

Meningitis in Closed Head Injury 2 Years Experience at Lahore General Hospital

RIZWAN MASOOD BUTT, ASHRAF SHAHEEN, MANZOOR AHMED

Nazir Ahmed

Department of Neurosurgery, PGMI / Lahore General Hospital, Lahore

ABSTRACT

During the time period of January 2006 till December 2007 there were 114300 patients with closed head injuries admitted at The Department of Neurosurgery Lahore General Hospital Lahore. The patients with closed head injury who developed meningitis were 17 and presented with headache, vomiting and neck stiffness. Headache was the commonest symptom. Diagnosis was made with the help of post contrast CT scan brain and CSF examination. Majority of patients admitted with head injury were adults while among patients who developed meningitis predominantly were children. Road traffic accident was the commonest cause of trauma. Majority developed meningitis within 6 weeks of trauma. There was no patient who developed meningitis after 12 weeks. Glasgow coma score at admission was above 8 in most of the patients. All patients were treated with combination of antibiotics for 6 to 12 weeks. Clinically outcome was moderate disability and good recovery in most of the cases.

Conclusion: *Meningitis may occur following closed head injury. Its incidence is more in children than in adults. Responsible organism is not commonly identified on CSF examination. Outcome is reasonably good after proper management. Prophylactic antibiotics to all patients with closed head injury are not required.*

Key words: *Meningitis, Brain injury, Cerebrospinal fluid leak, Skull fracture, Closed head injury.*

INTRODUCTION

Meningitis after head injury is a known complication after base of skull fracture, dural tear and CSF leakage. This indicates an open fracture. Prophylactic antibiotics have a role in such cases.¹⁻⁴ When there is no skull base fracture, no cerebrospinal fluid leakage and no pneumocephalus on CT then it is a closed head injury. The study aims to identify the incidence of such cases and their outcome.¹⁻⁵

MATERIALS AND METHODS

Objectives of study were to estimate the actual incidence of meningitis in closed head injury, the time interval after which meningitis develops and outcome of treatment.

Inclusion criteria were patients of all ages and both sexes, who had meningitis after closed head injury. All patients with posttraumatic meningitis after any time interval were included. Those who had received anti-

biotics for any reason were included. **Exclusion criteria** meant penetrating brain injury, open skull fractures or any craniospinal surgery. The cases with, CSF rhinorrhea, CSF otorrhea, and radiological evidence of skull base fractures such as intracranial air were excluded. **Study design.** The study is an observational study. The patients were hospitalized till recovery of meningitis and discharged when stable. Follow-up was of 2 months. **The diagnosis of bacterial meningitis** was made on clinical presentation and CSF examination. Cerebrospinal fluid findings included increase in leukocyte count, decrease in CSF glucose (<60% of the level simultaneously measured in blood), increase in protein to > 45 mg/dL and positive CSF smear or culture. Our study has certain limitations. Analysis did not allow us to evaluate specific risk factors for post traumatic meningitis. Patients were followed to a maximum of 2 months, so we may have underdiagnosed delayed cases. The large number of patients is a strength of this study.

RESULTS

During the period of 2 years of study, 11430 patients with closed head injuries were admitted at Department of Neurosurgery Lahore General Hospital. There were 17 patients with closed head injury who developed meningitis, bringing incidence to 0.015%. The adults were 8021 (70%) and children were 3409(30%) (Chart 1).

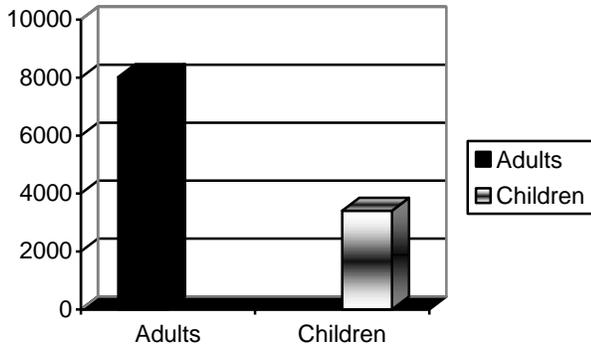


Chart 1: Incidence of head injury according to age.

