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Research Article

THE DETERMINATION OF FREQUENCY OF ETIOLOGICAL AGENTS AMONG ACUTE BACTERIAL MENINGITIS PATIENTS, RELATIVE TO CLINICAL OUTCOME

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Abstract:

Objectives: The research objective is the determination of the frequency of etiological agents like *Neisseria meningitidis*, *Haemophilus influenza*, and *Streptococcus pneumonia* in Acute Bacterial Meningitis having CSF-culture as 'positive'. To determine the survival frequency of Acute Bacterial Meningitis patients.

Material and Methods: We conducted this case-series study at Medicine Department of Services Hospital, Lahore (January 2017 to September 2017). We selected 292 patients having Acute Bacterial Meningitis for our study.

Results: We recorded (39.98 ± 17.57) years of mean age among patients. The number of patients with *Streptococcus pneumonia*, *Neisseria meningitidis*, and *Haemophilus influenza* was 52% (153), 36% (105), and 12% (34) respectively. We recorded 82% (239) with survival and 18% (53) patients expired.

Conclusion: The study concludes that SP is the most common EA that causes ABM. The number of male victims of ABM is higher than that of the females though survival has no association with gender. The age of the patient significantly associates with survival.

Keywords: Acute Bacterial Meningitis (ABM), *Streptococcus Pneumonia* (SP), *Haemophilus Influenza* (HI), Cerebrospinal Fluid (CSF), *Neisseria Meningitidis* (NM), Etiological Agents (EA), and Invasive Meningococcal Disease.

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INTRODUCTION:

ABM is an acute purulent-infection of sub-arachnoid space. Among all dreadful CNS infections, this carries a high morbidity and mortality rate [1]. Each year, 1.2 million cases come to diagnosis globally [2]. A significant portion of High Dependency/Medical Units at hospitals include patients with this disease. Causes of ABM among adults are SP, NM, HI, Klebsiella, Gram-Negative Bacilli Escherichia, and Staphylococcus aureus [3]. A study shows the percentage of SP, NM, and HI to be 47.49%, 33.90%, and 19.20% respectively among 121 ABM patients [4]. Proteus and Listeria monocytogenes are fewer common causes whereas Streptococcal viridians, Streptococci (Group-B) and Acinetobacter are rare causes. The spectrum of clinical presentation of ABM is wider, including altered sensorium, fever, neck stiffness, and headache. ABM has 68% of complication rate, which is very high [5]. Hemiplegia, seizures, intracranial thrombosis, hydrocephalus, and cranial-nerve palsies are some common complications. ABM carries a 14% mortality rate where (19 to 37%), 10% and 5% are the rates of SP, NM, and HI respectively [6]. Generally, ABM mortality risk increases with decreased-level of consciousness (at presentation), old age (> 50 years), seizures (admission within one day), delayed diagnosis/treatment, raised intracranial pressure, and co-morbidities (diabetes-mellitus included). Other predictions include CSF glucose decreased (< 40 mg), and increased CSF protein level (> 300 mg/ml) [7]. ABM diagnosis complete examination of CSF and Culture, Sensitivity, and CSF Gram-stain are used for the identification of EA. CSF-culture produced (70 to 90%) positive case-rate for EA of ABM [8]. Finding out the markedly raised intracranial-pressure or SOL (Space Occupying Lesion) brain through fundoscopy and brain, CT scan is prudent before the performance of diagnostic-LP (Lumbar Puncture). Our study intends to determine ABM's common EA's frequency taking CSF-culture, clinical outcome and sensitivity as a basis. Through this, the treating physicians will explore more causes of prevalence and complications among patients of ABM.

