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Short Term Treatemt outcome and Associated factors of Meningitis in Children Beyond Neonatal Age at Tibebegion Comprhensive Specialized Hospital; North West Ethiopia

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A THESIS

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ABSTRACT

BACKGROUND-The mortality and neurologic sequelae associated with acute bacterial meningitis (ABM) Remain high despite advances in medical care. In our country information on clinical outcomes of meningitis and associated risk factors is limited. The objective of this study was to evaluate short-term treatment outcome in patients treated as meningitis in children beyond neonatal age at Tibebe Ghion specialized Hospital to identify factors that could be focused on to improve outcome in this setting.

METHODS-A hospital based cross sectional study design was conducted among 215 children in Tibebe Ghion comprehensive specialized hospital. Simple random sampling method was used to select charts and the data was collected by using structured checklists. Data were checked for completeness, inconsistencies and was entered to SPSS Version 25 for analysis. Bivariate and multivariate logistic regression was used to identify factors associated with treatment outcomes of meningitis. The findings were presented with p-values, and odds ratio with its 95% confidence level. P-value of less than 0.05 was used to declare significance level.

RESULT: About 19.1% children beyond neonatal age with meningitis developed poor outcomes: developed complication and died. In this study, age [AOR= 17.931(2.983, 107.779)], the presence of seizure at presentation [AOR= 4.321(1.250, 14.941)], CSF cell count [AOR= 4.218(1.171, 15.194)] and nutritional status [AOR= 2.737(1.049, 7.141)] were the determinant factors for clinical outcome of meningitis.

CONCLUSION: In this study, nearly one in five of children beyond neonatal age with meningitis developed poor outcomes. Our finding also indicated that age, the presence of seizure at presentation, CSF cell count, and nutritional status were associated with poor outcome of meningitis. Therefore, creating community awareness about risk factors of meningitis, early diagnosis and treatment of cases and improving nutritional supplementation are recommended to improve the clinical outcome of children affected with meningitis.

Keywords: Clinical outcomes, meningitis, children, Tibebe Ghion Specialized Hospital, Ethiopia.

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ABBRIVIATION

ABM-Acute Bacterial Meningitis

AOR- Adjusted Odd Ratio

BDU-Bahir Dar University

CI-Confidence Interval

CMHS-Collage of Medicine and Health Science

CNS-Central Nervous System

COR-Cruds Odd Ratio

CSF -Cerebro Spinal Fluid

EPI=Expanded Program of Immunization

FCSH=Felege Hiwot Comprehensive specialized Hospital

Hib=Hemophilus Influenza type B

ICP-Intra Cranial Pressure

LP-Lumbar Puncture

LPA-Latex Particle Agglutination

RDS-Respiratory Distress Syndrome

SPSS-Statistical Package of Social Population

TGSH-Tibebe Ghion Specialized Hospital

WHO-World Health Organization

1 Introduction

1.1 Background

Meningitis is one of the most severe diseases accounting for numerous deaths per year. Fatality rate due to meningitis remains high, which is between 2% and 30%. Long term complications like epilepsy, mental retardation and sensory neural deafness are observed in 10%–20% cases (1). Meningitis is an infection of the subarachnoid space and leptomeninges caused by a variety of pathogenic organisms and continues to be an important source of morbidity and mortality (2). Meningitis may develop in response to number of causes most prominently bacterial as Streptococcus pneumoniae, Neisseria meningitides, Hemophilus Influenzae, Escherichia coli, Group B Streptococcus or viruses, physical injury, cancer and drugs(3).

Community acquired bacterial meningitis is a life threatening infection of the leptomeninges often related with serious complication and sequelae. Low and middle-income countries account for 98% of the estimated 5.6 million disability-adjusted life years attributed to meningitis globally. In high-income countries, bacterial meningitis ranks among the top ten causes of death in children younger than 14 years of age (4).

The region in Sub-Saharan Africa, including Ethiopia, is known as the “meningitis belt” because of the high prevalence of meningitis in the area (5,6). Meningitis in children takes the form of sporadic cases with a rate of 1.5/100,000 and 20/100,000 population in the developed and developing countries, respectively. A minimum of 890,000 cases are estimated to occur per year. Among them, 160,000 and 135,000 are disabling and fatal cases, respectively (7).

Acute bacterial meningitis remains an important cause of death and neurological sequelae in Children, the clinical features of meningitis are often non-specific and may overlap with those of other infections. Early diagnosis and appropriate treatment are perhaps the most important steps in management, but published data suggested that fewer than half of the cases of meningitis are identified at first assessment (8,9).

1.2 Statement of the problem

Bacterial meningitis is one of the most serious infections seen in infants and children, which is associated with acute complications and chronic morbidity(10)

Globally, the median incidence of meningitis in children is 34.0 (16.0-88.0) per 100 000 child-years, with a median case-fatality rate of 14.4% (5.3%-26.2%).The median case-fatality rate was also highest in the African region (31.3%).(11)

Study done in Pakistan The mortality rate of acute bacterial meningitis in children <5 years is 34%. Mortality among subgroups were 7 (27%), 14 (28%), and 43 (39%) for Hib, Streptococcus pneumonia, and unknown etiology, respectively. Sequelae among cases included developmental delay (37%), motor deficit (31%), hearing impairment (18.5%), epilepsy (14%), and vision impairment (14%). Sequelae were higher after pneumococcal meningitis (19, 73%) compared with Hib meningitis (8, 53%)(12).

