

Frequency of External Ventricular Drain Related Infection

SAFIA RAHMAN, SEEMA SHARAFAT, ZAHID KHAN

Farooq Azam

Departments of Neurosurgery / Pathology, MTI, Lady Reading Hospital, Peshawar

ABSTRACT

Objective: To evaluate the frequency of external ventricular drain (EVD) related infections.

Material and Methods: This observational study was conducted at the department of Neurosurgery / pathology, Postgraduate medical institute, Lady Reading Hospital Peshawar from July 2014 to December 2014. A total of 18 consecutive patients, who undergone EVD, irrespective of their age and gender were included in the study. Those who had intracranial infection, Cerebrospinal fluid leak (CSF) or revision of EVD (external ventricular drain) were excluded from the study.

Results: We had total 18 patients who underwent EVD in the study period. There were 44.4% males and 55.6% females. Their age range was from 1-69 years with the mean age of 40years. Main indication for EVD was intracranial hemorrhage in 55.6% cases. Post EVD infection was observed in 16.6%.

Conclusions: We conclude that external ventricular drainage is an effective and quick technique for the management of acutely raised intracranial pressure with dilated ventricular system. The incidence of EVD related infection is significant (16.6%). Early diagnosis is made on the basis of CSF culture, gram staining and routine evaluation for increased white cell count, increased proteins and decrease glucose level. This will help to permit immediate and specific treatment.

Key Words: EVD, Hydrocephalus, Infection, Ventricular drain, Ventriculostomy.

INTRODUCTION

External ventricular drains (EVD) are commonly used in critical care units for the treatment of acute obstructive hydrocephalus, intracranial pressure monitoring and / or the administration of intraventricular medications.¹⁻³ Complications arising from EVDs include hemorrhage, misplacement, dislodgement, blockage, and, most significantly, infection, which may be complicated by ventriculitis, meningitis, brain abscess, or subdural empyema^{2,4}. The overall complication rate ranges from 3.4 to 32.2%.^{2,4,10}

External ventricular drainage (EVD) – related infection is one of the most severe complications¹. According to the literature, the incidence rate of EVD – related infections ranges from 5% to 20% and it is mainly due to gram-positive cocci (*Staphylococcus epidermidis* or *Staphylococcus aureus*), but gram – negative bacteria such as *Pseudomonas aeruginosa* or *Acinetobacter baumannii* have also been found as

causal agents.^{1,2,11} EVD related infection increase not only mortality but also have severe neurological sequelae.¹

Diagnosis of EVD-related infection (meningitis, ventriculitis) is based on the presence of biochemical and bacteriological analysis of cerebrospinal fluid (CSF).¹² Therefore, the study of cerebrospinal fluid (CSF) remains the key to the diagnosis of EVD-related infections.^{7,13}

As there is limited local study on this topic. This study will help us to assess the frequency of EVD-related infection and thus to help in management of such patients.

MATERIAL AND METHODS

This was an observational study of patients who were admitted to the Neurosurgical Department MTI, LRH and underwent the initial EVD insertion over a period

of 6 months (July to December 2014). We included all the patients in our study requiring EVD system due to hydrocephalus secondary to subarachnoid haemorrhage (SAH), spontaneous or traumatic intraventricular hemorrhage (IVH), tumors associated with hydrocephalus, and intraparenchymal bleed of both gender irrespective of their age. The material used for the EVD system was standardized for all samples. We Excluded those patients who had CNS or CSF infection before insertion of the drain or had Reinsertion or revision of the EVD system. After getting approval from the hospital ethical committee to conduct the study and taking informed consent, Cerebrospinal fluid samples were taken from drain daily for 10 days and were examined for cell count, total protein and glucose concentration. And bacteriological CSF cultures were taken on alternate day. We defined EVD-related infection as positive CSF culture and gram stain and presence of other supportive CSF laboratory findings:

1. Pleocytosis with presence of white blood cells of more than $50 / \text{mm}^3$.
2. A decrease in the CSF glucose level (normal level = 60 mg/dl).
3. An increase in the CSF protein level (normal level = 40 mg/dl).

Patients were not classified as having EVD infections if only an isolated CSF culture was positive but other parameters were within normal values. All information was entered into a proforma especially designed for this purpose. The data was analyzed by statistical program SPSS version 11.

RESULTS

We had total of 18 patients during the study period. Their age ranged from 1 – 69 years with the mean age of 40years. The gender distribution of our patients is given in table 1.

Table 1: Gender Distribution.

Gender	No. of Patients	Percentage	Ratio
Male	08	44.4%	01
Female	10	55.6%	1.25
Total	18	100	

Indications for External Ventricular Drains:

Main indications are given in table 2.

