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Bacterial Isolates from Cerebrospinal Fluid of Ventriculo-Peritoneal Shuntand Their Antimicrobial Susceptibility Pattern at Tertiary Care Hospital.

Dr.M.Nithya[1], Dr.L.Jayalakshmi[2], Dr.G.Jyothilakshmi[3],Dr.P.ShashikalaReddy[4]
1,2,3,4(Department of Clinical Microbiology, Osmania General Hospital & Osmania Medical College, Hyderabad, Telangana- 500095, India)

Abstract:
Background: *Ventriculoperitoneal (VP) shunt placement is the treatment of choice for hydrocephalus that provides a rapid means of normalizing intracranial pressure and prevents neuronal damage. Infection is a frequent complication of neurosurgical procedures that ranges from 2-27% with high morbidity and substantial mortality. The preferred treatment of Cerebrospinal Fluid (CSF) shunt infections involves intravenous antimicrobial therapy. The aim of the present study is to identify the bacterial isolates and their antimicrobial susceptibility in CSF samples of VP shunt patients.161 CSF samples from 125 VP shunt patients received at Microbiology laboratory, Osmania General Hospital from May 2018 to January 2019 were immediately processed for microscopic examination by Gram's stain and bacterial culture. Antibiotic susceptibility testing was done for the isolates by Kirby Bauer disk diffusion method. Of the 161 CSF samples 9 were culture positive (5.59%). Most common isolate was Coagulase negative Staphylococci (4 = 44.4%) followed by Staphylococcus aureus and Klebsiella pneumoniae (2 = 22.2% each) and Escherichia coli (1= 11.2%). All Gram-positive isolates were sensitive to Methicillin. Early detection of VP shunt infections and their antibiotic susceptibility help in appropriate management of the infection.*
Keywords*: Cerebrospinal Fluid, Hydrocephalus, ventriculoperitoneal shunt, Gram's Stain, Gram positive isolates.*

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I. Introduction

Hydrocephalus is a very commonly encountered entity in neurosurgical practice in both pediatric and adult population and is defined as the pathological increase in intracranial cerebrospinal fluid (CSF) volume and can be either congenital or acquired following brain injury, tumor or infection. Normal production of CSF occurs in the ventricles; however, it can accumulate due to overproduction or decreased circulation to other brain compartments. The accumulation leads to swelling of the ventricular system and ultimately to brain damage. (1) Despite the growing use of endoscopic third ventriculostomy, ventriculoperitoneal (VP) shunt has been the treatment of choice for hydrocephalus since the invention of the shunt valve by John Holter in 1959.[2] Its effectiveness has been overshadowed by complications such as infection and mechanical malfunction (1).

Infection is a common complication of ventriculoperitoneal shunt placement with infection rate ranging from 2 – 27%. About 10% of VP shunt infections are found at more than one year after operation. (3) Biofilm forming bacteria such as *Staphylococcus epidermidis* and S*taphylococcus aureus* attach to the surface of implanted devices to cause shunt infections [4]. Gram negative bacteria are next frequent pathogens. (5) Shunt infection is generally defined as the identification of a bacterial pathogen from the CSF both by gram's stain and culture in patients with fever, neurologic symptoms and signs of shunt malfunction (6).

Once infection is suspected, a CSF sample is taken and empirical antibiotic treatment is recommended. (7) The preferred treatment of choice for VP shunt infection is antimicrobial therapy. Though there are many other surgical modalities, antimicrobial therapy is the primary method of treatment but the main disadvantage of antimicrobial therapy is antibiotic resistance. (8)

The objectives of the present study include isolation, identification of the bacterial isolates and their antimicrobial susceptibility in Cerebrospinal Fluid (CSF) samples of VP shunt patients.

II. Material and Methods

A hospital based prospective observational study was done at Microbiology laboratory, Osmania General Hospital from May 2018 to January 2019 on 161 CSF samples received from 125 VP shunt patients.

The relevant data collected include the age, gender of the patient, the clinical condition requiring shunt procedure, antibiotic therapy of the patients. CSF specimens were immediately processed for microscopic examination by Gram's stain and bacterial culture using blood agar, chocolate agar and MacConkey agar. Culture isolates were identified using standard microbiological methods. Antibiotic susceptibility testing was done for the isolates by Kirby Bauer disc diffusion method.

