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A study of Antimicrobial Treatment and Clinical Outcome in patients with Acute Meningitis

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ABSTRACT

Acute meningitis remains a serious neurological illness with significant morbidity and mortality if not treated appropriately. Effective treatment in a timely manner will minimize the poor outcome in patients with acute meningitis. It is important to identify the causative organism and its sensitivity pattern to initiate the appropriate antimicrobial therapy. It is also necessary to provide effective treatment in a timely manner to minimize the poor outcome in patients with acute meningitis. Therefore, in this retrospective study we describe the prescription pattern of antibiotics in patients with acute meningitis in a tertiary care hospital and the clinical outcome of the patients. A retrospective 5yrs observational study conducted at Lourdes hospital Ernakulam from may 2016 to April 2021. Patients diagnosed with acute meningitis and prescribed with antimicrobial agents were included in the study. (sample size 128) Among 128 patients, the age wise incidence of acute meningitis was more in pediatric patients and in gender wise females were more affected. The most common type of acute meningitis seen was aseptic meningitis. Among the 7 culture positive reports, gram positive organism was found more than gram negative organism and the most commonly prescribed empirical antibiotic group were cephalosporin among which ceftriaxone is most widely used one. There were three reported ADR due to the use of vancomycin, while assessing the clinical outcome of patients, the mortality rate was 0 %. Further evaluation of clinical outcome was centered on duration of therapy and length of stay which has significant association with type of meningitis and age category respectively. The study shows that the early recognition of an explicit etiology that prompt meningitis, benefits in the initiation of appropriate antimicrobial therapy. This positively influence the clinical outcome.

INTRODUCTION

Meningitis is one of the common worldwide diseases and it remains the international health concern. Acute meningitis (duration of less than 5 days) accounts for approximately 75% of all community acquired meningitis cases and is most caused by unknown pathogens, as well as viral and bacterial organisms. Acute meningitis is typically an isolated event that does not occur[1]. Approximately 173000 deaths were reported in 2002 mostly in children from developing countries. The incidence and etiological agents of meningitis differs according to geographic region, with degrees of endemicity[2]. But to a greater extent epidemiology of bacterial meningitis have changed because of widespread use of conjugate vaccines and preventive antimicrobial treatment of pregnant women[3]. Acute meningitis still remains a serious neurological illness with significant morbidity and mortality if not treated promptly and appropriately[4]. Acute meningitis can be viral or bacterial, so it is important to identify the causative organism and its sensitivity pattern to initiate the appropriate

antimicrobial therapy[5]. The empiric approach to antimicrobial selection in patients with meningitis is also influenced by the causative organism, patient's age, and host factors[6]. Therefore, the lack of proper diagnosis and treatment can worsen the patient's condition. Hence it is necessary to provide effective treatment in a timely manner to minimize the poor outcome in patients with acute meningitis[7]. In this study we mainly analyses the incidence of acute meningitis in a tertiary care hospital and describe the prescription pattern of antibiotics in acute meningitis. Other objectives also includes the identification of the causative organism and its sensitivity pattern, the reported ADRs due to the use of antibiotics. We also assess the clinical outcome of the patients based on the days of antimicrobial therapy and length of stay at the hospital.

While discussing the condition on detail, it is necessary to have knowledge regarding the etiology and treatment. Meningitis is defined as the inflammation of the protective membrane that surround the brain and spinal cord, known as meninges[8]. It can be caused by bacterial, viral, and fungal infections, also caused due to certain drug reactions by chemical irritation of membrane. It damages the brain and spinal cord if not treated properly. In meningitis there will be a spillover of cells into CSF to produce an increased cell count. Meningitis is the major infectious condition of the central nervous system (CNS)[9]. When meningitis includes parenchymal involvement, it is referred to as meningoencephalitis, meningomyelitis, or meningoencephalomyelitis[10]. If there is nerve root involvement it is a meningoradiculitus. The meninges consist of three protective membranes that surround and enclose the brain and spinal cord. They provide protection to brain and contain the cerebrospinal fluid which flows around brain and spinal cord. The three different layers of meninges are called the: DURA (also called the dura mater)- tough, fibrous outermost membrane. Arachnoid - It is the fine, delicate middle membrane. Pia mater - It is the delicate innermost membrane[9]. The meninges are layers of tissue that surround the brain and spinal cord. Without meninges, the spinal cord and brain would be subject to more trauma. They function to protect the nervous system, to produce cerebrospinal fluid, to hold it in place, and to provide a passageway for fluids, nerves, and vessels. They provide safety and security to the entire nervous system.[10,11].