Study done in Children's Hospital of Philadelphia, The overall mortality rate of meningitis was 4.2% (95% CI, 3.5%-5.0%); the cumulative mortality rates were 2.2% and 3.1% at 7 days and 28 days, respectively, after admission. 23% of total deaths occurred on the first day of hospitalization; approximately half of the total deaths occurred during the first week of hospitalization. In the subset of children with pneumococcal meningitis (n=504), 29% of deaths occurred on the first day of hospitalization and 71% of deaths occurred during the first week of hospitalization. There were 15 deaths (6.0%) in children who received corticosteroids and 102 deaths (4.0%) in children who did not receive corticosteroids (relative risk, 1.50; 95% CI, 0.89-2.54).(13)

Bacterial meningitis accounts for approximately 6-8% of hospital admissions in Ethiopia with a case fatality rate of as high as 22-28 %(8). The most common pathogens being S. pneumonia, N. meningitides and H.influenzea (9,10). During the last several decades disease epidemiology and clinical features has changed dramatically in the countries that adapted the conjugate vaccines against H. influenza type b and S. pneumonia (11)

In the Ethio-Swedish children's Hospital in Addis Ababa the mortality rate was very high: 38% for H.influenzae and 41% for S.pneumoniae. Four of the 8 cases of penicillin-resistant pneumococcal isolates died (50%) as opposed to 15 of 38 (39%) penicillin-susceptible pneumococcal cases. Of the few complications documented, subdural effusion occurred in 18% of cases. Seizures observed at admission

or a few days later were seen in 41% of the cases. Four cases, 2 from each organism, had signs suggestive of brain herniation before they died. (14)

Information regarding short term treatment outcomes of meningitis in children and determinant factors for poor treatment outcome is scare. The objective of this study is to assess short term treatment outcomes of meningitis in children beyond neonatal age and determinant factors for poor treatment outcomes among children admitted a Tibebe Ghion Specialized Hospital and to identify those factors.

1.3 Justification of the study

This study is being done to know the associated factor and short term treatment outcome of meningitis in children so as to reduce mortality and morbidity.

As stated on the literature review and back ground there are limited studies which show associated factor and outcome of meningitis among children with meningitis in our set up and comparable hospitals.

TGSH is one of the largest hospitals in the country which is giving teaching activities and flow of patients are increasing from day to day for which the local causative organisms should be known as well as treatment outcome and associated factor of the disease is not studied.

To give quality care one should know the disease properties related to the environment, personal power and medication availability of medications which is not studied in our set up and comparable hospitals.

Since the hospital is receiving patients from nearby primary and general hospital this research will give major change on prevention and the management of meningitis in children

So, the result of this study will assess the association of dependent and independent variables and can help us on identifying complication and death rates due to meningitis and contributing factors in our set up. It will help to prepare quality service delivery manuals, guidelines and protocol to scale up survival rate and allocation of adequate material and human resource**.**

1.4 Significance of the study

In line with the above attributes and defined objectives, this study has multifaceted benefits to managing health professionals, hospital management, regional health bureau, stakeholders, ministry of health and communities at large by assessing prevalence of meningitis, treatment outcomes and contributing factors of mortality and to take appropriate action to the problem to maximize the quality of health care deliver.

2 Literature review

A.Treatment outcome of meningitis in children

In northern India in hospitalized cases with meningitis seizures were observed in 45.62% cases followed by raised intracranial pressure in 28% cases and coma in 10.5% cases. Other complications were infarct on imaging 7%, hydrocephalus 3.5% and subdural effusions 5.26%. From these children 89.5% got discharged and 10.5% died.(15)

In sub- Himalaya India among the ULOD cases with meningitis, 13.33% developed seizures during hospitalization and the intracranial pressure got raised in 3.33% patient. Ventilator support was required in 3.33% children. State of coma was observed in 6.66% and 3.33% died; while 3.33% patient left the hospital against medical advice. In LOD cases with meningitis 20% developed seizures, intracranial pressure got raised in one 10%, and ventilator support was required in one 10% child.(16)

Study done in Jordan the overall mortality of meningitis in children was 8%. 60% of children recovered without complications and 32% were left with one or more of the complications. The most complications are subdural effusion(14%), recurrent convulsions(8%), Hydrocephalus(6%), Deafness(4%) ,Cerebral atrophy(4%), Facial palsy(2%), cortical blindness(2%), Hemi paresis(4%).(17)

Study done in Greek showed the rate of acute complications of meningitis in children (arthritis and/or subdural effusion) was estimated at 6.8% while the rate of sequelae (severe hearing loss, Ventriculitis, hydrocephalus or seizure disorder) among survivors was estimated at 3.3%. Risk factors on admission associated with sequelae included seizures, absence of hemorrhagic rash, low CSF glucose, high CSF protein and the etiology of meningitis.(18)

