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Research Article

Assessment of etiological agents and the clinical outcome in cases of acute bacterial meningitis

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ABSTRACT

Objectives: To determine the frequency of common etiological agents (i.e. Streptococcus pneumonia, Neisseria meningitides and Haemophilus influenza) in CSF-culture positive acute bacterial meningitis.
To determine the frequency of survival of patients with acute bacterial meningitis.
Material and methods: This case series study was conducted at Department of Medicine, Bahawal Victoria Hospital, Bahawalpur from January 2017 to June 2017. Total 292 patients of acute bacterial meningitis was selected for this study.
Results: Mean age of the patients in this study was 39.98 ± 17.57 years. Streptococcus pneumoniae was detect in 153 (52%) patietns followed by Nesseria meningitides 105 (36%), Hamemophilus influenza 34 (12%). Survival rate in this study was 239 (82%) and 53 (18%) were expired.
Conclusion: Streptococcus pneumoniae was the most common etiological agent which cause acute bacterial meningitis. Male are more victim of acuter bacterial meningitis as compare to female. Survival rate is not associated with gender of the patients. Survival rate is significantly associated with age of the patients.

Key words: Meningitis, Lactate dehydrogenase, Cerebrospinal fluid, Meningococcus, Neisseria meningitidis, Invasive meningococcal disease, Meningitis, Epidemiology, Meningitis belt

INTRODUCTION

Acute Bacterial Meningitis (ABM) is an acute purulent infection within the subarachnoid space. It is the most common and dreadful CNS infection, carrying high mortality and morbidity.[1] Globally 1.2 million new cases are diagnosed annually.[2]It contributes to a significant proportion of admissions in Medical and High Dependency Units of the hospitals.

In adults, ABM is commonly caused by Streptococcus pneumoniae, Neisseria meningitidis, Haemophilusinfluenzae, Staphylococcus aureus, and the gram negative bacilli Escherichia coli and Klebsiella.[3] In one study of 121 patients with ABM, S. pneumoniae accounted for majority of cases (47.4%), followed by N. meningitidis (33.9%), and H. influenzae (10.2%).[4] Less common causes include Listeria monocytogenes and Proteus. Rare causes are Acineobacter, Group B Streptococi, and Streptococcal viridians.

ABM has a wide spectrum of clinical presentations including fever, headache, neck stiffness and altered sensorium. The disease has a high rate of complications (68%).[5] Common complications include seizures, hydrocephalus, cranial nerve palsies, mono- or hemiplegia, and intracranial thrombosis. ABM carries an overall mortality of 14%. Highest mortality is for S.

pneumoniae (19-37%), followed by N. meningitidis (10%) and H. Influenzae (5%).[6] In general, risk of death from ABM increases with decreased level of consciousness at presentation, early onset of seizures i.e. within 24-hours of admission, signs of raised intracranial pressure, old age > 50 years, co-morbidities including diabetes mellitus, and delay in the early diagnosis and/ or prompt treatment. Decreased Cerebrospinal Fluid (CSF) glucose concentration (< 40 mg/ ml) and markedly increased CSF protein concentration (>300 mg/ ml) are other predictors of increased mortality and poorer outcome.[7]

The diagnosis of ABM relies on CSF complete examination (C/E) while the identification of its etiological agent(s) requires CSF Gram Stain and Culture & Sensitivity. The CSF Culture for etiological agent is positive in 70-90% cases of ABM.[8]Before performing diagnostic Lumbar Puncture (LP) it is prudent to rule out any Space Occupying Lesion (SOL) Brain or markedly raised intracranial pressure by CT-Scan brain and fundoscopy.

In view of above, the present study will determine the frequency of common etiological agents of ABM on the basis of CSF culture & sensitivity, as well as the clinical outcome of disease. This will help to guide the treating physicians regarding the more prevalent causes and the different complications of ABM in our patients.

OPERATIONAL DEFINITIONS:

1) CSF-Culture positive:

It is demonstration of specific bacterial growth on culture of collected CSF samples i.e.:

Streptococcus pneumoniae- Gram stain showing lancet-shaped gram positive capsulated displococci; On culture forming small round alpha hemolytic colonies in blood agar.