Based on the etiology and proper diagnostic factors, we initiate the treatment for meningitis. Antibiotics are the mainstay therapy for acute meningitis. Oral antibiotics are less reliable for meningitis because their infection-fighting ability can be hampered by vomiting, poor absorption in the gastrointestinal tract, and other uncertainties. Antibiotics are typically given three times a day for 7 to 21 days, depending on the type of bacteria organism causing the meningitis and the type of antibiotic chosen[12]. The antibiotics or combination of antibiotics that will be most helpful depend on the type of bacteria causing the meningitis infection. Often this can be determined by analysing a sample of fluid obtained with a test called a lumbar puncture, or spinal tap. Because the results of this test may take several hours, broad-spectrum antibiotics effective against a range of bacteria are often given in the meantime. After results of spinal fluid tests become available, different antibiotics may be delivered alone, or in combination, as indicated. Commonly used meningitis treatments include a class of antibiotics called cephalosporins, especially cefotaxime and ceftriaxone. Various penicillin-type antibiotics, aminoglycoside drugs such as gentamicin, and others, are also used. Some forms of bacterial meningitis are particularly dangerous as well as very contagious, so family members and friends who've had contact with the patient may need to take prophylactic antibiotics to prevent getting the disease. Ciprofloxacin is most commonly used for preventive meningitis treatment[13].

Theoretically they are different management methods for acute meninigitis but when it comes to practice, a more precise and evident data are imperative. On the study conducted by Amor Loutfi et al (2020) , it is mentioned that Bacterial meningitis syndrome was observed in 67.2% of cases. Cerebrospinal fluid (CSF) was cloudy in 57.1% of cases. The common pathogens identified on CSF culture were coagulase, negative Neisseria meningitidis in 30 (13%) and streptococcus pneumoniae 6 (2.5%). They concluded that meningitis is a real health problem in the providence of Kenitra, affecting especially children[14]. A study on "aetiological agents of cerebrospinal meningitis: a retrospective study" was conducted by Michael Owusu et al (2012) from a teaching hospital in Ghana".Confirmed meningitis cases were made up of 117 (71.8%) culture positive bacteria, 19 (11.7%) culture positive cryptococcus neoformans and 27(16.6%) Gram positive bacteria with negative culture. The most prevalent bacteria was streptococcus pneumoniae 91 (77.7%), followed by E. coli 4 (3.4%), salmonella species 4 (3.4%), Neisseria meningitidis 3 (2.5%), pseudomonas species 3(2.5%) and others. Pneumococcal isolates susceptibility to penicillin, chloramphenicol and ceftriaxone were 98.9% (95%CI: 94.0% to 100.0%), 83.0% (95%CI: 73.4% to 90.1%) and 100.0% (95%CI: 95.8% to 100.0%) respectively. They concluded that streptococcus penumoniae is an important cause of meningitis among all age groups and its susceptibility to penicillin and ceftriaxone remains very high. They also suggested that the Ghanaians of all ages and possibly other developing countries in the meningitis belt could benefit from the use of the pneumococcal vaccine. They also noted that the other bacterial and fungal pathogens should also be considered in the management of patients presenting with meningitis[15]. And also the study conducted by Mareta Rindang Andarsari et al (2017) on the topic "Drug utilisation study of antibiotics in bacterial meningitis" aims to assess the use of antibiotics prescribed for patients with bacterial meningitis . The study was conducted using 85 patients. The result show that the meningitis appears to be mostly occurred in productive age. Number of antibiotics prescribed were 130 prescriptions, as single and combination therapy. The most prescribed antibiotic was cephalosporins (97 prescriptions), dominated by 2g twice daily ceftriaxone with 86 (66.15%) from overall prescriptions. Followed by combination therapy, mostly ceftriaxone and metronidazole. The study concluded by saying that the bacterial meningitis is mostly treated using ceftriaxone which is an appropriate drug of choice[16].

From the studies and research that was going on, it is evident that the clinical outcome is highly influenced by the causative organism, severity of the condition and also the patient specific management. Most of the studies are either focused on the etiology or treatment alone. In this retrospective study we are aiming to analyse the use of the antibiotic based on the etiology and its effect on the clinical outcome of the patients by considering their duration of antibiotics therapy and length of hospitalization. We also analyse the age wise incidence and also the most common type of meningitis that is seen in the respective locality.

