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Original Research Paper

Medical Microbiology

THE STUDY OF BACTERIAL PROFILE IN PERITONEAL FLUID IN PATIENT WITH VP SHUNT

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ABSTRACT

Background Shunt infections can complicate the otherwise successful treatment of hydrocephalus, leading to increased healthcare costs for patients and patient morbidity and mortality. The main cause being the shunt infections ranging to 27%. The most common intra-abdominal response to infection is sheathing of the peritoneal catheter.

Objectives:

1. To isolate and speciate the bacterial infectious agents from various clinical samples of VP shunt tips of VP shunt patients.
2. To note the sensitivity pattern of the isolated organisms.
3. To detect the type of infection and further carry out the microbiological study so that in future infections can be prevented before their complication.

Methodology:

A descriptive and observational study of the peritoneal fluid collected from patients with VP shunt related procedures were carried out at the Government Rajaji Hospital, Madurai and at the Institute of Microbiology of Madurai Medical college. The period of study would be April, 2019 to July, 2019. Peritoneal samples were collected from both the neurosurgery and the Pediatric patients. They were done using a sterile syringe and needle and were stored in sterile containers for microbiological investigations. Specimens were transported through cold chain and in sterile conditions. The samples reached the microbiological lab within 4 hours of collection. **Results** The real incidence of infected shunts is higher than that of the malfunctioning shunts due to the microbial infections. Early detection and management of shunt infection with appropriate antibiotics along with prompt removal. In our study incidence of Shunt infections were 27%. About 50% of the isolated microorganism was found to be Klebsiella Pneumonia. The median age of the patients at the time of VP shunt revision was found to be 17years. Most common aetiology was congenital conditions and the most common complaint was headache. **Conclusion** Risk factors associated with the perioperative and operative period are of critical importance so that we can see reductions in the infection rate.

KEYWORDS : VP shunt, infection, hydrocephalus

INTRODUCTION

Today one of the most common procedures in neurosurgical and Paediatrics practice is insertion of shunt, which has stayed the mainstay of treatment for hydrocephalus over past 50 years. Shunts are used for relieving the intracranial pressure and maintaining the outflow of excess CSF that has accumulated. Despite this lifesaving procedure, our medical health sector is still failing in saving the lives of many. Under this the major target section turns out to be our Pediatrics hydrocephalus patients. The main cause being the shunt infections ranging to 27%. [1]

Even greater concern is the infection-related mortality, with rates up to 20% reported in the literature.[2] The infection rate was 13.6% for an operation lasting more than 90 minutes versus 5.2% for procedures of less than 30 minutes' duration.[3] Most studies report staphylococcus epidermis as the most common infectious agent, followed by staphylococcus aureus.[4] Also approximately 70% of shunt infections occur within 2 months after shunt placement. Infective shunts in hydrocephalus patients lead to adverse neurological outcomes like delayed milestones and mental retardation.[5]

AIMS AND OBJECTIVES

The main objective of the study of bacterial profile in peritoneal fluid of VP shunt patients is

1. To isolate and speciate the bacterial infectious agents from various peritoneal samples of VP shunt tips of VP shunt patients.
2. To note the sensitivity pattern of the isolated organisms.
3. To detect the type of infection and further carry out the microbiological study so that in future infections can be prevented before their complication.
4. To further carry out the data analysis.

METHODOLOGY

A descriptive and observational study of the peritoneal fluid collected from patients with VP shunt related procedures was carried out at the Government Rajaji Hospital, Madurai and at The Institute of Microbiology of Madurai Medical college. The period of study was July and August, 2019.

During this 3-month period of study a total of 48 VP shunt procedures took place. Out of which 28 patients underwent shunt revision and their clinical samples were collected. The peritoneal fluid accumulated in the peritoneal end of shunt tips was collected in sterile screw capped, leak and shatter resistant Uricol 50 ml capacity containers for microbiological investigations. These were properly labelled with the patient's name, medical record number, location and the time and with the date the specimen was collected on. Then the specimens were transported through cold chain and in sterile conditions to the microbiological lab. The samples reached the microbiological lab within 1 hour of collection.

Further the samples were processed. The samples were plated on to the Nutrient agar, blood agar media and Mac-Conkey's. They were incubated at 37^{0}C. The organisms isolated were studied by standard biochemical tests and antibiogram put up. The sensitivity pattern was performed using Kirby-Bauer disk diffusion method and was noted as per CLSI guidelines.