Neisseria meningitides- Gram stain showing paired kidney beans shaped gram negative capsulated cocci; on culture forming oxidase-positive colonies in chocolate agar.

Haemophilus influenza- Gram stain showing small gram negative capsulated rods; on culture forming colonies in enriched-chocolate agar (Heme and Factor V-encriched)[9]

(These findings was confirmed by Assistant Professor Microbiology of Pathology Department).

2) Acute Bacterial Meningitis:

Patients presenting with less than 7 days history of neck rigidity in addition to any of the following complaints(s):

- Fever (recorded body temperature > 100^0F)

-Headache (subjective complaint on clinical history), and/or

-Altered sensorium (Decreased Glasgow Coma Scale score <15/15).

- On clinical examination patients having signs of meningeal irritation i.e.

Neck stiffness (Pain and resistance on passive neck flexion.)

Kernig'sign (Pain in hamstrng muscles of tight on knee extension. Beyond 90^0 with hip flexed at 90^0)

- The diagnostic LP showing presence of all of the following:

- WBCs > 100/ ml with > 50% of neutrophilicpleocytosis in CSF.

- CSF proteins > 45 mg/ ml.

- CSF glucose < 40 mg/ ml or < 40% of simultaneous serum glucose level.[7]

Survival Rate:

Mortality is defined as the death of patient after 24 hours and within 7 days of hospital stay while on treatment of AB M. (Patient was followed till 7 days while on treatment of ABM).

MATERIAL AND METHODS:

This case series study was conducted at Department of Medicine, Bahawal Victoria Hospital, Bahawalpur from January 2017 to June 2017. Total 292 patients of acute bacterial meningitis was selected for this study.

Inclusion criteria:

- Age = 15-65years
- Both male and female
- Cases of CSF culture positive acute bacterial meningitis.

Exclusion criteria:

- Partially treated cases of ABM
- CT Brain evidence of SOL / Intra cranial hemorrhage
- CSF with > 50% lymphocytic pleocytosis for viral meningoencephalitis.
- Tuberculous meningitis (ZN Stain pos+ CSF)
- Cerebral malaria (MP pos+Blood film)
- Hematological malignancy i.e. leukemia and lymphoma (suggestive blood peripheral morphology)
- Systemic Lupus Erythematosis (Serum ANA pos+)

DATA COLLECTION PROCEDURE:

This study was carried out at Bahawal Victoria Hospital which is a tertiary care center. Two hundred and ninety two patients was included in the study after scrutinizing with inclusion and exclusion criteria. Approval was taken from Institutional Review Board and informed written consent was taken from every patient and/ or attendant(s). Name, age, gender and hospital registration number was entered in the proforma.

The patients presenting with signs and symptoms of acute bacterial meningitis was admitted in the hospital. After excluding any SOL brain by CT-Scan Brain and fundoscopy, patient was put in either sitting or lateral recumbent position. After strict antiseptic measures and giving local anesthesia, diagnostic lumbar puncture was done in L4/L5 or L3/L4 intervertebral space to obtain 10 mL of CSF for C/E, Grams stain and Culture & sensitivity. Sample was collected in sterile bottle and sent to Pathology department of hospital. CSF was inoculated in blood, chocolate and thiomartin agar plates. The result of CSF Culture & Sensitivity and the clinical outcome of disease was entered in the patient proforma.

DATA ANALYSIS:

All the data was entered and analyzed in SPSS Version 16. Mean and standard deviation was calculated for numerical data like age and duration of hospital stay. Frequencies was calculated for every etiological agent (Streptococuspneumoniae, Neisseria meningitides and Haemophilus influenza) and survival. Stratification was done for age, gender and duration of hospital stay after stratification chi-square test was applied to see the level of significance. P value ≤ 0.5 was considered significant.

RESULTS:

Mean age of the patients in this study was 39.98 ± 17.57 years.

Among the 292 patients of ABM, Streptococcus pneumoniae was detect in 153 (52%) patietns followed by Nesseria meningitides 105 (36%), Hamemophilus influenza 34 (12%). (Fig. 1)

Survival rate in this study was 239 (82%) and 53 (18%) were expired. (Fig. 2)

As shown in table No.1 Streptococcus pneumoniae was found in 153 (52.40%) patients and 116 (75.82%) were survived. Among the 105 (35.96%) with Nesseria meningitides survival rate was 95 (90.48%). Out of 34 (11.64%) patients with Hamemophilus influenzae, survival rate was 28 (82.35%). Significant (P. value 0.011) association was found between etiological agent and survival of the patients.