Bacterial growth of a kind recorded on sample of CSF-culture like SP (Gram-positive capsulated-diplococci of lancet shape gram-positive on Gram-stain; the forming of rounded, small alpha-hemolytic colonies in blood-agar), NM (Gram-negative capsulated-cocci of the shape of kidney beans pain on Gram-stain; forms oxidase-positive colonies in chocolate on culture), and HI (Gram-negative capsulated-rods on Gram-stain; enriched chocolate agar colonies formed on culture i.e Factor V and Heme enriched). A professor of

Microbiology from Pathology Dept. confirmed these findings [9].

Patients having neck rigidity of fewer than seven days, history of a headache, fever of > 1000 F, meningitis irritation like Kernig sign (hamstring muscle pain during knee extension) neck stiffness (pain/resistance on flexing neck passively), altered sensorium (Glasgow Coma scale decreased score < 15/15). The diagnostic lumbar puncture showing presence of CSF proteins (> 45 mg/ml), CSF glucose (< 40 mg/ml or simultaneous serum-glucose level <40%), WBCs (> 100/ml with neutrophilic pleocytosis > 50% in CSF) [7]. If a patient dies within after 24 hours while being under ABM treatment, with 7 days, is considered mortality.

MATERIAL AND METHODS:

We conducted this case-series study at Medicine Department of Services Hospital, Lahore (January 2017 to September 2017). We selected 292 patients having Acute Bacterial Meningitis for our study. Our inclusion criteria were, both gender patients of (15 to 65) years age, having CSF-culture positive ABM. We excluded patients with partial treatment of ABM, evidence of intracranial haemorrhage or SOL in CT-Brain, CSF with lymphocytic pleocytosis (> 50%) for viral meningoencephalitis, Cerebral-malaria (MP +ve Blood-film), Haematological malignancy (lymphoma and leukaemia), Systemic-Lupus-Erythematosus (ANA-serum positive), and Tuberculous meningitis (ZN Stain Positive CSF).

We selected 292 patients who were fulfilling the criteria of inclusion. We took informed consent from each patient. We collected name, gender, age, and registration of hospital in a proforma. We admitted ABM patients in the hospital. We put the patients in either recumbent-position or sitting. We ensured anti-septic measures and anaesthesia and performed diagnostic lumbar-puncture in (L4/L5 or L3/L4) intervertebral-space to achieve CSF (10 mL) for C/E, culture & sensitivity and Grams-stain. We used a sterile bottle for the collection of the sample and sending it to Dept. of Pathology of the hospital. We inoculated CSF in chocolate, blood and thiomartin agar plates. We entered the clinical outcome, sensitivity, and CSF-culture in the patient's proforma. We used SPSS to enter and analyse the data. We calculated the mean and standard deviation for numerical data (hospital duration and age). We calculated frequencies for every EA (SP, NM, and HI) and survival. We did age, duration at the hospital, and gender stratification, applied Chi-square test to check

significance level considering P-value significant as ≤ 0.5 .

RESULTS:

In our study, the mean age of the patients was (39.9 ± 17.5) years. Among 292 ABM patients, we detected SP, NM, and HI among 52.4% (153), 35.9% (105), and 11.6% (34) patients respectively. In our study, 82% (239) patients survived whereas 18% (53) patients expired. The survival rate among patients with SP, NM, and HI was 75.8% (116), 90.4% (95), and 82.3% (28) patients respectively with P-value as 0.011 significant. We found an association between patients' survival and EA. After gender stratification, we found the survival rate among male and female patients as 82.5% (147) and 80.70% (92) patients out 60.9% (178) and 39% (114) patients respectively with insignificant P-value as 0.684. We also found an association between patients' survival and gender. We divided patients into 02 age-groups; (15-40) and (41-65) years. The rate among (15-40) and (41-65) year's age-group was 90.3% (133) and 73.10% (106) out of 50.3% (147), and 49.6% (145) patients respectively. The association of age with survival rate was significant with p-value = 0.000. We make two groups of the duration of stay at the hospital as (1-3) and (4-7) days' group. The number of patients in group (1-3) days and (4-7) days' groups were 51% (149) and 49% (143)