III. Results

During the study period, 161 samples from 61 male and 64 female VP shunt patients were included. Among 61 male patients single sample was received from 46 patients whereas two samples from 8 patients, 3 from 2 patients, 4 samples from 3 patients and from one male patient 6 samples were received at various intervals totalling to 86 CSF samples. Among75 samples from 64female patients, single sample from 55 patients, 2 samples from 7 patients and 3 samples from 2 patients were received. Nine bacterial isolates resulted among 161 samples, giving an overall infection rate of 5.59%. Of the nine patients who got infected, there were five females and four males. One female patient was aged 52yrs with malignancy,3yrs male with post-meningitic hydrocephalus and 19 years male with post traumatic hydrocephalus, while six were aged below 1 year with congenital hydrocephalus. (Fig: 1). Gram's staining examination revealed occasional cells suggesting that the isolates may be from VP shunt tube colonisation. Among the 9 bacterial isolates most common isolate was *Coagulase negative Staphylococcus* (4) followed by *Staphylococcus aureus* (2), *Klebsiella pneumoniae* (2) and *Escherichia coli* (1). The sensitivity pattern of bacterial organisms revealed that all the gram-negative organisms were 100% sensitive to broad spectrum antibiotics like imipenem & tigecycline and resistant to Cefoperazone. The gram-positive bacteria were 100% sensitive to Cefoperazone+Sulbactum and resistant to cloxacillin (Fig: 2).

Figure: 1 showing the gender distribution of culture positives among 161 samples

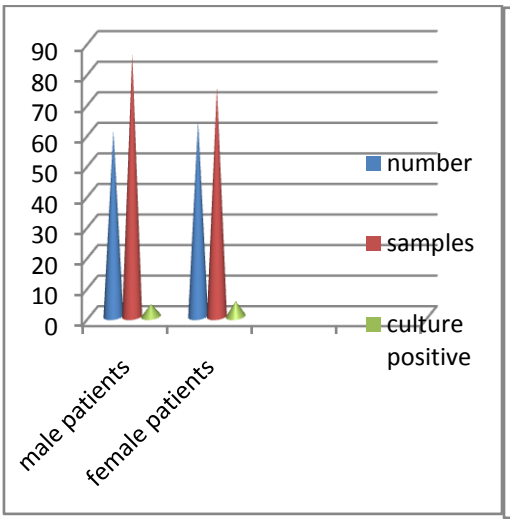
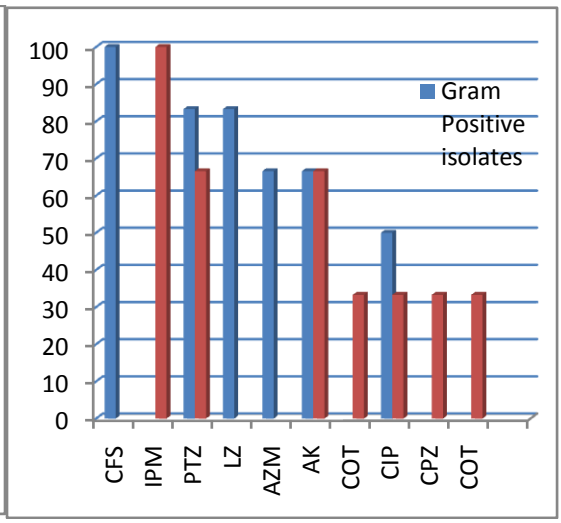


Figure: 2 antibiogram of 6 Gram Positive and 3 Gram Negative isolates



(CFS- Cefaperazone+Sulbactum, PTZ-Piperacillin+Tazobactum, LZ – Linezolid, AZM- Azithromycin, CIP-Ciprofloxacin, COX – Cloxacillin, IPM- Imipenem, COT- Co- Trimoxazole, CPZ – Cephaperazone, AK – Amikacin)

IV. Discussion:

Culture positivity in the present study was 5.59% with nine bacterial isolates andthe remaining 153 samples were sterile. Short duration of surgery and the use of antibiotic prophylaxis were associated with a lower risk of infection. [6]

Coagulase negative Staphylococci were the commonest isolate in the present study and 60.5% of the isolates were *Staphylococcus albus* in Morrice JJ et al study. [9] The findings of previous studies were shown in Table.1

Table: 1 Infection rate and most common isolate in various studies:

Author	% of isolates	Common bacterial isolate
Sarguna et al [5]	3.98 %	*Coagulase negative Staphylococci*
Bokhary et al [7]	25.9 %	*Staphylococcus aureus*
Kumar V et al [8]	50.6 %	*Staphylococcus aureus*
Present Study	5.59 %	*Coagulase negative Staphylococci*

Among Gram negative isolates *Klebsiella pneumoniae* was most common in the present study whereas *Pseudomonas aeruginosa* and *Escherichia coli* were isolated in other studies. Antimicrobial susceptibility testing results showed the development of resistance to commonly used antimicrobial drugs.

V. Conclusion:

When CSF shunt infections are identified early and managed with appropriate antibiotics it helps in reducing excessive morbidity and mortality among VP surgery patients.

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