Effectiveness of Topical Vancomycin To Reduce The Cerebrospinal Fluid Shunt Infection

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ABSTRACT

Objective — *To assess the effectiveness of topical vancomycin in minimizing the ventriculoperitoneal shunt (VP) infection.*

Study design — *Cross sectional study.*

Place & Duration of study — *Neurospinal & Cancer Care Institute Karachi, from February 2017 to June 2020.*

Methodology — *The study was conducted after ethical committee approval from the hospital and all the patient gave written consent to be included in the study. The diagnosis of hydrocephalus was made on neuro-imaging like CT scan brain or MRI brain. Cerebrospinal fluid detail report was obtained to find out any infection before surgery. Additional topical vancomycin was used with infection control protocol during the surgery. The patients were followed till six months post-surgery for any infection related to the procedure.*

Results — *A total of 193 patients were included in this study. There were 118 (63%) females and 75 (37%) males. The age was from 2-months to 16 years, the mean age of 95±93 months. The mean duration of surgery was 33±7minutes. Children less than one year of age were 79 (41%). Congenital variety of hydrocephalus was the most common etiology observed in 69 (35.7%) patients. VP shunt infection occurred in 7 (3.6%) within 3-months of surgery. Coagulse-negative Staphylococci 2 (1%) and Staphylococcus aureus in 4 (2%) were the common pathogens isolated as cause of infected shunt. A p<0.05 was found for topical vancomycin and shunt infection association which was significant. However, the p- value > 0.05 was insignificant for gender and history of prematurity with VP shunt infection.*

Conclusion — *Use of topical vancomycin spray can significantly reduce the infection of the VP shunt.*

Key words — *Cerebrospinal shunt infection, Topical vancomycin, Impregnated-antibiotic catheter.*

INTRODUCTION:

A ventriculoperitoneal shunt is a device for cerebrospinal fluid diversion, which is required in the majority of patients having hydrocephalus. One of the most important steps in this regard is to prevent shunt infection as it can have severe consequences for the patient leading to morbidity and sometimes mortality.[1] The prevalence of shunt infection in developing countries range from 10% to 15% and this is the most frequent reason of shunt revision.[2,3]

The risk factors for ventriculoperitoneal shunt infection include younger age, female gender and etiology of hydrocephalus.[1,4] The most common organisms involved in the shunt infection are found in normal skin flora including Staphylococcus aureus.[5] The patient with infected shunt may develop fever, increase in head size, headache, vomiting, irritability, low conscious level, and seizure.[6]

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Preoperative administration of antibiotics is considered as the mainstay for preventing infection addition to observing standard operation theater sterilization protocols.[7,8] The recent development in this regard is the use of antibiotic impregnated catheters. Meta-analyses showed that these catheters can markedly minimize the rate of shunt infection.[9,10] The use of prophylactic intravenous antibiotics, duration of surgery, with the additional use of antibiotic impregnated catheters, intraventricular (IVT) antibiotics and topical vancomycin administration have been used as an adjuvant method to successfully reduce the shunt related infection.[11] The rationale of this study was to assess the effectiveness of topical vancomycin in reducing shunt related infection and its consequences.

METHODOLOGY:

This was a cross sectional study conducted after approval from ethical committee. Written consent was taken from patients and parents of the minors. The study was done at Neurospinal and Cancer care Institute Karachi from February 2017 to June 2020. The sample size calculated based upon a 15% shunt infection rate with WHO calculator and size of 193 obtained.

Patients who had hydrocephalus, age from 2-months to 16-years, of both gender were included. Patients who were previously operated and had shunt placement, infected cerebrospinal fluid and immunodeficiency were excluded. The diagnosis of hydrocephalus was made on neuroimaging like CT scan brain or MRI brain. CSF detail report was obtained to rule out infection before surgery.

The VP shunt was scheduled as the first operation on the list. To minimize and prevent infection hospital protocol was followed. The intravenous antibiotic ceftriaxone was given to all patients as a prophylaxis and surgical gloves were changed after draping. The head shave was done with the sterilized razor. Vancomycin was chosen in this study because it is considered highly effective against skin flora especially streptococcus and staphylococcus.[9,10] The injection vancomycin 500 mg was added in 300 ml 0.9% NaCl to make a diluted mixture. This cocktail was utilized as a cleanser for the operative area from the skull to the umbilical area. VP shunt was also drenched into the solution. No drug was injected into the ventricle system during the surgery. The bipolar diathermy was used as per requirement. IV antibiotic continued for 48-hours after surgery in all patients.

