ORIGINAL ARTICLE

Incidence of Infection and Causative Organisms in Patients with Ventriculoperitoneal Shunting for Hydrocephalus

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ABSTRACT

Objective: *To determine about the incidence of infection and causative organisms in patients with Ventriculoperitoneal shunting for hydrocephalus.*

Materials and Methods: *This retrospective observational study was carried out in the Department of Neurosurgery Lady Reading Hospital Peshawar, from Jan 2012 to Dec 2013 (one year).The medical record of all cases operated in last one year was checked from record room. Documentation was done according to Performa designed indicating age, sex, clinical features and type of microorganism. All patients of either sex and age with Previous Ventriculoperitoneal shunt surgery and Signs and symptoms suggestive of shunt infection were included in the study. While patients of previous Ventriculoperitoneal shunt with no signs and symptoms were excluded from the study. All the data were analyzed by SPSS 20 and results were represented in the form of graphs / tables.*

Results: *Total 82 patients were included in the study in which males were 50 (60.97%) and females were 32 (39.02%). All the patients were in the age range of 6 months to 75 years having mean age of 37.75 years ± 5 SD. 58 (70.73%) were in pediatric age group and 24 (29.26%) were adults. Regarding etiology congenital acquiductal stenosis was the leading cause in children's having 22/58 (37.93%) and CNS tumors were the most common cause in adults having 10/24 (41.66%). Fever and vomiting were the most common mode of presentation with 66 (80%) cases. overall incidence of shunt infection was 12 (14.63%) in which the most common microorganism was coagulase negative staphylococci having 6/12 (50%) cases.*

Conclusion: *Shunt infection most commonly occur in children's and coagulase negative staphylococci is the most common causative organism.*

Key Words: *Incidence, Infection, Ventriculoperitoneal shunting, Hydrocephalus, Coagulase negative staphylococci.*

Abbreviations: *CSF: Cerebrospinal Fluid.*

INTRODUCTION

Hydrocephalus is an enlargement of the ventricular system, which results from an imbalance between production and absorption of cerebrospinal fluid (CSF) within the brain – CSF pathways.[1] Ventriculoperitoneal (VP) shunting of the cerebrospinal fluid (CSF) remains one of the most Important for treatment of patients with hydrocephalus.[2,3] Shunt malfunction and Infection are two most common complications of VP shunt. Shunt infection is defined as isolation of the organism from the ventricular fluid (CSF), shunt tube, reservoir, or blood culture along with the clinical signs and symptoms suggestive of shunt infection or malfunction like fever, peritonitis, meningitis, signs of infection along the shunt tract, or nonspecific signs and symptoms of headache, vomiting, change in mental status, or seizures.[4] In the literature, reported infection rates range from 3% to 27% among children implanted with a VP shunt before the age of 6 months.[5,6] Prematurity is also a risk factor for VP shunt infec-

tions.[6]

While in adults The incidence of shunt-associated infection has a range of 1% – 18%[7,8] and several independent risk factors have been identified, including previous shunt – associated infection, shunt revision for dysfunction, postoperative CSF leakage, advanced age, duration of the shunt placement, experience of the neurosurgeon, and use of a neuroendoscope.[9,10] In children common organisms causing shunt infections are. Staphylococcus aureus and coagulase – negative Staphylococcus species, a variety of gram – negative rods, Proprionibacterium species, and Enterococcus faecalis.[11-14] While in adults, Staphylococcus aureus, coagulase negative Staphylococci, gram negative bacilli and polymicrobial organisms are common infective agents.[15] Shunt infection is suspected when patient present with signs of meningitis, inflammation in the path of the catheter, malfunction of the system, symptoms such as abdominal pain, distension or the presence of intra-abdominal cyst.[16] Other symptoms that may be related to infection are seizures, irritability and changes in the level of consciousness. CT brain can reveal ventricular dilatation. The disconnections throughout the system, highlighted by radiographs of the path of the catheter.[17] Patients with suspected malfunction, or abdominal pain should be submitted to ultrasound to outline collections in abdominal cavity.[18] CSF, Shunt tube, Blood Serum are collected and sent for Culture and sensitivity.

