient in third, fourth and sixth decade.

Regarding the causes of hydrocephalus we found variety of causes with brain tumours having the highest percent of cases in our study, they were 7 patients representing 35 % of cases and next category was the congenital infection 4 patients(20%) . Congenital aqueduct stenosis was seen in 3 patients representing 15 %. Other causes like post meningitic, normal pressure hydrocephalus and arachnoid cyst were found in 2 patients in each category (10% each).

The brain tumours detected in our study were intraventricular like, ependymomas (3 patients) and others were extra ventricular mostly posterior fossa tumours (2 patients) and pineal body tumour (2 patients). Perinatal infection or TORCH like rubella and herpetic infection were seen. Cases of meningitis mostly confronted in preterm babies in incubators.

Shunt malfunction is quite common, and some of them could have repeated malfunctions. Such patients with repeated shunt block could be better managed by ETV. Formerly shunted patients have less favorable results, somewhat greater risk of serious complications; therefore, more experience is essential when offering them an ETV.

Carefully selected patients with obstructive hydrocephalus could benefit from ETV after shunt malfunction.

In our study 12 patients gave history of previous ventriculo-peritoneal shunt operation. They complained of shunt blockage, failure, infection or over drainage .Some of them had functioning shunt for years and complicated all of a sudden, others had shunt operation more than one time. All previous patients of obstructive hydrocephalus who are candidate for ETV had the chance to live free from shunt tube in their heads with an easier method and much less post operative complications.60 % of cases had previous shunt operation with number of patients equals 12 while 8 patients with percentage of 40 % had no history of previous shunt.

Following the patients of previous shunt operation we found that 8 of the patients had successful ETV with percentage of 66 % while only 4 patients had failed ETV, this is very promising for patients of complicated VP shunt, this is nearly matching with Boschert *et al* [55] who suggested that use of ETV is safe and effective for the treatment for shunt dysfunction in patients with obstructive hydrocephalus with success rate 82%. This confirms how ETV became superior to VP shunt in condition of good selection of type of hydrocephalus.

CT scan of the brain was done to all patients before undergoing the ETV to assess the cause and type of hydrocephalus and condition of ventricular system and the degree of ventricular dilatation also to put precise plan for the endoscope entrance.

In our study we were concerned with the role of CT and how it is useful by itself in assessment of the case, we found that CT can assess the ventricular system and degree of dilatation, diagnosis of type of hydrocephalus, presence of previous shunt tube and the overall brain condition but still we are in need of other imaging modalities which is mostly MRI in some specific conditions like brain tumours, cases of normal pressure hydrocephalus and other cases when specific type of hydrocephalus is not clear. When preoperative CT films were available we were concerned with measurement of ventricular index and cause of obstructive type of hydrocephalus as well as if there were shunt tube, but our priority was the ventricular index.

CT obtained after ETV by one month and ventricular index is measured to assess the degree of ventricular dilatation and to detect any complication of the procedure.

In our study reduction of ventricular index and radiological improvement occurred in 14 patients from the 20 cases studied reflecting 70 % success rate. Beems and Grotenhuis[56] reported a success rate of 76% in a large series of 339 pediatric patients. In another series of adult and pediatric patients, Hopf et al., [57] reported that their success rate with ETV was 76% and concluded that ETV is most successful in occlusive hydrocephalus. Most of the reported series involve either pediatric patients or a mixed population. The success rate varies from 30 – 90% among different studies. The difference in results depends on difference in patient age, cause of hydrocephalus and previous shunt status.

Success was not equal in all cases while some cases showed marked and excellent improvement others showed poor improvement. Normal pressure hydrocephalus,

congenital brain cysts like arachnoid cyst and some brain tumours like 3rd ventricular ependymoma showed marked improvement.

Tumors of the third ventricle associated with hydrocephalus could be managed by complete tumor excision, shunt surgery or external ventricular drainage, followed by tumor excision.[58, 59] Endoscopic biopsy and ETV through a single or dual port was found to be safe and effective, and it avoids second surgery.[60, 61] Shono *et al*[62] found it to be safe and claimed that the risk of tumor dissemination due to the neuroendoscopic procedures was minimal when the appropriate chemotherapy and radiotherapy were provided postoperatively. Computer-assisted planning and performing a navigated endoscopic procedure could help in performing both ETV and biopsy in a better way. [63]

Other brain tumours like posterior fossa tumours and congenital aqueduct stenosis showed less improvement in comparison to cases mentioned above.