METHODOLOGY

This retrospective study was carried out in neurology department of Lourdes hospital, Post Graduate Institute of Medical Science and Research, Ernakulam, Kerala, India. It is a tertiary care referral teaching hospital. It is a 500 bedded multi speciality hospital with a wide range of amenities. The institution is equipped with seven super speciality department and 22 other departments with facilities comprising twelve operation theaters, ten intensive care units and a computerized Lourdes Mediware system. Clinical laboratories are with ISO standards. It is one of the topmost hospitals in Kerala.

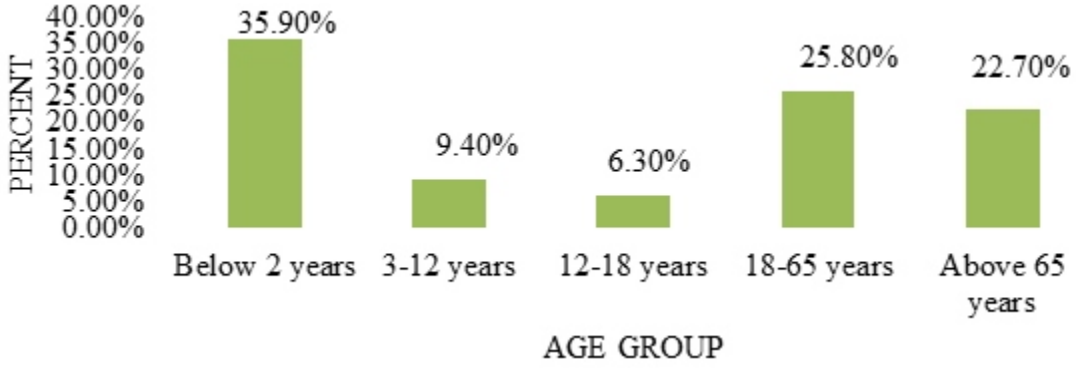
Patients of both gender of all ages, Patients who are diagnosed with acute meningitis and Patients who were prescribed with antimicrobial agents for acute meningitis were included in the study and Patients with incomplete medical records, Patients who got discharged against medical advice were excluded. Patients were selected on the basis of this inclusion and exclusion criteria. The data were collected using Lourdes Mediware system, medical records of the patients, specially designed data collection form and antibiotic therapy monitoring form. A total of 128 patients admitted with acute meningitis were included in the study (minimum sample size required was found to be 125). The details of the subjects admitted in the hospital for the past 5 years were collected using Lourdes Mediware system as well as medical records of the patient. Various parameters like patient demographic details, laboratory parameters, causative organisms and its sensitivities pattern, diagnosis, type of acute meningitis, antibiotic therapy and its ADR were monitored in the study period. The clinical outcome of the patients was also evaluated. The collected data were analysed and interpreted using Microsoft excel and SPSS. Mean and frequency of various variables were found out using SPSS and excel software and were presented as graphs, tables and pie diagrams. Incidence of acute meningitis in all population, and clinical outcome of the patients based on duration of therapy and length of stay at the hospital were identified using Pearson chi-square.

RESULTS

One hundred and twenty-eight meningitis case records managed in a tertiary care hospital in Ernakulam during a period of 1st May 2016 to 30th April 2021 were randomly studied and evaluated for the incidence of acute meningitis, prescription pattern of antibiotics and to access the clinical outcome.

DEMOGRAPHIC DETAILS OF THE STUDY POPULATION:

One hundred and twenty-eight patients with acute meningitis were diagnosed and treated at the tertiary care hospital. 46 (35.9%) patients were below 2 years, 12 (9.4%) patients belong to the age category 3-12 years, 8 (6.3%) patients belong to 12-18 years, 33(25.8%) patients belong to 18-65 years, and 29(22.7%) patients were above 65 years.



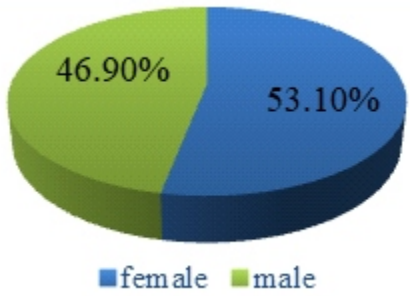


Figure 4.02 : Gender distribution of the study population

In present study, among the 128 patients, 68(53.1%) were female and 60 (46.9%) were male as shown in figure 4.02.

ACUTE MENINGITIS IN A TERITARY CARE HOSPITAL

Out of 128 cases, 73 (57%) patients were diagnosed with aseptic meningitis, 27 (21.1%) patients with acute viral meningitis, 26 (20.3%) cases with acute bacterial meningitis and each case (0.8%) of fungal and post operative meningitis.