Shunt infection is treated by removing the shunt or distal end exteriorization and vancomycin and a third or fourth generation cephalosporin for 3 – 4 weeks and sub-sequent relocation of the shunt system after negative C&S.[19,20] Previous studies have evaluated shunt – associated infections predominantly in the pediatric population, and only limited data are published about infection in adults.[21,22] We performed a retrospective analysis of consecutive episodes of CSF shunt related infection among both adult and pediatric population, to determine the microbiological characteristics of shunt associated infections and treatment.

MATERIALS AND METHODS

This Retrospective study was carried out in the Department of Neurosurgery Lady Reading Hospital Peshawar, from Jan 2012 to Dec 2013 (one year). The medical record of all cases operated in last one year was checked from record room. Documentation was done according to Performa designed indicating age, sex, clinical features, investigations with findings on X-rays, Cause of hydrocephalus, CT, MRI in specific cases where needed, CSF culture and sensitivity, shunt tube C&S where needed, and serum C&S. All patients of either sex and age with Previous Ventriculoperitoneal shunt surgery and Signs and symptoms suggestive of shunt related infection were included in the study. While patients with no History of shunt infection were excluded from the study. All patients were admitted through casualty. All patients were subjected to detail history, examination, Neuro-imaging like CT brain, MRI brain in specific cases, CSF culture and sensitivity, shunt tubes C&S. Shunt tube lower end was Exteriorized or removed. Patients were put on empirical therapy, Vancomycin and third generation cephalosporin and later on converted according to C&S. Meanwhile EVD was put in (as in adults or children when fontanels closed) or Ventricular taping if fontanels open in children. When 2 consecutive C&S were negative, again shunt was put in. all patients discharged on 4th postoperative day, when the patients were stable. Patient follow-up as per medical record checked after 1 month, 3 months, 6 months and 1 year. All the Data was put in preformed Proforma and data was analyzed using SPSS software version 20.

RESULTS

Total 82 patients were included in the study in which males were 50 (60.97%) while females were 32 (39.02%). All the patients were in the age range of 6 months to 75 years having mean age of 37.75 years ± 5 SD. 58 (70.73%) were in pediatric age group and 24 (29.26%) were adults. Regarding etiology congenital acqueductal stenosis was the leading cause in children's having 22/58 (37.93%), myelomeningoceole in

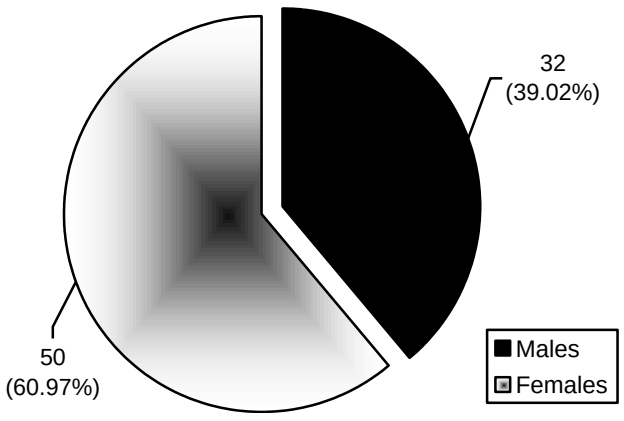

Fig. 1: *Gender Distribution of Patients N = 82.*

20 (34.48%), CNS tumors in 10 (17.24%), post infectious in 3 (5.17%) and post hemorrhagic in 3 (5.17%). CNS tumors were the most common cause in adults having 10/24 (41.66%), Sub arachnoid hemorrhage in 4 (16.66%), Trauma in 3 (12.5%), Normal pressure hydrocephalus in 4 (16.66%), post TBM in 2 (8.33%) and unknown in 1 (4.16%). Fever and vomiting were the most common mode of presentation with 66 (80%) cases, altered sensorium in 10 (12.19%), seizures in 20 (25%), and abdominal tenderness in 3.6%. overall