Posterior fossa tumor hydrocephalus could be managed by ventriculo-peritoneal shunt, tumor excision and ETV. We agree that the best option to treat hydrocephalus due to posterior fossa lesions is total excision. ETV should be considered as an alternative procedure to VP shunt in controlling severe hydrocephalus, related to posterior fossa tumors while patients await their definite tumor excision. The use of pre-resectional ETV was found to be an effective and safe procedure with a high success rate. [64] ETV was found to be better than VP shunt. [65] However, ETV cannot always prevent post-operative hydrocephalus in all cases of posterior fossa tumor. [66]

In our study failed ETV was encountered in a case of congenital infection, a case of post meningitic hydrocephalus and two cases of brain tumours. We can conclude that results in brain tumours vary widely according to type, grade and site of the tumour. Normal pressure hydrocephalus has favorable results while brain infection usually gives less improvement.

The incidence of complications with ETV has been reported ranging from 0 to 20%,[67- 70], but the permanent complications are few. However, complications such as fever, bleeding, hemi-paresis, gaze palsy, memory disorders, altered consciousness, diabetes insipidus, weight gain and precocious puberty are reported.

In our study we followed patients after ETV to detect complications. Two patients out of the 20 patients of the study showed complications (10 %). The first patient was a girl of 9 years old diagnosed as having posterior fossa brain tumour and had partial removal of the tumour and she had ETV for accompanying hydrocephalus. She complained of post operative fever presented clinically shortly after the procedure. The second case was a newborn girl of 4 months old had obstructive hydrocephalus secondary to congenital infection, in follow up CT it showed spots of gases of brain infection manifested clinically by fever and laboratory investigations showed characters of infection like increase white cell count and increase in erythrocyte sedimentation rate and C- reactive protein.

ETV results are good in obstructive hydrocephalus. Post-operative failures usually occur early; regular clinical and radiological assessment must be performed, especially in the first years after the neuroendoscopic procedure. [71]

Measurement of intracranial pressure during the immediate post-operative period after endoscopic third ventriculostomy could be required in patients who continue to have clinical features of raised ICP or failed to show an improvement after ETV. [72, 73]

Some patients fail to show an improvement despite of patent stoma after ETV. This could be due to complex hydrocephalus (combination of obstructive and communicating).[74] Lumbar puncture helps by increasing the compliance and the buffering capacities of the spinal subarachnoid spaces, it probably decreases the cerebrospinal fluid outflow resistance from the ventricular system, facilitate the decrease in the ventricular volume and allowing faster permeation of CSF in the intracranial subarachnoid spaces. A cycle of 1 to 3 lumbar punctures should always be performed in patients who remain symptomatic after ETV, before ETV is assumed to have failed and an extra cranial cerebrospinal fluid shunt is implanted. Patients with temporary defect in CSF hydrodynamics would show clinical improvement after lumbar puncture while those with permanent defect in CSF absorption or permeation will need some form of shunt. [75, 76]

In conclusion, CT brain is considered a reliable diagnostic test in evaluation of patients of obstructive hydrocephalus after ETV operation; it shows the degree of improvement in ventricular size not only but also improvement of permeation and detection of complications if present. Also it is useful preoperative in assessment of hydrocephalus and its cause.

SUMMARY

The study included 20 patients with obstructive hydrocephalus. Their ages ranged from 2 months to 52 years. Considering the pathological diagnosis in the 20 patients, there were seven patients having brain tumours, four with congenital infection, three congenital aqueduct stenosis, two meningitis, two sub arachnoid cyst and two normal pressure hydrocephalus. Computed tomography was performed to all patients before and one month after they underwent endoscopic third ventriculostomy. Patients were followed for success of the endoscopy and complication detection if present. It gave successful outcome in fourteen patients in terms of post operative decrease in peri ventricular permeation and opening of sulci and brain fissures and decrease of ventricular dilatation while only six cases showed unsuccessful outcome in terms of remaining of peri ventricular permeation, closed fissures and sulci and same size of the dilated ventricles, even it was larger in some cases. Of the twenty patients there were twelve had previous ventriculo-peritoneal shunt operation which was complicated and they had endoscopic third ventriculostomy while shunt in place and closed, from the twelve patients eight had successful endoscopic third ventriculostomy while four cases only had failed ETV. Two patients out of 20 patients showed complications. First case showed post operative fever and the second one showed post operative infection diagnosed by laboratory and imaging investigations.