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Epilepsy in Hydrocephalus Patients: A Case Study

Dr Mohammed Nooruldeen Jabbar and Fatimah M. Nooruldeen

[1*]Specialist Neurosurgeon, Canadian Specialist Hospital – Dubai, UAE.

[2]MB ChB Student, The University of Manchester, United Kingdom

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***Corresponding Author:** Dr Mohammed Nooruldeen Jabbar, Specialist Neurosurgeon, Canadian Specialist Hospital – Dubai, UAE.

Aim

To study the incidence of seizures in hydrocephalus patients, risk factors and the need for prophylactic antiepileptic drugs in these patients.

Abstract

Epilepsy is not a typical symptom of hydrocephalus but can be associated with hydrocephalus and complication of its treatment.

Hydrocephalus may be the consequence of wide variety of congenital and acquired disease affecting brain. It commonly requires surgical treatment, which in turn places the patient at risk for a variety of mechanical and infectious complication. The causes of hydrocephalus, treatment, and the complication of treatment are all potential instigators of epilepsy. Furthermore, the onset of epilepsy may precede, coincide with, or follow the onset of hydrocephalus.

We studied 347 patients with hydrocephalus due to variety of causes retrospectively, who were treated by ventriculo-peritoneal shunt placement; the incidence of epilepsy among them, risk factors, and the need for prophylactic antiepileptic drugs are discussed.

Keywords: Epilepsy, CSF, Hydrocephalus, Burr Hole, Shunt Surgery

Introduction

Children and adults with hydrocephalus are at increased risk of seizures, particularly if there has been a complication during a shunt placement or revision procedure [1].

- Buildup of scar tissue in the brain from operations & shunt revisions.
- Infections such as meningitis, encephalitis or ventriculitis.
- Reaction to a drug
- Increased ICP. (Which lead to stretching of the cortex).
- Subdural hematoma (SDH).
- Brain tumors or cysts.
- Metabolic conditions, such as hypoglycemia, hyperglycemia, electrolyte imbalances, and uremia [1].
- Conditions in which seizure and hydrocephalus may coexist like Schizencephaly [2], Hydranencephaly [2] & malformation of vein of Galen [3].

A seizures disorder may occur after ventricular shunting, the incidence of which is variably reported from 5 to 48 percent. It has been suggested that choice of burr hole site is a contributing factor, with a higher incidence of seizures occurring in frontal as opposed to occipital approaches, but this report not been confirmed subsequently [4].

Prophylactic anticonvulsants are not recommended in general by most neurosurgeons, although many patients undergoing ventricular puncture may be taking anticonvulsants for other reasons. Papers suggesting an increased seizure incidence in patients with ventriculostomies is not conclusive in that regard [5].

Patients and Methods

In this study, 347 patients were enrolled retrospectively who underwent surgical treatment of hydrocephalus in three different hospitals from January 2018 to January 2020 which were identified by file search of diagnosis and treatment.

43 of them had seizures, which were treated by antiepileptic drugs, but the type of the seizure not included in the study because impossible to gather reliable information regarding it. The study focus on patients with epilepsy in which the date of the onset of epilepsy taken as the date of first seizure and if this date was unclear from the record, the date of initiation of antiepileptic drug treatment was used instead of.

The date of the first shunt surgery and subsequent date of shunt revision or revisions (if present), cause of hydrocephalus, and the site of burr hole CSF shunt insertion were recorded. Age of the patients was recorded and it was between 1 month and 31 years old.

Results

From January 2018 to January 2020, 347 patients were admitted as cases of Hydrocephalus. Nine patients (2.59 %) had epilepsy as one of the presenting features preoperatively (table 1).

34 patients developed epilepsy following surgery: either single surgery (5 patients)-table 2A- or after revisions of failed shunt surgery (29 patients)-table 2B

Thus, the total number of patients with associated seizures was 43. All the patients (347) had shunt surgery. Out of the 347 patients, 87 patients had to have revisions. Out of these 87 patients, 29 (33.3 %) developed postoperative epilepsy, while out of the patients with single surgery (260) only 5 (1.9%) had postoperative epilepsy.

Out of the 260 patients, 96 patients had frontal burr hole and of these, epilepsy developed in 4 patients (4.1 %).

Out of the 260 patients, 164 patients had parietal burr hole and of these, only one patient developed epilepsy (0.6 %).

About the age distribution, out of the 347 patients: 262 (75.5 %) patients were under 20 years old. Out of the 262 patients, 38 patients (14.5 %) developed epilepsy.

No. of Patients	Age	Cause of Hydrocephalus
1	27 years	Idiopathic
1	18 years	Post meningitis
1	31 years	Intraventicular tumor
6	< 2years	Congenital

Table 1: The frequency distribution for patients developed seizure preoperatively.

No. of Patients	Age	Cause of Hydrocephalus	Site of burr hole
3	<2 years	Congenital	Frontal
1	7 years	Posterior fossa tumor	Frontal
1	31 years	Post – traumatic	Parietal

Table 2 (A): The frequency distribution of patients developed seizure postoperatively (without shunt revision).