Table 1: *Age Wise Distribution of Patients N = 82.*

Age of the Patients	No of Patients	Percentage of Patients
< 1 year	20	24.39%
1 to 14 years	38	46.34 %
15 to 45 years	14	17.07%
> 45 years	10	12.19%

Table 2: *Etiology of Hydrocephalus in Children's N = 82.*

Etiology	No of Patients	Percentage of Patients
Congenital acquiductal stenosis	22	37.93%
Post hemorrhagic	3	5.17%
Post myelomeningoceole	20	34.48 %
Post infection	3	5.17%
CNS tumors	10	17.24%

incidence of shunt infection was 12 (14.63%) in which the most common microorganism was coagulase negative staphylococci having 6/12 (50%) cases, Staphylococcus aureus in 2 (16.46%), Streptococcus epidermidus in 2 (16.46%), klebsiella pneumonia in 1 (8.33%), and polymicrobial in 1 (8.33%). Of the infected 12 cases 8 (66.66%) were in pediatric age group and 4 (33.33%) were adults. All the patients were re operated for VP shunting after 2 consecutive C&S were negative. Majority 7 (58.33%) patients had shunt infection in first month of surgery, while 2 (16.66%) in first 3 months, 2 (16.66%) in 6 months and 1 (8.33) in 1 year. Medical records of patients follow up was checked, and patients were followed for shunt reinsertion after, 1 month, 3 months, 6 months and 1 year.

Table 3: *Signs and Symptoms in Shunt Infection Patients N = 12.*

Signs and Symptoms	No. of Patients	Percentage of Patients
Fever	6	50%
Vomiting	2	16.66%
Altered sensorium	2	16.66%
Abdominal tenderness	1	8.33%
Seizures	1	8.33%

Table 4: *Frequency of Causative Microorganisms in Infected Shunts N = 12.*

Causative Organisms	No of Patients	Percentage of Patients
Coagulase negative staphylococci	6	50%
Staphylococcal aureus	2	16.66%
Streptococcus epidermidus	2	16.66%
Klebseilla pneumonia	1	8.33%
Polymicrobial	1	8.33%

DISCUSSION

Most published studies of CSF shunt related infections have involved the pediatric population.[23,24] In the present study, we investigated both pediatric and adult patients of shunt – associated infection. Shunt infection is a very morbid complication of ventriculoperitoneal shunting. Various methods have been tried with variable success. Meticulous aseptic techniques preoperatively and intraoperatively is essential in preventing bacterial colonization.[25] Infections following VP shunt procedure can cause catheter blockage complicating the results of surgery and are associated with high morbidity and mortality.[26] Colonized shunts do not function well mechanically.[27] In our study we had 58 (70.73%) pediatric patients with VP shunt and adults 24 (29.26%). So hydrocephalus more common in pediatric population as compared to adults in our study. We had congenital aqueductal stenosis most common cause of hydrocephalus in 22 (37.93%) in