respectively. The rate of survival was 17.50% (26) for (1-3) days' group and 18.8% (27) for (4-7) days' group. We found an insignificant association (P-value = 0.764) between survival rate and hospital-stay duration. We did age stratification relative to EA pattern. We made two age groups, (15-40) and (41-65) years. Among the patients (147) or (15-40) year's age-group, we found 51% (75), 38.76% (57) and 10.2% (15) patients with SP, NM, and HI respectively. Among the patients (145) or (41-65) year's age-group, we found 53.8% (78), 33.10% (48) and 13.10% (19) patients with SP, NM, and HI respectively. The association between EA and age was insignificant with P-value = 0.525. Among 60.9% (178) male patients, we found SP, NM, and HI rate to be 51.1% (91), 34.8% (62), and 14% (25) patients respectively. Among 39% (114) female patients, we found SP, NM, and HI rate to be 54.39% (62), 37.7% (43), and 7.9% (9) patients respectively. The association between gender and EA pattern was insignificant with P-value of 0.278. Among (1-3) days' hospital stay group patients (149), we found the rate of SP, NM, and HI to be 49% (73), 37.5% (56) 13.4% (20) patients respectively. Among (4-7) days' hospital stay group patients (143), we found the rate of SP, NM, and HI to be 55.9% (80), 34.2% (49) and 9.8% (14) patients respectively. The association between hospital duration and EA was insignificant with P-value of 0.423.

Table – I: Etiological Agents Pattern

Etiological Agents Pattern	Number	Percentage
Streptococcus Pneumoniae	153	52
Neisseria Meningitides	105	36
Hemophilus Influenzae	34	12

Table – II: Survival Rate Stratification

Survival	Number	Percentage
Yes	239	82
No	53	18

Table – III: Etiological Agent, Age, Gender and Hospital Stay Stratification

Etiological Agent, Age, Gender and Hospital Stay Stratification		Yes		No		Total		P-Value
		No	%	No	%	No	%	
Etiological Agents	Streptococcus Pneumoniae	37	24.18	116	75.82	153	52.4	0.011
	Neisseria Meningitides	10	9.52	95	90.48	105	35.96	
	Hemophilus Influenzae	6	17.65	28	82.35	34	11.64	
	Total	53	18.15	239	81.85	292	100	
Age	15 - 40 Years	14	9.52	133	90.48	147	50.34	0.000
	41 - 65 Years	39	26.9	106	73.1	145	49.66	
	Total	53	18.15	239	81.85	292	100	
Gender	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	100	
Hospital Stay	1 - 3 Days	26	17.5	123	82.5	149	51	0.764
	4 - 7 Days	27	18.88	116	81.12	143	49	
	Total	53	18.15	239	81.85	292	100	