Stratification for gender was done. Out of 178 (60.96%) male patients, survival rate was 147 (82.58%) and out of 114 (39.04%) female patients survival rate was 92 (80.7%). Insignificant (P. value 0.684) association was found between gender and survival of the patients. (Table No. 2)

As shown in table No.3, two age groups was made age group 15-40 years and age group 41-65 years. Among the 147 (50.34%) of age group 15-40 years survival rate of the patients was 133 (90.38%). Out of 145 (49.66%) patients of age group 41-65 years, survival rate was 106 (73.1%). A significant association of age with rate of survival was seen. P. value 0.000.

Duration of hospital stay of the patients was divided into two groups 1-3 days group and 4-7 days group. Total 149 (51%) patients belonged to 1-3 days group and 143 (49%) patients belonged to 4-7 days group. Survival rate was 26 (17.5%) and 27 (18.88%) of group 1-3 days and 4-7 days respectively. Insignificant (P = 0.764**)** association

between duration of hospital stay and survival rate was seen. (Table 4)

Stratification of age in relation to pattern of etiological was done. Two age groups was made, age group 15-40 years and age group 41-65 years. In age group 15-40 years Streptococcus pneumonia, Nesseria meningitides and Hamemophilusinfluenzae were found in 75 (51.02%), 57 (38.76%) and 15 (10.2%) patients respectively. Among the 145 (49.66%) patients of age group 41-65 years, Streptococcus pneumonia, Nesseria meningitides and Hamemophilusinfluenzae were found in 78 (53.79%), 48 (33.1%) and 19 (13.1%) patients respectively. Insignificant (P = 0.525) association between age and pattern of etiological agent was found. (Table 5)

Out of 178 (60.96%) male patients, Streptococcus pneumonia, Nesseria meningitides and Hamemophilus influenzae were found in 91 (51.12%) patients, 62 (34.83%) patients and 25 (14.04%) patients respectively. Out of 114 (39.04%) female patients, Streptococcus pneumonia, Nesseria meningitides and Hamemophilus influenzae were found in 62 (54.39%), 43 (37.72%) and 9 (7.89%) patients. Insignificant (P = 0.278) association between gender and pattern of etiological agent was seen. (Table 6)

Out of 149 (51.03%) patients with duration of hospital 1-3 days, 73Streptococcus pneumonia, Nesseria meningitides and Hamemophilus influenzae were found in 73 (49%), 56 (37.58%) 20 (13.42%) patients respectively. In duration of hospital stay 4-7 days group, out of 143 (48.97%) patients, Streptococcus pneumonia, Nesseria meningitides and Hamemophilus influenzae were found in 80 (55.94%), 49 (34.27%) and 14 (9.79%) patients respectively. Insignificant (P = 0.423)association between duration of hospital stay and pattern of etiological agent was seen. (Table 7)