There is a statistically significant ($p<0.05$) association between age and the diagnosis. In age group below 2 years, 38 (52.1%) were diagnosed with aseptic meningitis, 11 (40.7%) of the acute viral meningitis and 11(42.3 %) of the acute bacterial meningitis were diagnosed within 18- 65 years. Patient with

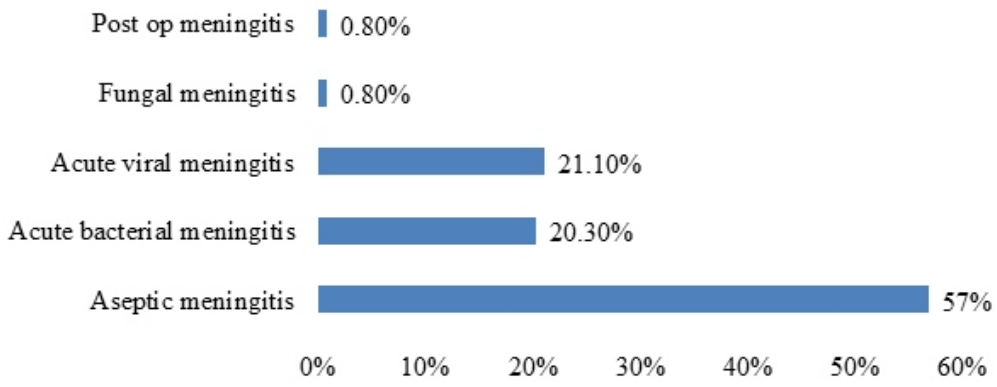


Figure 4.03 : Type of acute meningitis in the study population

Table 4.01 : Age and the type of meningitis

Age	Diagnosis					
	Aseptic meningitis	Acute bacterial meningitis	acute viral meningitis	Fungal meningitis	post op meningitis	Total
Below 2 years	38(52.1%)	6(23.1%)	2(7.4%)	0(0%)	0(0%)	46
3-12 years	8(11.0%)	1(3.8%)	3(11.1%)	0(0%)	0(0%)	12
12-18 years	5(6.8%)	0(0%)	3(11.1%)	0(0%)	0(0%)	8
18-65 years	10(13.7%)	11(42.3%)	11(40.7%)	0(0%)	1(100%)	33
above 65 years	12(16.4%)	8(30.8%)	8(29.6%)	1(100%)	0(0%)	29
Total	73(100%)	26(100%)	27(100%)	1(100%)	1(100%)	128
χ^2 =37.1	df=20			p < 0.05		

fungal meningitis belong to the age category above 65 years and post op meningitis case belong to 18- 65 years. It is concluded that the majority of patients with aseptic meningitis were below 2 years.

CULTURE REPORTS: CAUSATIVE ORGANISM AND ITS SENSITIVITY PATTERN

CSF samples of 128 patients were collected and 7 culture positive reports were observed. Cerebrospinal fluid (CSF)

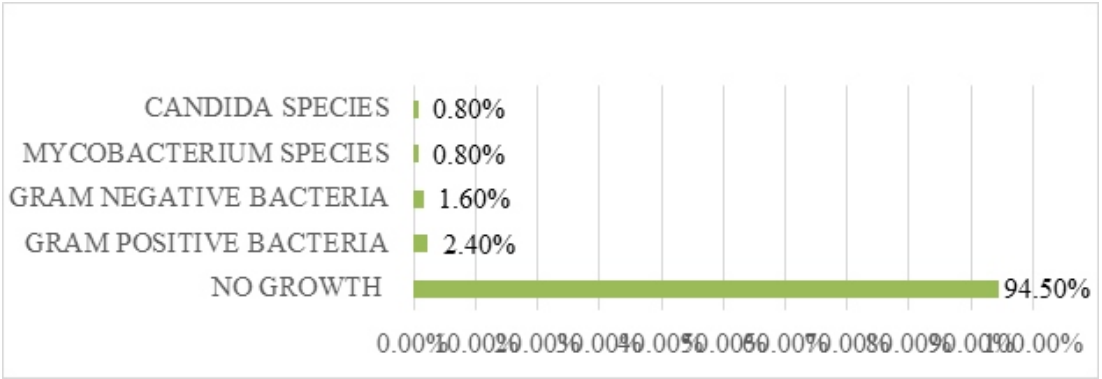


Figure 4.04 : Organisms Isolated in the study population

cultures were positive for streptococcus viridians in 2(1.6%), klebsiella pneumoniae in 1(0.8%), staphylococcus aureus (MRSA) in 1(0.8%), Acinetobacter bauimanii in 1(0.8%), mycobacterium tuberculosis in 1(0.8%) and candida species in 1 (0.8%). In 121 (94.5%) cases there were no presence of organism. As already said, among the bacterial organism, gram positive organism (2.4%) was found more than gram negative organism (1.6%). Out of 7 isolated organism, 3 were found to be in pediatric population.