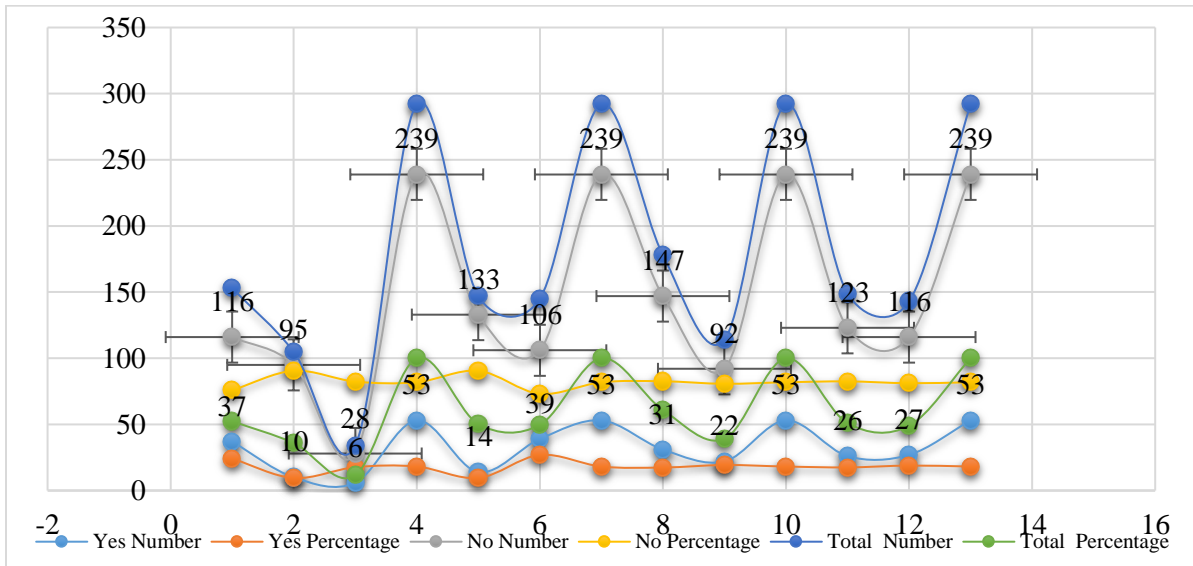
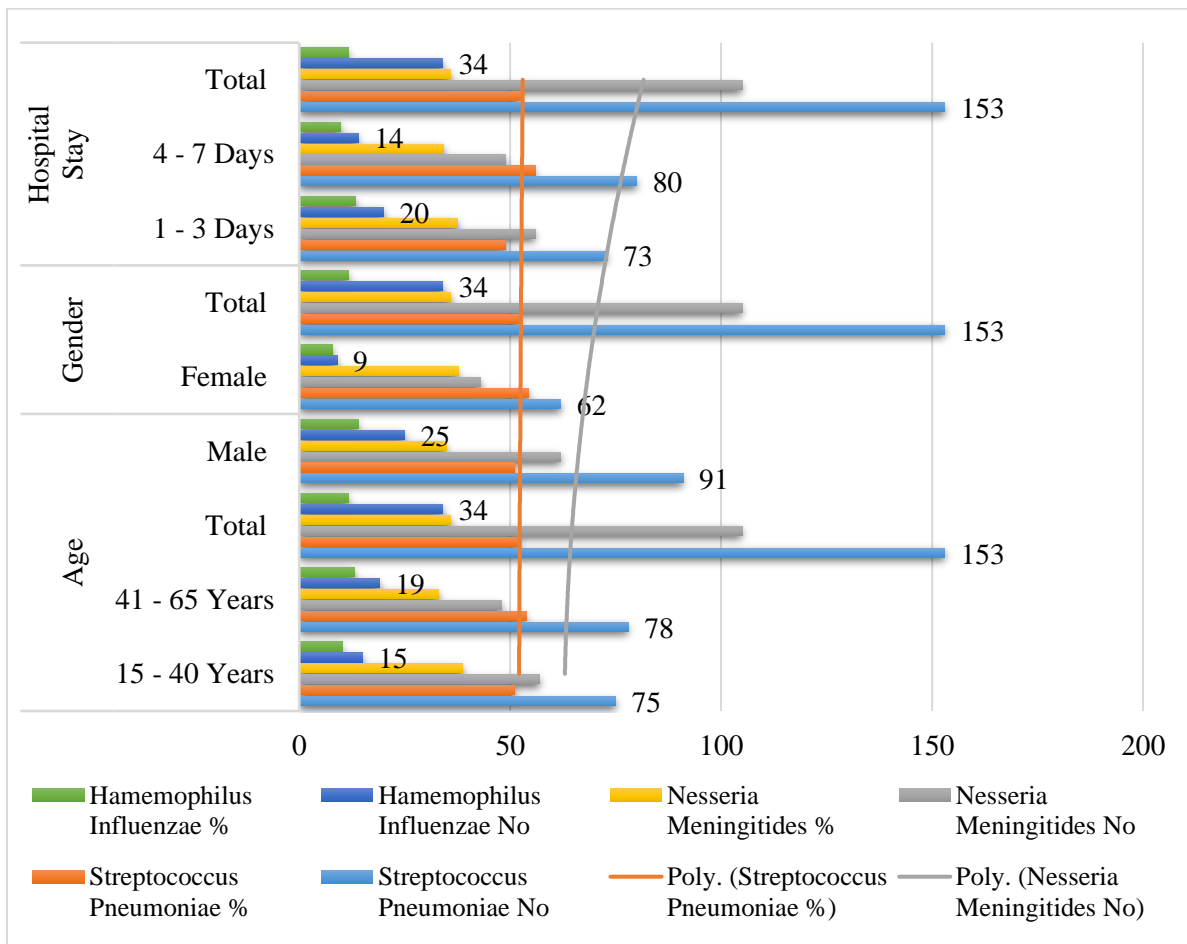