The records included patients from both the neurosurgery and the Pediatric departments. The relevant data included the age and sex of the patient, the clinical condition requiring shunt procedure (e.g., communicating hydrocephalus, obstructive hydrocephalus, or CSF leakage), length of hospital stay, laboratory data, antibiotic prophylaxis, therapy and follow up of the patients. Shunt-specific data was also included along with date of device insertion and revision (if performed) before

infection. Statistical study of bacterial profile and further analysis of the data collected was carried out.

Among the materials required are Sterile screw capped, leak and shatter resistant Uricol 50 ml capacity containers, Nutrient agar, Mac-Conkey's agar and blood agar.

RESULTS

The study included 48 patients who underwent VP shunt surgery. There were 30 male and 18 female patients show male predominance. Age distribution: 12 patients were below 5 years, 28 patients below 20 years and 20 patients above 24 years. Out of 48 VP shunts, 20 VP shunts were 1st time administered and 28 (58.3%) were cases of shunt revision primarily due to physical obstruction and infected VP shunts. The samples were collected from patients who were undergoing shunt revision. The shunt infection rates in our study was found to be 27% - 32% .

Among these 28 clinical samples collected – 8 (28.6%) peritoneal samples showed microbial growth and the other 20 either had no growth (n=4, 14.3%), or were due to obstruction (n=16 57.1%). (Fig1)

Klebsiella pneumoniae, NFGNB and Aerobic spore bearing bacilli were isolated growths from the clinical samples which accounted for 50%, 25% and 25% of the infected microbial growth respectively. (Fig 2)

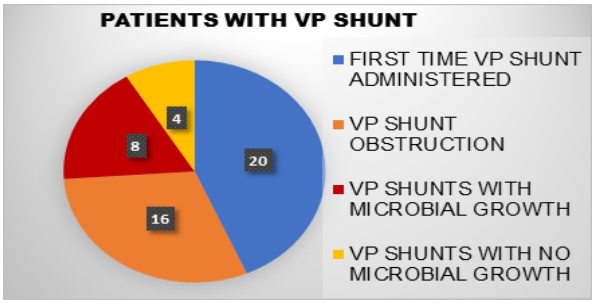

Fig 1.

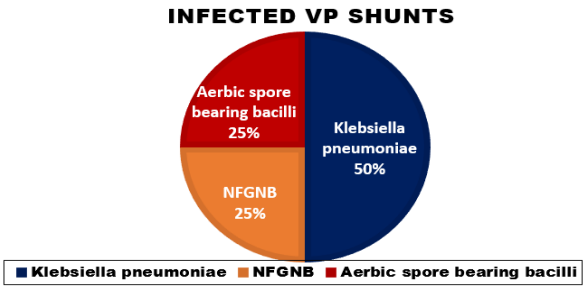

Fig 2.

In healthcare settings, *Klebsiella* bacteria can be spread through person-to-person contact (for example, from patient to patient via the contaminated hands of healthcare personnel, or other persons) or, less commonly, by contamination of the environment. The bacteria are not spread through the air.

It is important to know that these isolated organisms are highly resistant to common antiseptics and disinfectants such as Quantenary Ammonium compounds, Chloroxylenol, and Hexachlorophane and may even grow in hospital antiseptic lotion bottles but are sensitive to acids, beta glutar aldehyde and strong phenolic disinfectants.

Clinical features and chief complaints of VP shunt revision patients were found to be headache (52%), vomiting(22%), lack of appetite(16%), fever, neck tenderness, seizures, general malaise, irritability, pain and erythema with headache and vomiting being most common.(Fig 3)

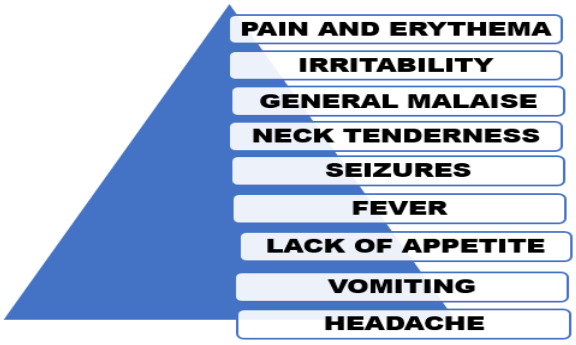

Fig 3. Clinical Features And Chief Complaints Of Vp Shunt Revision Patients

Colonized shunts do not function well mechanically. However, no deaths occurred as a result of shunt infection in our series. The infected VP shunt patients were managed by prompt shunt removal, antibiotic therapy supplemented for 10-14 days along with external drainage if needed, then followed by new shunt replacement.