Table 2: Indications for EVD.

Indications	No. of Patients	Percentage
Spontaneous intracranial bleed	10	55.6%
Posterior fossa tumors	04	22.2%
Other intracranial tumors	02	11.1%
Hydrocephalous	02	11.1%
Total	18	100

EVD Related Infection:

Three of our cases had EVD related infection. Which make 16.6% of the total 18 cases.

DISCUSSION

External ventricular drainage (EVD) is frequently used in neurosurgery to drain cerebrospinal fluid in patients with raised intracranial pressure.¹⁴ We performed a retrospective study in order to evaluate the frequency of EVD-related infection. External ventricular drains were placed in 18 patients during our study period of 6 months.

In our study the age of the patients ranged from 1 year to 69 years with the mean age of 40 years. We had more female patients (10/18, 55.6%) than males (8/18, 44.4%). The male to female ratio was 1:1.25. The results are comparable to other studies. Pfisterer and colleagues⁹ studied 130 patients with external ventricular drains. Their age ranged from 6 month to 79 years with the mean age of 46 years. Majority (52.3%) of their patients was female.

The most common indication for putting EVD is raised intracranial pressure after intracranial hemorrhage.^{10,15} This was also reflected in our study. We had 55.6% (10/18) patients with spontaneous intracranial hemorrhage. In another study it is about 53.8%.⁹ The rest had other causes for hydrocephalous.

Because external ventricular drains (EVDs) provide access to cerebrospinal fluid (CSF), there is potential for EVD associated acute bacterial infection¹⁶. In our study, 16.6% (3 cases) patients developed infection. The results vary in different studies. Omar and colleagues¹⁷ studied 87 patients. In their study the frequency of EVD – related infection was as high as 32.2% (95% CI 23.3% to 42.57%). The cumulative incidence of EVD – related infection in Hegel and colleagues¹⁴ study was 8.3% like results were published in other studies.²

The device-associated infection rate observed in our study is higher than the rate reported by Scheithauer, et al,¹⁸ (6.3 per 1000 device days) and Hagel, et al, (8.3%). Berger, et al¹⁹ shared their long term experience regarding external ventricular drain in pre-term infants. They had 37 such patients and infection rate was 5.4%.

The exact reason for higher infection rate in our study is not clear. However, hemorrhagic cause of hydrocephalous (subarachnoid / intraventricular hemorrhage), Cerebro-Spinal Fluid leak, and placement of EVD for long duration, systemic or bur-hole site infections, short subcutaneous tunneling and frequent irrigation and manipulation of catheter increases incidence of infection. Not following aseptic techniques without antibiotic coverage infection chances increases.²

The culture sensitivity report was positive in 72.2% (13 cases) of our patients. In 55.5% (10 cases) the pathogens identified were staphylococci, and in the rest were streptococci, Enterococci etc. in one study the pathogens most commonly identified were coagulase – negative Staphylococcus (62%) followed by Enterococcus spp. (19%). Gram – negative bacilli were responsible for 50% of the infections, followed by gram – positive cocci (29%) and others (21%).⁵

Postoperative colonization can either arise from endogenous organisms present on the skin, which spread along the intracutaneous tract or by exogenous organisms introduced into the EVD system during manipulation at the EVD system by healthcare workers. There are data suggesting that increasing the distance from the EVD exit site to the burr hole reduces bacterial colonization and infection of the catheter.²⁰⁻²² Endogenous infections might be prevented by using antimicrobial coated or silver coated EVD catheters which may decrease bacterial colonization and thus prevent infection as published by Wang, et al,²¹ and Koeng, et al,²³ studies.

CONCLUSION

We conclude that external ventricular drainage is an effective and quick technique for the management of acutely raised intracranial pressure with dilated ventricular system. The incidence of EVD related infection is significant (16.6%). Early diagnosis is made on the basis of CSF culture, gram staining and routine evaluation for increased white cell count, increased proteins and decrease glucose level. This will help to permit immediate and specific treatment.

Address for Correspondence:

Dr. Zahid Khan

Department of Neurosurgery, Lady Reading Hospital

Peshawar – Pakistan

Cell: 03359345434

E-mail: seemasharafat@yahoo.com

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AUTHORS DATA

Name	Post	Institution	E-mail
Dr. Safia Rahman		Departments of Neurosurgery / Pathology, MTI, Lady Reading Hospital, Peshawar	
Dr. Seema Sharafat			
Dr. Zahid Khan		Department of Neurosurgery, PGMI / Lady Reading Hospital, Peshawar – Pakistan	seemasharafat@yahoo.com
Dr. Farooq azam			