Patients were followed up to 6-months for any adverse effects related to shunt infection. All data were recorded in a structured form. Data was analyzed on SPSS version 23. Mean and standard deviation was calculated for quantitative data. Frequency and percentage were calculated for qualitative data. For outcome two sided Fisher's exact test and Chi square test were applied. A p-value < 0.05 was considered significant.

RESULTS:

A total of 193 patients were included in this study. There were 118 (63%%) females and 75 (37%) males. The age was from 2-months to 16 years with the mean age of 95±93 months. The mean duration of surgery was 33±7 minutes. Children less than one year of age were 79 (41%). Congenital variety of hydrocephalus was the most common etiology observed in 69 (35.7%) patients.

VP shunt infection occurred in 7(3.6%) within 3-months of surgery. Coagulase-negative Staphylococci in 2 (1%) and Staphylococcus aureus in 4 (2%) patients were the common pathogens isolated as cause of infected shunt. (table-II) A $p<0.05$ was found significant for topical vancomycin and shunt infection. However, the $p>0.05$ was insignificant for gender and history of prematurity with VP shunt infection.

DISCUSSION:

The focus of this study was on minimizing shunt related infection in hydrocephalus patients. This is one of the approaches to minimize shunt infection.[9,10] However, multiple risk factors are also taken into consideration when outcome is analyzed. Antibiotic have been utilized to minimize the infection such as methicillin or cloxacillin and others despite which shunt infection is still a challenge for the neurosurgeons.[12-14.]

Cerebrospinal fluid shunt infection associated with hydrocephalus is considered as one of the leading problems as it results in prolonged hospitalization, repeat surgery, neurological deterioration and adds economical burden.[15] Hence review studies have shown that prophylactic antibiotics have a positive impact on the CSF-shunt infections control. In this study prophylactic antibiotic was also used. Use of topical vancomycin in addition to prophylaxis is reported to reduce the infection from 6.8% to 3%. This was more often noticed in the younger population.[16] In our study the infection was reduced to 3.6% by this approach. This is markedly different from previously reported rate of 10-15% from developing countries. In this study no association of infection was found with the gender and history of prematurity though these are considered as risk

Table I: Demographic Variables and Cause of Hydrocephalus

Characteristics	n=193	Frequency
Gender		
Male	75	37.0%
Female	118	63.0%
Age		
3-months to 1-year	79	41.0%
>1year to 5-years	38	19.6%
6-years to 10-years	34	17.6%
11-years to 16-years	42	21.8%
Etiology		
Congenital	69	35.7%
Aqueduct stenosis	21	11.0%
Tumor	52	27.0%
Tuberculosis	18	9.3%
Post-meningeal sequale /post-trauma	33	17.0%
Prematurity		
No	164	85.0%
Yes	29	15.0%

Table II: Shunt-related Infection

Shunt Infection	n=7	Percentage
<30 days	4	2%
>30 days	3	1.5%
Organisms		
Coagulase-negative Staphylococci	2	1%
Staphylococcus aureus	4	2%
Streptococcus viridans	1	0.6%

Mostafavi et al in their study reported that antibiotic played a significant role in reducing the infection especially in those patients who had CSF glucose level of greater than 40mg/dl or in patients who had gram-negative organisms.[17] The intravenous antibiotics were cost effective as they helped in minimizing the infection.[18] In this study we included only those patients who had no CSF infection and used intravenous antibiotics for two days combined with pre and postoperative cover for 48 hours along-with antibiotic-impregnated shunt catheters. This has been reported to be an effective approach in reducing infection rate.[19]

CONCLUSIONS:

The additional use of topical vancomycin with infection control protocol reduced the rate of shunt infection to 3.6% . This was a significant reduction in infection and cost-effective approach.

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Received for publication: 31-03-2021

Accepted after review: 30-06-2021

Author's Contributions:
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Ethical statement: Hospital ethics committee approval was taken and informed consent from patients obtained.

Competing Interest:
The authors declare that they have no competing of interest.

Source of Funding: None

How to cite this article:
Kalhoro A, Hashim ASM, Sattar AB, Rajper SB. Effectiveness of topical vancomycin to reduce the cerebrospinal fluid shunt infection. J Surg Pakistan. 2021;26 (2):69-73. Doi:10.21699/jsp.26.2.7.