Fig. 1: Pattern of etiological agents in patients of ABM

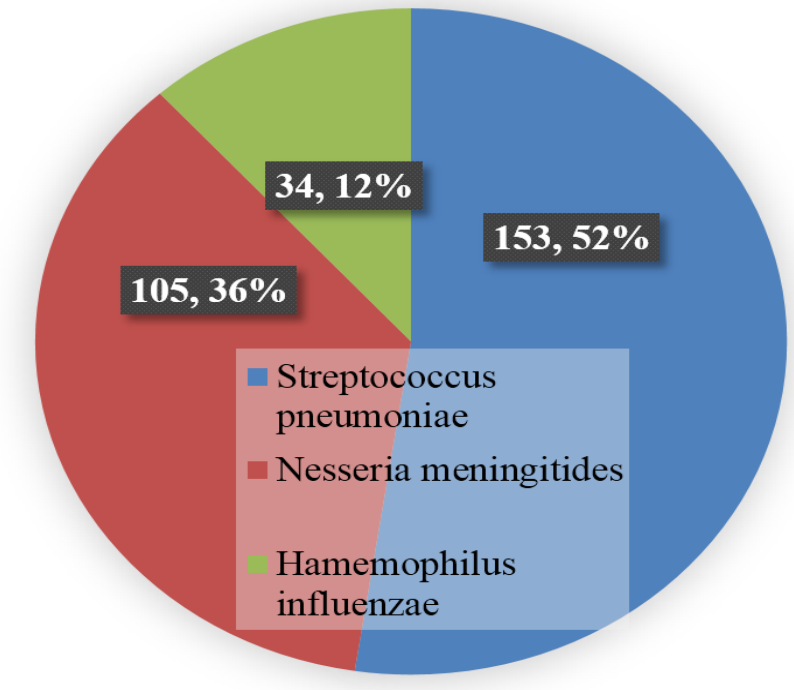

Fig. 2: Survival rate of patients with ABM

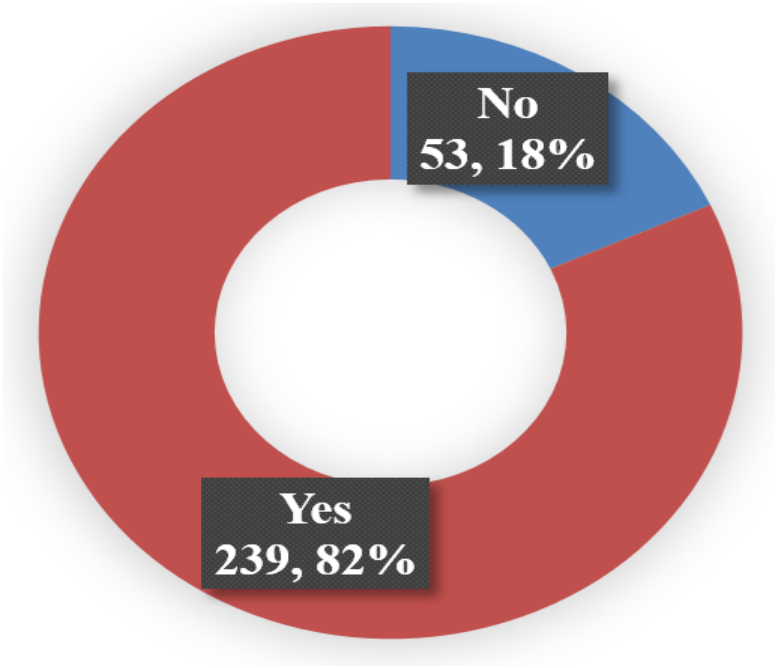

Table 1: Association of etiological agent with survival

Etiological Agent	Survival		Total	P. value
	No (%)	Yes (%)		
Streptococcus pneumoniae	37 (24.18)	116 (75.82)	153 (52.40)	**0.011**
Nesseria meningitides	10 (9.52)	95 (90.48)	105 (35.96)	
Hamemophilusinfluenzae	6 (17.65)	28 (82.35)	34 (11.64)	
Total	**53 (18.15)**	**239 (81.85)**	**292**	

Table 2: Association of gender with survival

Gender	Survival		Total	P. value
	No (%)	Yes (%)		
Male	31 (17.42)	147 (82.58)	178 (60.96)	**0.684**
Female	22 (19.3)	92 (80.7)	114 (39.04)	
Total	**53 (18.15)**	**239 (81.85)**	**292**	

Table 3: Association of age with survival

Age Group	Survival		Total	P. value
	No (%)	Yes (%)		
15-40	14 (9.52)	133 (90.48)	147 (50.34)	**0.000**
41-65	39 (26.9)	106 (73.1)	145 (49.66)	
Total	**53 (18.15)**	**239 (81.85)**	**292**	

Table 4: Association of duration of hospital stay with survival

Duration of hospital stay	Survival		Total	P. value
	No (%)	Yes (%)		
1-3	26 (17.5)	123 (82.5)	149 (51)	**0.764**
4-7	27 (18.88)	116 (81.12)	143 (49)	
Total	**53 (18.15)**	**239 (81.85)**	**292**	