Table – IV: Age, Gender and Hospital Stay Stratification among Etiological Agents

Age, Gender and Hospital Stay		Streptococcus Pneumonia		Neisseria Meningitides		Hemophilus Influenza		Total		P-Value
		No	%	No	%	No	%	No	%	
Age	15 - 40 Years	75	51.02	57	38.76	15	10.2	147	50.34	0.525
	41 - 65 Years	78	53.79	48	33.1	19	13.1	145	49.66	
	Total	153	52.4	105	35.96	34	11.64	292	100	
Gender	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	
Hospital Stay	1 - 3 Days	73	49	56	37.58	20	13.42	149	51.03	0.423
	4 - 7 Days	80	55.94	49	34.27	14	9.79	143	48.97	
	Total	153	52.4	105	35.96	34	11.64	292	100	

**DISCUSSION:**

The infection of membranes that surrounds spinal-cord and brain is termed as meningitis. There is multiple

aetiology involved in meningitis like fungal, viral, or bacterial but bacteria are the common EA among them. Meningitis varies from being acute (quick symptoms

on-set), chronic (lasting months), aseptic, or mild but identifying its cause is of vital importance to start appropriate intervention [9]. ABM is a life-threatening disease with high mortality and morbidity rate around the world, especially among developing countries [10, 11]. In our study, the mean age of the patients was (39.9 ± 17.5) years. Ahmad et al. reports (41 ± 12.30) years mean age in his study [12]. In our study, among 292 ABM patients, we detected SP, NM, and HI among 52.4% (153), 35.9% (105), and 11.6% (34) patients respectively. Abdulrab et al. took 121 ABM patients and performed a lumbar puncture in 92.60% (112) patients [4]. He found the rate of SP (+ve culture), NM, and HI to be 47.40%, 33.90%, and 10.20% respectively, which is in similarity with our study. Ahmad et al. found the rate of SP, and NM to be 36.80% (35), and 31.50% (30) respectively, which is in favour of our study [12]. Abro et al. find the rate of NM, SP, Staph. Aureus, Klebsiella Pneumonia, Strept. Agalactiae, and E. Coli to be 54.70% (29), 33.96% (18), 3.7% (02), 3.77% (02), 1.8% (01) and 1.80% (01) respectively [13]. These results are not similar to our study as the common-agent is NM in this study instead of SP. In our study, 82% (239) patients survived whereas 18% (53) patients expired. Abdulrab et al. show a 22.30% mortality rate among ABM patients which is similar to our study outcome [4]. Abro et al. reported a lower mortality rate comparing to our study which is 07.54% [13]. In our study, ABM shows male dominance with more male victims than female. Same is the case with the studies of Ahmad et al. and Abro et al. with the number of male and female ABM patients to be 84.2% and 15.7% respectively [12].

CONCLUSION:

Our study concludes that SP is the common-most EA causing ABM with male dominance (more male victims than female). There is a significant association of survival rate with patients' age, however, no association with the patient's gender.

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