Among total 17 patients who developed meningitis, paediatric cases were 15 (88%) and 2 (11.7%) were adults (Chart 2).

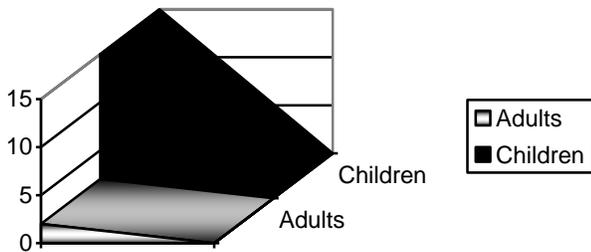


Chart 2: Incidence according to age.

According to causes of head injury, road traffic accidents (RTA) were cause in 9 (52.9%), falls in 5 (29.4%) and assaults in 3 (17.6%) patients.

The patients presented with headache, vomiting and neck stiffness. Headache in 17 (100%), vomiting in 15 (88%), neck stiffness in 13 (76%) and all symptoms combined were seen in 9 (52.9%) patients (Chart 4).

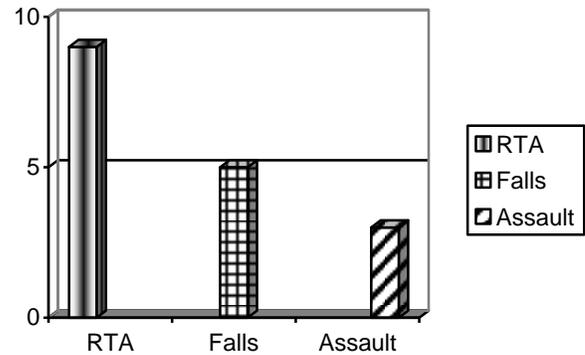


Chart 3: Causes of head injury.

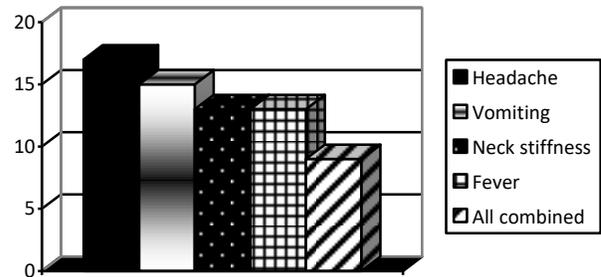


Chart 4: Clinical features of patients with meningitis.

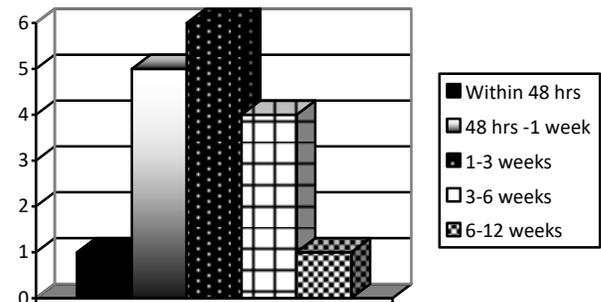


Chart 5: Time interval between head injury and presentation with meningitis.

CT with contrast was positive in 17 (100%) patients. Cerebrospinal fluid examination was performed in 8 (47%) patients. It showed no organism in 4, staphylococcus in 2, pneumococcal in 1 and mixed organisms in 1 patient. According to time interval between closed head injury and development of meningitis following facts were noted. Within 48 hours 1 (5.4%), between 48 hours to 1 week 5 (29.1%), bet-

ween 1 to 3 weeks 6(36%), between 3 to 6 weeks 4 (24%), between 6 to 12 wks 1 (5.4%) and after 12 weeks no patient developed meningitis (See Chart 5).

There were 3 patients who developed meningitis during hospital stay, while 14 developed meningitis after being discharged from initial admission and needed readmission. Glasgow coma score at admission was noted. Between GCS 13-15 there were 8 (47%), between 12-8 there were 5 (29.4%) and between 7-3 GCS there were 4 (23.5%) patients.

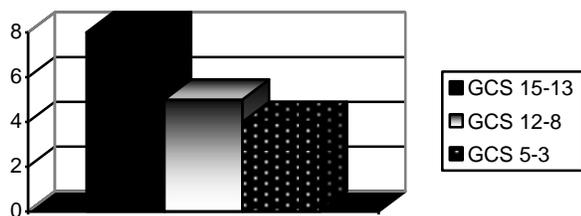


Chart 6: Glasgow coma score at admission.