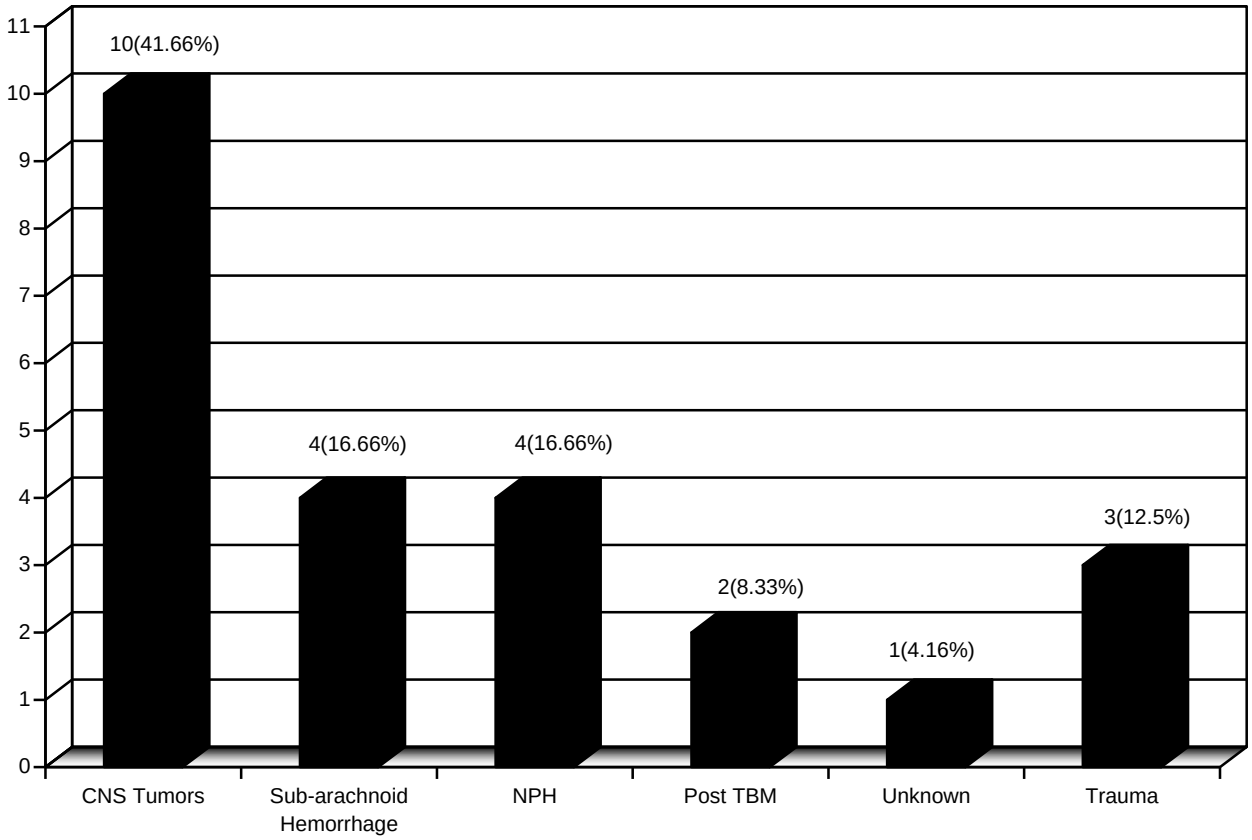

Fig. 2: *Etiology of Hydrocephalus in Adults N = 82.*

children which had more chance of infection in 5 (22.72%). Our results are comparable study conducted by Stephen C etal[28] who reported 23% shunt infection in patients with hydrocephalus due to aqueductal stenosis. We had evaluated shunt infected in 12 patients so incidence of infection is 14.63% which is consistent with accepted rates of pediatric VP shunt infection at other institutions.[29] However, the incidence of infection in shunted patients with hydrocephalus has wide variation, ranging from 1.5% – 69%.[30,31] But in a recent study in our country the rate of shunt infections was reported to be 14.5%,[32] which is very close to our results. We had shunt infection more in pediatric population in 8 (66.66%) as compared to adult population in 4 (33.33%). Ersahin et al, reviewed the charts of 306 patients undergoing 612 shunt procedure and found that patients under 1 year and patients with multiple revisions were at increased risk for infection.[33] So his results are consistent with our results except he reviewed large sample size. Shunt infection is more in pediatric age. We found coagulase negative staphylococci most common organisms 6 (50%) causing shunt infection, followed by Staph aureus and Streptococcus epidermidis. which is comparable to international study in which coagulase negative staphylococci cause 36 to 80% of shunt infection.[34,35] In gram positive shunt infections, majority of the organisms are commensals of the skin, a result of direct wound contamination during surgery.[36] Although gram negative bacterial colonization of the skin is not common, they could probably be introduced during surgery. Another probable mechanism is 'retrograde' infection, in which an asymptomatic perforation of the bowel leads to distal contamination of the VP shunt catheter and retrograde progression of infection.[37] In another international study The organisms most frequently causing infections of indwelling ventricular catheter are the coagulase – negative staphylococci. The second most frequent pathogen is S. aureus[38-41] which is comparable to our study.

CONCLUSION

Shunt infection most commonly occur in children's and coagulase negative staphylococci is the most common causative organism.

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