The antibiotic sensitivity tests done showed that streptococcus species were sensitive to all the antibiotics while klebsiella species were resistant to ampicillin and sensitive to cephalosporins. The methicillin resistant staphylococcus aureus was only sensitive to vancomycin and linezolid. Acinetobacter bauimanii showed intermediate resistance to ceftriaxone but were sensitive all other cephalosporins such as cefoperazone sulbactam, cefepime, ceftazidime, cefuroxime and meropenem.

ANTIMICROBIAL THERAPY

In the treatment of acute meningitis, the patient is initially treated with empirical antibiotic therapy. Selection of empirical antibiotic therapy depends on age and underlying condition until the microbiology test obtained. Among broad spectrum

Table 4.02 : Antibiotic sensitivity pattern

ANTIBIOTIC (MIC)	Streptococcus viridans (n=2)	Klebisella pneumonia (n=1)	MRSA (n=1)	Acinetobacter baumanii (n=1)
Ampicillin	≤0.25 S ≤0.2 S	≥32 R	-	-
Benzylpencillin	≤0.12 S ≤0.0 S	-	≥0.5 R	-
Amoxicillin/ clavulanic acid	-	≤2 S	-	-
Amikacin	-	≤2 S	-	-
ciprofloxacin	-	≤0.25 S	-	-
Cefepime	-	-	-	4 S
Ceftazidime	-	-	-	8 S
Colistin	-	-	-	≤0.5 S
Imipenem	-	≤0.25 S	-	≤0.25 S
Cefoperazone sulbactum	-	≤8 S	-	≤8 S
Ceftriaxone	≤0.25 S ≤0.1 S	-	R	16 I
Cefotaxime	≤0.12 S ≤0.1 S	S	-	-
Cefuroxime	-	≤2 S	-	-
Gentamycin	-	≤1 S	-	≤1 S
Meropenem	-	≤0.25 S	R	0.25 S
Vancomycin	-	-	≤0.5 S	-
Linezolid	-	-	≤2 S	-

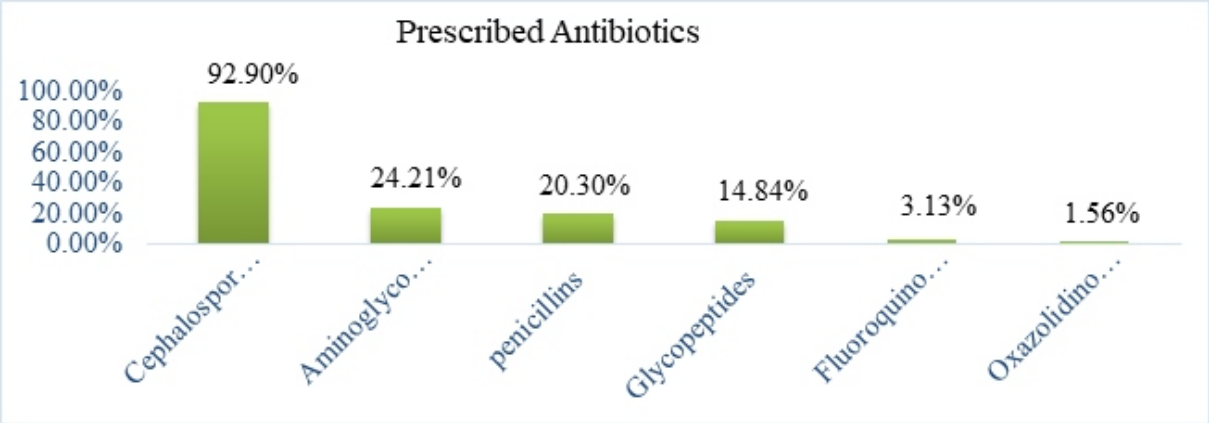


Figure 4.05 : Antibiotics prescribed in acute meningitis

antibiotics, cephalosporin is preferred for empiric therapy because of its consistent CSF penetration and their high activity against pathogens of bacterial meningitis.