All patients were treated with a combination of 3rd generation Cephalosporin, Benzyl penicillin and Metronidazole according to body weight for 6 to 12 weeks. Improvement was seen within 24 hours in 9 (52.9%), between 48 to 72 hours in 6 (35%) and after 72 hours in 2 (11.7%) patients.

Table 1:

Duration of Improvement	No.	%
Within 24 hours	9	52.9%
24 – 48 hours	6	35%
After 72 hours	2	11.7%

According to condition at discharge clinical outcome was measured using the Glasgow outcome scale (GOS) which defines five categories:

- 1) *death*, Mortality was 1 (5.8%) patient.
- 2) *vegetative* (unresponsive) in 1 patient
- 3) *severe disability* (unable to live independently) in 4.
- 4) *moderate disability* (independent but unable to return to work or school), in 6 and
- 5) *good recovery* (able to return to work or school) in 5 patients, Among survivors, follow-up was 3 months.

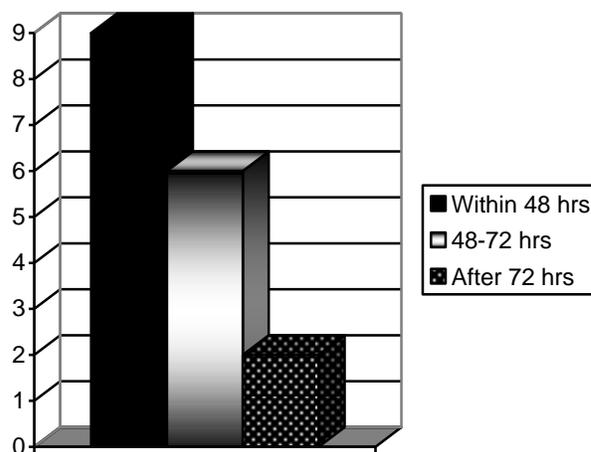


Chart 7: Improvement after onset of meningitis treatment.

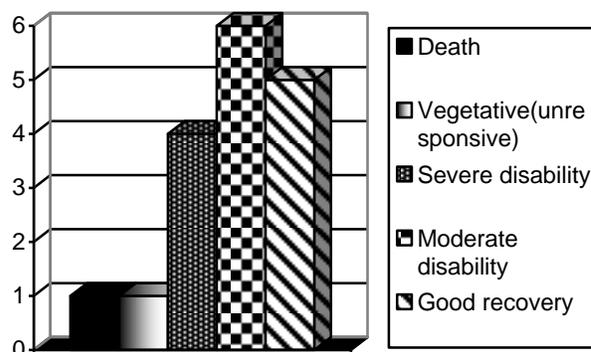


Chart 8: Outcome of patients after meningitis from closed head injury.

DISCUSSION

Incidence

Post-traumatic meningitis is reported to have incidence ranging from 0.38-2.03% A CSF fistula is seen in 16.5-80% of all cases of posttraumatic meningitis and serves as a portal of infection. Base of skull fractures mostly are not diagnosed on plain x-rays. With the availability of CT scan, skull base fracture and pneumocephals is easy to identify. Pneumocephalus can be seen in 78% to 86% of those with a skull base fracture.^{1,3,6-8} The posttraumatic meningitis after pneumocephalus is seen in 21.5%. Among skull base fractures patients and CSF fistula incidence of meningitis was 20%. In a study out of 4,788 only 0.56% patients with head injury developed meningitis. The incidence of

posttraumatic meningitis after head trauma ranges from 0.2 to 17.8 per cent. It is reported that 6 % of patents with closed head injury developed meningitis.^{2,5,6}

Table 2:

No.	Outcome	No.	Percentage
1.	Death	1	
2.	Vegetative	1	
3.	Severe Disability	4	
4.	Moderate Disability	6	
5.	Good Recovery	5	

Causes of Injury

Motor vehicle crashes were the most common mechanism of injury, then falls, blunt assault, and gunshot wounds. Such patterns are common worldwide.^{1,3}

