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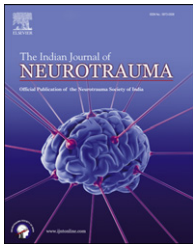

Original article

Efficacy of periprocedural vs extended use of antibiotics in patients with external ventricular drains – A randomized trial☆

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ABSTRACT

Background: External ventricular drains (EVD) are considered gold standard for intracranial pressure monitoring. Antibiotics are routinely administered to patients with EVD for extended duration, however, no conclusive evidence supports this practice.

Aim: To compare the efficacy of periprocedural versus extended use of antibiotics, in patients requiring external ventricular drains.

Patients and methods: This is a three year prospective study starting from 1st Jan 2002. All patients who required EVDs as part of their treatment protocol were randomized into two groups, group A who received periprocedural antibiotics and group B who received, antibiotics for extended duration, while EVD was in situ. Patients with open head injuries, pre-existing CNS infection, who required EVD for second time, breach in surgical technique and who had antibiotics for other reasons were excluded from this study. A standard protocol was used to insert and monitor EVDs. No EVD was left in situ for a period more than 144 h. Cerebrospinal fluid cultures were sent on day 0, 1, 3 and 5. On removal, EVD tip was sent for culture. Group A received two doses of intravenously administered ceftazidime. Group B received ceftazidime extended till removal of EVD.

Results: Both groups were well matched in number of patients, age, sex, duration of ventriculostomy Closed head injury was the most common indication (42.86%) for ventriculostomy. One patient in group A (6.67%) and two patients in group B (7.40%) had ventriculostomy related infection with overall infection rate of 7.14%.

Conclusion: Our observation, despite being underpowered, definitely points towards limiting the antibiotic prophylaxis to only periprocedural period for clean neurosurgical procedures like ventriculostomy.

☆ This study was part of treatment protocol and was not granted from any other source. This manuscript was not presented at any meeting.

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1. Introduction

External ventricular drains are considered gold standard for intracranial pressure monitoring. The ability to drain cerebrospinal fluid to control intracranial pressure confers a distinct advantage over other types of monitoring.[1,2] But enthusiasm for considerable diagnostic, prognostic and therapeutic value of this technique has always been somewhat dampened by potential risks of infection and haemorrhage.[3,4] Antibiotics are used for extended periods in patients with external ventricular drains, however no conclusive evidence supports this practice.[5] This study was undertaken to compare the efficacy of periprocedural with extended use of antibiotics in patients with external ventricular drains. This being a prospective study, randomized prior to procedure, chance of operator/investigation bias was ruled out.

2. Patients and methods

All patients who required EVD as part of their treatment protocol were included in this three year prospective study starting from 1st January 2002. Informed consent was taken for this procedure in each case. Patients with open head injury with disrupted meningeal barrier, scalp abrasion or laceration within 3″ of site of EVD, shunt infections and meningitis were excluded. Patients who required EVD for second time, who required antibiotics for other reasons and in whom there was breach in surgical technique were also excluded from the study. These patients were randomized into two groups, at the time of admission, namely A – periprocedural antibiotic group and B – extended duration antibiotic group. Ceftazidime was used in both groups.

A standard protocol was used throughout the study period for insertion and monitoring of EVDs. Procedure was done either in Neurosurgery intensive care unit or operation theatre. Each procedure was done by a neurosurgeon based on the technique to tap the frontal horn of the non dominant lateral ventricle. Scalp was shaved and cleaned with betadine scrub for five min, then with spirit and then with 10% betadine paint and left to air dry. After instituting EVD, distal end was tunneled approximately 4 cm subcutaneously to a separate exit site and secured. The scalp incision was closed with 3-0 nylon suture. A sterile occlusive dressing was placed and changed every 72 h. CSF cultures were sent on day 0, 1, 3 and 5 using standardized protocol. EVD tip was sent for culture at the time of its removal. For this study, ventriculostomy related infection [VRI] was defined by the presence of the positive CSF/EVD tip culture.

The data was analyzed using SPSS version 9.0. Parametric variables were compared using analysis of variance. Non parametric data was compared using χ^2 analysis and Fisher's exact test. P values of <0.05 for a two tailed test were considered significant.