Table 5: Association of age with etiological pattern

Age Group	Pattern of etiological agent			Total	P. value
	Streptococcus pneumoniae	Nesseria meningitides	Hamemophilusinfluenzae		
15-40	75 (51.02)	57 (38.76)	15 (10.2)	147 (50.34)	**0.525**
41-65	78 (53.79)	48 (33.1)	19 (13.1)	145 (49.66)	
Total	**153 (52.4)**	**105 (35.96)**	**34 (11.64)**	**292**	

Table 6: Association of gender with etiological pattern

Gender	Pattern of etiological agent			Total	P. value
	Streptococcus pneumoniae	Nesseria meningitides	Hamemophilusinfluenzae		
Male	91 (51.12)	62 (34.83)	25 (14.04)	178 (60.96)	**0.278**
Female	62 (54.39)	43 (37.72)	9 (7.89)	114 (39.04)	
Total	**153 (52.4)**	**105 (35.96)**	**34 (11.64)**	**292**	

Table 7: Association of duration of hospital stay with etiological pattern

Duration of hospital stay	Pattern of etiological agent			Total	P. value
	Streptococcus pneumoniae	Nesseria meningitides	Hamemophilusinfluenzae		
1-3	73 (49)	56 (37.58)	20 (13.42)	149 (51.03)	**0.423**
4-7	80 (55.94)	49 (34.27)	14 (9.79)	143 (48.97)	
Total	**153 (52.4)**	**105 (35.96)**	**34 (11.64)**	**292**	

DISCUSSION:

Meningitis is an infection of the membranes (meninges) surrounding the brain and spinal cord. Meningitis is usually of multiple etiology-bacterial, fungal or viral yet bacteria remain the common etiological agent. Meningitis can be acute, with a quick onset of symptoms, or chronic, lasting a month or more, or can be mild or aseptic, but the emphasis should be on identification of cause so that appropriate interventions can be applied.[9]

Bacterial meningitis continues to be a potentially life threatening emergency with significant morbidity and mortality throughout the world and is an even more significant problem in many other areas of the world, especially in developing countries.[10-11]

In present study mean age of the patients with acute bacterial meningitis was 39.98 ± 17.57 years. Mean age of the patients of acute bacterial meningitis was 41±12.3 years reported by Ahmad et al.[12]

In our study among the 292 patients of ABM, Streptococcus pneumoniae was most common (52%) patients followed by Nesseria meningitides 36%, Hamemophilus influenza in 12% cases. In one study by Abdulrab et al,[4]121 patients with acute bacterial meningitis was recruited and Lumbar puncture was performed in 112 (92.6%). The most common pathogen was Streptococcus pneumoniae found in 47.4% of positive cultures, Neisseria meningitidis in 33.9%, and Haemophilusinfluenzae in 10.2%. Findings of this study are in favor of our study.

Ahmad et al[12] also reported the most common organisms isolated were Streptococcus pneumoniae in 35 (36.8%) patients followed by Neisseria meningitides in 30 (31.5%) patients. Findings of this study are also similar with our study.

Abro et al,[13] among 53 bacterial meningitis patients, Neisseria meningitides were isolated in 29(54.7%), Strept. Pneumoniae in 18(33.96%), Staph.Aureus in 2(3.77%, Klebsiell Pneumoniae in 2(3.77%), Strept.Agalactiae in 1(1.8%) and E.Coli in 1(1.8%). Results of this study is not in favor in of our study because in our study the most common isolated etiological age was Streptococcus pneumoniae but in this study the most common isolated etiological ages is Neisseria meningitides.

In our study survival rate was 239 (82%) and 53 (18%) were expired. In one study by Abdulrab et al,[4] mortality rate in patients with acute bacterial meningitis was 22.3% which is comparable with our study. Abroet al[13] reported mortality rate as 7.54% which is lower than our study.

In our study male are more victim of acute bacterial meningitis as compare to female. In cases with bacterial meningitis there is a slight male predominance reported by Ahmad et al.[12]Male predominance was also seen by Abro et al in their study. In their study male patients was 84.21% and female patients was 15.78%.

CONCLUSION:

Streptococcus pneumoniae was the most common etiological agent which cause acute bacterial meningitis. Male are more victim of acuter bacterial meningitis as compare to female. Survival rate is not associated with gender of the patients. Survival rate is significantly associated with age of the patients.

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