In our study, about 119 (92.9%) prescriptions of cephalosporins were present, 31(24.21%) prescriptions with aminoglycosides, 26(20.3%) with penicillins, 22(17.18%) with carbapenems, 19(14.84%) with glycopeptide, 4(3.125%) with fluroquinolones, and 2(1.56%) with oxazolidinones. From the collected data, 51 out of 128 were prescription of combinations therapy, which 17 of them were combination of ceftriaxone and vancomycin followed by combination of cefotaxime and ampicillin (15). Cephalosporin is the most commonly used antibiotic class in the study population. Among the cephalosporin, most commonly used antibiotic is ceftriaxone (53.125%), followed by cefotaxime (18.75%), cefixime (9.37%), cefoperazone (7.03%), cefuroxime (3.125%) and cefpodoxime proxetil (1.56%). But the use of cefoperazone is irrational in the management of meningitis due to its inability to cross BBB. Out of 22 prescriptions of carbapenems, 16 (12.5%) were meropenem, 4(3.125%) were faropenem and 2(1.56%) were orpenem. Vancomycin (14.84%) is the only glycopeptide used in the management of acute meningitis. Ofloxacin (2.34%), ciprofloxacin (0.78%), and linezolid (1.56%) were the other empirical antibiotics used. In the age category below 2 years, the most commonly used antibiotics were cefotaxime, amikacin and ampicillin. Out of 128, 7 (0.05%) patients got treated with definite antibiotic therapy. Total of 12 antibiotics were used in which most of them were cephalosporins (50%). Other antibiotic classes were penicillins, carbapenems, antitubercular drugs and oxazolidinones. Cephalosporins used were cefotaxime 2(16.6%), cefoperazone sulbactum 2(16.6%), ceftriaxone 1(8.33%) and cefepime 1(8.33%). 2(16.6%) patients were treated with ampicillin, 2 (16.6%) with meropenem and one (8.33%) with linezolid. One (8.33%) patient with the tubercular meningitis is treated with the AKT4 kit containing isoniazid, rifampicin, ethambutol and pyrazinamide. There were parenteral to oral conversion in 17 (13.28%) patients. The common parenteral to oral conversion was cefotaxime to cefixime (23.52%) followed by meropenem to faropenem (17.64%) and ceftriaxone to cefixime (17.64%). Conversion of 2 (11.76) ceftriaxone to cefuroxime was also present followed by ceftriaxone to cefpodoxime axetil (5.88%), cefoperazone to cefixime (5.88%) and cefoperazone to cefuroxime (5.88%). All of the conversion were switch over therapies.

CLINICAL OUTCOME OF THE PATIENTS

Out of 128 cases, only 5 (3.90%) patients had complications related to meningitis. The most common among them was seizure which was seen in 2 (1.56%) pediatric patients and one adult (0.78%). In adults, hearing loss (0.78%), gait abnormality