The bacteria isolated from the infected shunts are either Hospital acquired, from patient's own skin or due to the retrograde infection from gastro intestinal tract. The sensitivity pattern mostly shows them sensitive to Ampicillin, ciprofloxacin, Cefotaxime and Vancomycin and resistant to Penicillin and Gentamycin.

The median age of the patients at the time of VP shunt revision was found to be 17years (range 13 years-18 years). Fig 4.

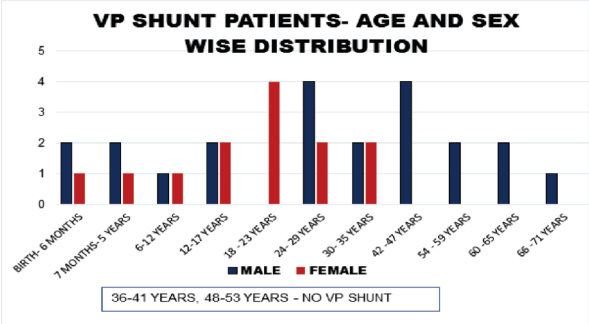

Fig 4.

The most common etiology for the shunt malfunction and revision was found to be congenital (33.3%) followed by aqueductal stenosis(16.6%) and Post Meningitis (16.6%).

Table 1

ETIOLOGY OF HYDROCEPHALUS	48 (n)	%(percentage)
Aqueductal stenosis	8	16.6%
Congenital	16	33.3%
Post meningitis	8	16.6%
Post tuberculous	4	8.3%
CP angle tumour	2	4.2%
4th ventricular outlet obstruction	10	20.9%

DISCUSSION

Shunt infection poses a major threat in the treatment of hydrocephalus patients and still remains a challenge to overcome. In this study, infection (27%) was the second most common complication following shunt surgery responsible for significant morbidity and mortality. First being the shunt dysfunction due to obstruction. 60% of patients with infected VP shunt revision fall under 20 years of age hence showing greater frequency of infection in young adults and children. Children are more likely than adults to acquire shunt infection,

perhaps because of longer hospital stay, higher skin bacterial concentrations, immature immune systems, or more adherent strains of bacteria. Similarly in other Indian studies, it is found that incidence of shunt revision using Chhabra's medium pressure shunt is very high in children at an average follow up of 1.6 yr. [6]

Approximately 50% of shunt infections present were within 6 months of the surgical procedure. Infection rates are much higher in those patients in whom a longer period of hospitalization is required. This emphasizes the need to reduce the duration of hospitalization and to maintain special surgical wound care.

In comparison to the western world where shunt infection rates range from 3% - 9% [7,8], and in African countries 9-32% [9], in our study it was found to be 27% - 32% . Most studies from developed countries report Staphylococcus epidermidis as the most common infectious agent, followed by Staphylococcus aureus and GNB is only 7-20% [10], whereas research at Saudi Arabia showed GNB isolates were maximum and represented 81.3% of pathogens in the study[11] which is more in co-relation to our study which isolates maximum GNB from infected shunts. Infection may be caused either during surgical procedure, due to retrograde infection, from patient's skin or due to hematogenous spread.

It is important that the catheter should be inserted under aseptic techniques and in case of a catheter infection, it is both necessary to remove the shunt and commence the systemic antibiotic treatment. It should also not be forgotten that the timely usage of appropriate antibiotics according to the antimicrobial susceptibility testing is essential for successful treatment. Hence to prevent and manage shunt infections it requires a combined approach of both neurosurgeon and clinical microbiologist.

In western countries, adding intraoperative Vancomycin to a shunt infection prevention protocol significantly reduces CSF shunt infection rate.[12] But more studies are required to document the usefulness of Antibiotic impregnated shunts (AIS), in developing countries like ours.

Risk factors associated with the perioperative and operative period are of critical importance so that we can see reductions in the infection rate. By Identifying the risk factors and predictors of infectious agents, significant reduction in the post infective morbidity and mortality of patients can be achieved.

It was observed that infections could be reduced by simple measures such as-:

a) Hand washing and reducing the bacterial load from patient's skin.
b) Double gloving or changing the gloves during surgery.
c) Minimizing the handling of shunt

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