Pathophysiology

A skull fracture with accompanying dural tear results in a CSF fistula. This allows the passage of microorganisms into the cranial compartment. Diagnosis is difficult when CSF leakage is of low volume, intermittent or obscured by blood. CSF leaks may resolve spontaneously but patients remain at risk for meningitis as dural healing may be absent and the fracture may be covered with a small fibrous tissue or brain parenchyma.^{2,4} Using coronal CT, Farrell evaluated 30 patients with non-meningococcal meningitis following head injury and found a fracture in all cases, which corresponded to the site of the dural tear when surgery was carried out.⁵

Trauma – Meningitis Interval

The time between injury and diagnosis of PTM ranges from less than 24 hours to many years. Mean injury-infection intervals ranges from 8.4 days to 3.4 years.^{2,3,5} The median injury-infection interval, which is truer representation, ranges from 5-13 days.⁷⁻⁹ Our series is consistent with others as the median injury-infection interval was 10 days and the diagnosis of meningitis was made within 15 days of injury in 78% cases.

Clinical Presentation

A headache, fever, rapid progressive change in mental

status with stiff neck occur in meningitis. Headache has been noted in 57-86% of patients. Fever was seen in all patients. Neck stiffness was seen in 48%. Deterioration in consciousness is seen in 97-100% of cases.^{1,2,4} Majority of the patients had GCS between 13-15 at admission. This may be the reason of good outcome in our study. Studies have suggested that posttraumatic meningitis onset within 3 days in patients with non-penetrating, non-depressed injuries was uniformly pneumococcal and recommended empiric therapy. While the infecting organism is likely to be from the nasopharynx or external auditory canal, nosocomial bacteria cannot be excluded until culture results are known.^{1,9-11}

Laboratory Diagnosis of Meningitis

The diagnosis of meningitis is mainly on clinical signs and CSF examination. Positive CSF culture or a negative CSF culture in the presence of elevated neutrophil count, elevated protein concentration, and decreased glucose (less than 2/3rd of serum level). In 9 patients treatment was started without CSF examination, since lumbar puncture was believed to place them at risk for transtentorial herniation or reluctance on the part of the family. The CSF cultures may be positive in 73-100% of patients. Causative agents for posttraumatic meningitis include a wide range of both gram-positive and gram-negative organisms. Streptococcus pneumonia is the most common agent present in air sinuses and is isolated in 52-100% of cases. Others include Staphylococcus aureus and Streptococcal species. Gram-negative organisms may be seen in 17-100% and are noted in open cranial wounds or lengthy hospitalizations. Commonly isolated gram-negative bacteria include Escherichia coli, Klebsiella pneumonia, Neisseria meningitidis, Haemophilus influenzae, and Pseudomonas aeruginosa.¹¹⁻¹⁵

Management and Outcome

Antibiotics were started before the CSF culture and sensitivity report. A combination started was of Benzyl penicillin and 3rd generation Cephalosporin with Metronidazole. It covered both gram positive, gram negative and anaerobes with ability to penetrate the blood-brain barrier. The treatment was continued for 3 weeks or till 48 hours after complete recovery from meningitis. Patients were managed in an intensive care unit till they improved and got shifted in wards. Associated infections occurred in 37-70% patients including pneumonia, urinary tract infection.^{14,15} Admission

GCS was predictive of a good functional outcome but did not predict death from infection. Our outcome is comparable with other studies.¹⁶⁻²²

Common complications include pneumonia, deafness, anosmia, mental retardation, or other major neurologic deficits. A patient who dies with PTM should have a post-mortem examination for forensic implications.¹⁵ Mortality ranges from 0-65%. Our mortality rate of 5.8% is comparable with other series of critically ill patients. Considering the serious complications of the posttraumatic meningitis, still giving prophylactic antibiotics to all patients with closed head injury is not justified.

CONCLUSION

Meningitis may occur following closed head injury. Its incidence is more in children than in adults. Responsible organism is not commonly identified on CSF examination. Outcome is reasonably good after proper management. Prophylactic antibiotics to all patients with closed head injury are not required.

Address for Correspondence:

Prof. Rizwan Masood Butt

Department of Neurosurgery

SIMS / Services Hospital, Lahore

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