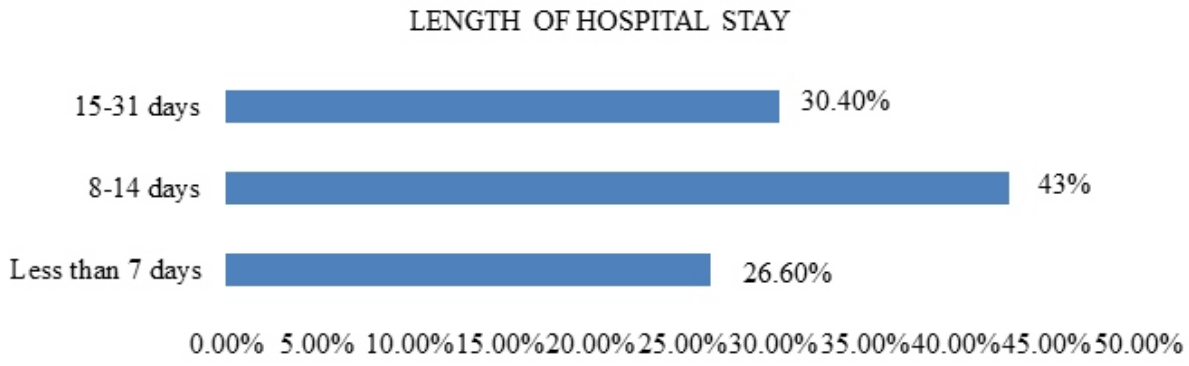


Figure 4.06 : Length of hospital stay in the study population

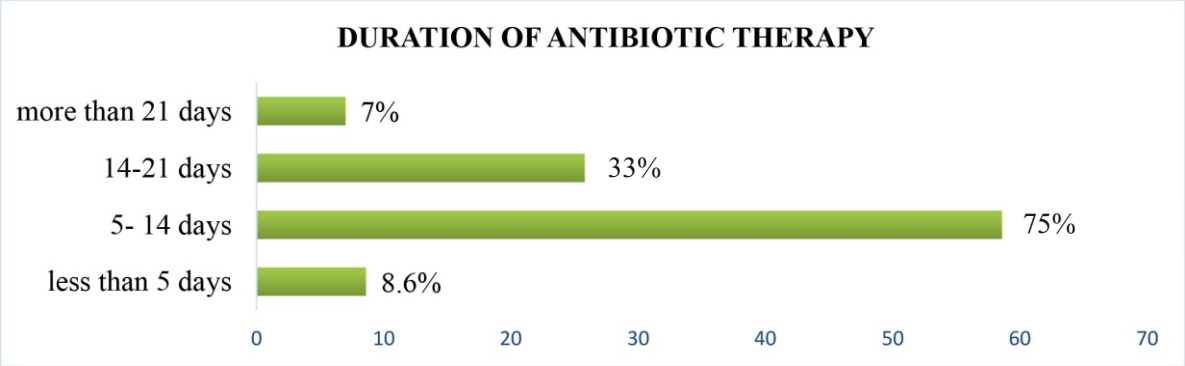


Figure 4.07 : Duration of antibiotic therapy in the study population

Table 4.03 : Age and length of hospital stay

Age groups	Length of hospital stay			
	Less than 7 days	8-14 days	15- 31 days	Total
Below 2 years	4(8.7%)	23(50%)	19(41.3%)	46(100%)
3-12 years	2(16.7%)	6(50%)	4(33.3%)	12(100%)
12-18 years	3(37.5%)	3(37.5%)	2(25%)	8(100%)
18-65 years	13(39.4%)	14(42.4%)	6(18.2%)	33(100%)
above 65 years	12(41.4%)	9(31%)	8(27.6%)	29(100%)
Total	34	55	39	128
χ^2=25.880	df=12		P <0.05	

Table 4.04 : Type of meningitis and duration of antibiotic therapy

Duration of therapy	Diagnosis					
	Aseptic meningitis	Acute bacterial meningitis	acute viral meningitis	Fungal meningitis	post op meningitis	Total
less than 5 days	5	3	3	0	0	11
5- 14 days	46	12	16	1	0	75
14-21 days	17	9	7	0	0	33
more than 21 days	5	2	1	0	1	9
Total	73	26	27	1	1	128
χ^2=30.503	df=15			p <0.01		

(0.78%) and drowsiness (0.78%) were seen. The mortality rate was found to be 0%.

In our study, the patient's clinical outcome is expressed in terms of length of hospital stay and duration of antibiotic therapy. The mean length of hospitalization for all the 128 patients was 12.06±5.2. In our study, 55(43%) patients were hospitalized for the duration of 8-14 days, 39 (30.4%) patients for 15-31 days, and 34 (26.6%) patients for less than 7 days.

Table 4.03 : Age and length of hospital stay

ADR related to vancomycin	Number of cases	Percent
Hypersensitivity	2	10.52%
Elevated serum creatinine	1	5.26%
Total no. of ADR	3	15.8%
Total no. of vancomycin	19	100%

While considering the duration of therapy, the mean duration of therapy was 13.5. Out of 128 patients, 75 (58.6%) went through antibiotic therapy for 5-14 days, 33(25.8%) patients had therapy for 14-21 days, 11(8.6%) patients had therapy for less than 5 days and 9 (7%) patients had more than 21 days therapy.

From the above table we can see that there is statistically significant association ($p<0.05$) between the age category of the patients and the length of hospital stay. In the age group below 2 years, out of 46 patients, 23(50%) were stayed for the duration of 8-14 days and 19 (41.3%) patients for 15-31 days. In age group 3-12 years, 6 (50%) patients were stayed for 8-14 days. Patients between 12-18 years of age, 3(37.5%) were admitted for less than 7 days and 3 (37.5%) for 8-14 days. Patients between 18-65 years of age, 14(42.4%) stayed in hospital for 8-14 days, 13(39.4%) for less than 7 days and 6(18.2%) for 15-31 days. From patients above 65 years of age 12(41.4 %) were hospitalized for less than 7 days duration.

There is significant($p<0.01$) relationship between the type of meningitis and the duration of therapy. Majority of the patients with aseptic meningitis (46), acute bacterial meningitis (12) and acute viral meningitis (16) had undergone antibiotic therapy for 5-14 days duration. Patients with fungal meningitis also had therapy for duration of 5-14 days.