No. of Patients	Age	Cause of Hydrocephalus
1	29 years	Idiopathic
1	27 years	Posterior fossa tumor
1	8 years	Posterior fossa tumor
7	10-20 years	Congenital
12	2-9 years	Congenital
7	< 2 years	Congenital

Table 2 (B): The frequency distribution of patients developed seizure postoperatively (with shunt

revision).

Discussion

Hydrocephalus is not commonly recognized as a cause of seizures in general, although epilepsy is reported to be frequently associated with shunt treated hydrocephalus, especially in children, while several authors have recorded increased risk of epileptic seizure after shunt replacement but the underlying mechanism are still controversial.

In our study we found that 43 patients (12.3%) out of the 347 patients developed seizures. Out of the 43 patients, 35 (81.3%) had congenital hydrocephalus and from these results we agree with Piatt et al who said in their study about hydrocephalus and epilepsy that the cause of hydrocephalus was strongly associated with the risk of epilepsy and patients with myelomeningocele who received antiepileptic drug treatment were found to have undergone more CSF shunt operations than other patients [6].

Sato O et al said in their study that the age at the time of initial shunt placement seems to be an important factor and children less than 2 years old are consequently at a higher risk of developing epilepsy than older ones [7]. While in our study we found that out of the 43 patients, 38 (88.3 %) patients were under 20 years old, and out of these 38 patients, 16 patients were less than two years old.

Rachel Fudge said in his study that development of seizure was not found to correlate with acute obstruction of CSF , or to the number of shunts revisions or position of the shunt , while Sato O et al said in their study that the insult to the brain at the time of ventricular catheter insertion , the presence of the shunt tube itself as a foreign body , the burr hole location , the number of the shunt revisions after malfunction , associated infection and the etiology of hydrocephalus are thought to be related to the risk of epilepsy [7].

In our study we found that there is a strong relation between the shunt revision and development of seizure in shunted hydrocephalus patients.

Out of the (347) patients, 87 patients had undergone one or more shunt revisions due to obstruction or infection and out of those 87, 29 patients (33.3%) developed seizure and this might be explained by formation of multiple scar tissue in the brain after multiple surgeries which could act as epileptogenic focus.

Piatt et al said in their study that patients with hydrocephalus who had had CSF shunts inserted at both frontal and parietal burr hole sites experienced more seizure than patients who had had shunts inserted at only frontal or only parietal sites [6].

In 1986, Dan and Wade reported that patients subjected to parietal shunt insertion had a significantly lower risk of epilepsy than patients with frontal shunts [6]. In our study we agree with Dane and Wade in which the incidence of seizure after frontal burr hole (4.1%) more than after parietal burr hole (0.6%).

The indictment of CSF shunt surgery in the process of epileptogenesis is two pronged, electrophysiological and clinical. The electrophysiological argument was developed on the basis of electroencephalographic (EEG) finding [8, 9, 10].

Patients with hydrocephalus who were treated with CSF shunts tended to have lateralized EEG abnormalities that correlated with the side of the shunt [8, 9, 11, 12, 13, 14]. Untreated patients with hydrocephalus had fewer abnormalities, which were seldom lateralized [9]. In one particularly detailed study [10], gradual evolution of EEG abnormalities was documented from an unremarkable state prior to surgical treatment through a focal slow wave disturbance after surgery to, in some cases, an epileptiform discharge focus at the

site of the cortical puncture.

The presence of a cranial defect even as small as a burr hole makes possible the recording of sharp and slow wave EEG activity in the immediate neighborhood of the defect that cannot be recorded at other more remote sites on the head. Focal sharp and slow wave activity arising as a breach rhythm at a burr hole can look very epileptiform, but it does not carry the same implication as epileptiform activity over an intact cranium [8, 9, 11, 12, 13, 14].

The electrophysiological changes in CSF shunted patients have been supported by clinical observation. Patients treated by CSF shunts are generally thought to have more seizures than untreated patients with hydrocephalus, and the lateralization of seizures tends to correlate with the side of the shunt [8, 10, 12, 13, 15, 16].

Conclusions

1. The patient with hydrocephalus is at a risk of having seizure disorder and the onset of this seizure may precede or follow the treatment of hydrocephalus.
2. The risk of development of seizures in hydrocephalus patients is associated with shunt revision, age of the patient and site of burr hole.
3. Although rare, epilepsy can be the presenting symptom of hydrocephalus patient.
4. The risk of developing seizure is higher in young patients less than 20 years old.
5. The site of burr hole has a good correlation with the occurrence of epilepsy. Frontal placement carrying a higher risk than the parietal one.
6. There was a strong correlation between the incidence of epilepsy and the shunt dysfunction which required revisions.

Recommendations

A. It is preferred to give prophylactic antiepileptic drug to those patients with:

1. Revisions.
2. Frontal burr hole (need further studies).
3. EEG changes (need to be studied).

B. A prospective study is needed to follow up those patients who:

1. Did not develop seizure early.
2. Present with epilepsy preoperatively.

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