3. Results

During the three year study period, 153 patients had an EVD as part of their management. 17 patients were excluded because they had underlying shunt infection, 5 had meningitis, 23 had open head injuries, 11 had scalp lacerations in the vicinity of EVD site, in 13 patient 2nd EVD was put after 5 days, in 33 patients antibiotics were used for some other indications, 7 patients expired during study period and two patients had accidental disconnection of the closed monitoring system, leaving 42 patients for this study.

Group A (Periprocedural antibiotics) comprised 15 patients and group B (Extended use of antibiotics) comprised 27 patients. There was no significant difference between these two groups with respect to number of patients, age, sex, duration of ventriculostomy and indications for EVD placement (Table 1). There were 3 cases of bacterial ventriculitis documented by positive CSF culture or EVD tip culture, which resulted in an overall infection rate of 7.14% (Table 2), with 6.67% in group A and 7.40% in group B. Small sample size of this study, because of rigid exclusion criteria, and low rate of infection precluded meaningful statistical analysis. Causative organisms isolated from CSF/EVD tip culture are shown in Table 2. CSF of 3rd patient of this study belonging to group A showed growth of *Staphylococcus aureus* on 3rd day of ventriculostomy. 17th patient in this study belonging to group B,

Table 1 – Various clinical characteristics of patients.

Sr. No.	Clinical characteristics	Group A	Group B	'P' value
1	No. of patients	15	27	>0.10
2	No. of male patients	9	15	>0.10
3	Mean age (yrs) {± SD}	39.91 ± 15.64	31.86 ± 19.05	>0.10
4	Mean duration of ventriculostomy (hrs) {± SD}	123.32 ± 7.04	128.86 ± 6.98	>0.10
5	Indication for EVD			
	CHI	7	11	>0.10
	ICB	2	2	>0.10
	ICB WITH IVH	1	2	>0.10
	SAH	2	5	>0.10
	O.H	1	2	>0.10
	O.H/TUMOR	1	3	>0.10
	VP Shunt malfunction	1	2	>0.10
6	VRI	1	2	>0.10

Table 2 – Distribution of infected patients according to organisms grown.

Pt. no.	Sample	Smear	Organisms grown	Group A	Group B	'P' value
3	CSF	G +ve cocci	*Staphylococcus aureus*	1	0	>0.10
17	CSF	G –ve bacilli	Pseudomonas	0	1	>0.10
37	CSF	G +ve cocci	β-Haemolytic, Streptococci	0	1	>0.10
37	EVD tip	G +ve cocci	Enterococci	0	1	>0.10

showed growth of pseudomonas on 3rd and 5th day of ventriculostomy. CSF of 37th patient belonging to group B, showed growth of β-haemolytic streptococci. EVD tip of same patient showed growth of Enterococci.

4. Discussion

Despite its usefulness, EVD is not without complications. The most devastating complication is infection, which affects from 0 to 27% of patients.[6–19] Risk factors associated with ventriculitis include haemorrhage,[6,12] neurosurgical operation,[6,12] irrigation of drainage system and duration of monitoring[8] in previous studies.

In 1972, Wyler and Kelly[3] examined the use of antibiotics with EVDs. They found an infection rate of 27% in patients who received no prophylactic antibiotics with 9%in those who did. They used antibiotics for extended duration. Subsequently, Stenager et al,[20] Rosner and Becker[21] and Mayhall et al[12] found no relationship between infection and use of antibiotics. In 2000, Alleyne et al[5] concluded that the use of continuous prophylactic antibiotics offered no benefits over periprocedural dosing in management of EVDs in a retrospective study. In their Cochrane review, Ratilal et al[22] supported the use of perioperative systemic antibiotics for the first 24 h postoperatively following EVD placement, benefit after this period remains uncertain.

In this study we had observed comparable infection rate in periprocedural and extended use group with overall infection rate of 7.14%, which points towards limiting the antibiotics to only periprocedural period for clean neurosurgical procedures like ventriculostomy.

Our observation, despite being underpowered and statistically insignificant, definitely points towards limiting the antibiotic prophylaxis to only periprocedural period for clean neurosurgical procedures like ventriculostomy, in view of heightened concern regarding iatrogenic over selection of antibiotic resistant organisms. Large, multicentral, prospective, randomized trials on similar pattern are recommended to conclusively compare the efficacy of periprocedural antibiotics with extended use of antibiotics for external ventricular drains.

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