ADVERSE DRUG REACTIONS:

The use of antibiotics has led to various adverse reactions. In this retrospective study, there were only three (2.3%) reported ADRs from the 128 cases. All the reported ADRs were due to the use of vancomycin. Total of 19 vancomycin prescription were present. Among them 3 (15.8%) cases had reported ADR. Two (10.52%) patients among the three were having hypersensitivity reactions, in which one of them belonged to the age category 18-65 years old and had breathless and the other patient who belonged to the age group above 65 years had skin rashes and itching. Both of them were treated with the antiallergens later. One (5.26%) patient who is 70 years old had elevated serum creatinine and later became normal after the stoppage of antibiotics.

DISCUSSION

Aseptic meningitis is the most common type of meningitis seen in the hospital followed by acute viral meningitis and acute bacterial meningitis. Majority of patients with aseptic meningitis were below two years old. The study done by Mohammed A Aldriweesh et al showed similar correlation between the age and the type of meningitis[17]. In the study conducted by Aparna yerramilli et alon the topic “a study on the clinical outcome and management of meningitis at a tertiary care centre” showed that aseptic meningitis(39%) was the predominant type of all varieties followed by pyogenic and tubercular meningitis and few cases of fungal meningitis were also observed which correlates with our study[18]. They also found that the incidence of seizure was high in patients with viral/ aspectic meningitis. Our result showed similar incidence in the complications.

In our study, organism was isolated only in 7 patients and they were treated with definitive antibiotic therapy according to the sensitivity pattern. Among them, gram positive organism (2.4%) was found more than gram negative organism and out of 7 isolated organism, 3 were found to be in pediatric population.In the study done by Michael Owusu et al, they found that majority of the S.pnemoniae infections occurred in children and younger patients. It is rather difficult to identify the organism present as the treatment had often started empirically prior to the identification of the type of meningitis through culture and sensitivity of organism[15].

Mostly the patients are treated with the empirical antibiotic therapy and among the antibiotics, cephalosporin was the most prescribed and in the cephalosporins group, most commonly used antibiotic is ceftriaxone. Similarly, in the study done by Mareta Rindang Andarsari et al, the most prescribed antibiotic group were cephalosporin (74.62%) and ceftriaxone is most widely used cephalosporin similar to our study[16]. In the age category below 2 years, the most commonly used antibiotics were cefotaxime, amikacin and ampicillin. In Matthijis C. Brouwer et al's study, we observed that the empirical for neonatal and pediatric patients should consist of ampicillin, gentamicin and cefotaxime or ceftriaxone[19]

Clinical outcome was evaluated based on the length of stay and duration therapy. Mean recovery time was found to be 12.06 and 50% of the age category below 2 years were recovered within 8-14 days. patients who stayed for the longest time were also pediatric age group. The median duration of therapy was found to be 14 and 58.7% of the patients went through antibiotic therapy for 8-14 days. Majority of the patients with aseptic meningitis, viral meningitis and bacterial meningitis were also had the antibiotic therapy for 8-14 days. The mortality rate was found to 0% and only 3.9 % patients had complications related to meningitis in which the common among them was seizure. In the study done by Sadie Namani et al, they analyzed the neurological complication in childhood bacterial meningitis and found out the highest incidence of neurological complications such as recurrent seizure[20]. The study about the neurological sequelae of bacterial meningitis done by Marjolein.J. Lucas et al shows that focal neurological deficits, hearing loss, cognitive impairment and epilepsy were the most frequent reported sequelae[21].

Vancomycin was the only antibiotic to cause ADR in 3 patients. Only 19 prescription of vancomycin was seen among 128 cases. So Yeon An et al (2011) conducted a study on the vancomycin associated spontaneous cutaneous adverse drug reactions and the main vancomycin related ADRs were skin rashes, hematologic abnormalities, fever and elevated serum creatinine[22].

CONCLUSION

The study shows that the age wise incidence of acute meningitis was more in pediatric patients and gender distribution in the study population shows that female category is more affected. The most common type of acute meningitis seen was aseptic meningitis. The etiology of acute bacterial meningitis is pre-eminent by gram positive bacteria. It is rather difficult to identify the organism due to initiation of empirical therapy prior to collection of CSF sample. By taking that into account, the differentiation of meningitis becomes more unspecified. While assessing the clinical outcome of the patients during our study, the mortality rate was 0% and the sequelae related to meningitis was proportionately lower. Further evaluation of clinical outcome was centered on the duration of therapy and length of stay which has significant association with the type of meningitis and the age category respectively. By analysing the prescription pattern of antibiotics, cephalosporins was found to be the drug of choice in the treatment of meningitis both as empirical and definite therapy. Thus, we can conclude that the early recognition of an explicit etiology that prompt meningitis, benefits in the initiation of appropriate antimicrobial therapy. This positively influence the clinical outcome of the patients.

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