In study done at university hospital in Norway children with meningitis 4(4.3%) of the patients died, (14)15.2% patients experienced one or more neurological sequelae, while 74 (80.5%) were healthy. Hearing impairment was the most frequent sequelae and was found in about 9% of patients. Five patients developed seizure disorder, three developed motor deficits and two became psychometric retarded. Cortical blindness was found in one patient and a ventricular peritoneal shunt was implanted in one patient because of hydrocephalus.(19)

In study done at Jima university hospital among patients with bacterial meningitis 67.4% improved without acute complication, while the remaining 32.6% had poor outcomes (9% died, 18% had delayed fever and 5.6% had acute neurologic complications).(20)

In retrospective study done at Gondar university Hospital overall case fatality of meningitis in children was 7.5%. All of the children who died were above the age of 10 years ($P < 0.05$). Prolonged fever is found to be more prevalent among children under five years followed by infants and older than 10 years ($p = 0.36$). Seizure after 72 hrs. of admission was a common complication among children older than 10 years old ($p = 0.283$) (21)

In Study done in Felege Hiwot Referral Hospital 69.8% of children had confirmed meningitis. In most patients, 63.7% there was no improvement seen with initial antibiotic therapy. Most patients 75.9%, discharged after improvement. From all patients studied 5.6% left the hospital against medical advice, and 3.4% cases died. Among the total participants of the study 32.4% developed seizure. In addition: 2.8%, 0.6%, 1.1%, 3.9% and 22.9% developed hydrocephalus, paralysis, brain abscess, shock and respiratory distress, respectively. Other complications were vision impairment, hearing deficit, hemiparesis and monoparesis.(22)

B. Associated factors for meningitis treatment outcome in children

In Study done in Irak male gender had significant prognostic effect and relation to complications of meningitis with P-value less than 0.05. Also, age<1 year found to have significant relation to complications as p value 0.0264.from clinical presentation only altered level of consciousness and focal neurological signs have significant relation to complications as p value was<0.05 in both. From investigations positive blood culture, positive CSF culture and CSF cell count>1000 all have significant relation to complications as their p value was <0.05.total duration of symptoms before diagnosis and delay in starting appropriate antibiotics was found to be significant in relation to complications as p value was<0.0001.(23)

In study done in Bangladish children with meningitis, and those with malnutrition, Total 12(20%) children died, 14(23%) developed major sequel, 10(17%) patients developed minor sequel. Relative risk of death was 5 fold followed by major sequel 6 fold and minor sequel 4 fold in malnourished group.(24)

In Benin children with meningitis In-hospital deaths accounted for 5.0%, whereas 70.1% children were discharged from hospital. Children aged 24–59 months accounted for most deaths (44.5%), followed by those aged 0–11 months (33.9%). There were more deaths in male children than in females (52.6% vs. 46.5%; P = .04).from survived 0.8% patients were reported to have lasting sequelae at the time of hospital discharge, including hearing loss and limb weakness.(25)

Study done in Sudan Most admissions were in summer; a period extending from March to June. Males represent 58.4%. The median age of all children is 1.3 years with a range of 2 days to 15 years. The most frequent age group was (1 to 5 years) among males (164/288, 56.9%) and among females (125/208, 60.1%), followed by age group (1 to 11 months) among males (104/288, 36.1%) and among females (76/208, 36.5% .High significance ($p<0.001$) but weak association (Corre = 0.27 [95% CI: 0.19 to 0.35]) were observed between hospital diagnosis and season of admission. Amongst patients diagnosed as having BM, 50.3% (100/199) were admitted in summer and 49.8% (99/199) in winter.(26)

In Angola children with meningitis during hospitalization, severe neurological sequelae were associated with prolonged fever (P< 0.001), secondary fever (P<0.001), prolonged altered consciousness (P<0.001), seizures (P< .001), focal neurological signs (P=0.008), an extrameningeal focus of infection (P= .02), and dehydration (P<0.00 1)(27)

Study at Jima university hospital showed Change of antibiotics from empiric therapy was found to be independent predictor of poor outcomes in young infants (AOR= 4.42, 95% CI (1.01-19.44)). However, in older infants and children: irritability (AOR=38.39, 95% CI (1.78-829.36)) and seizure prior to admission (AOR=27.53, 95% CI (1.45-522.35)), initial antibiotic regimen with ceftriaxone plus gentamycin (AOR=66.48, 95% CI (3.16-1400.13)), and missed doses of antibiotics (AOR=47.33, 95% CI (2.14-1046.19)) were found to independently predict poor outcomes.(20)

Study done in Gondar university Hospital a peak admission rate was registered during the month of March (22.5%) followed by February (15%) coinciding with the dry season. Bacterial meningitis was more common in children under one year (40%), and most patients were male (65%).Possible predisposing factors for meningitis were upper respiratory traction infection (25%), lack of breastfeeding (10%), previous admission (10%), lack of immunization (10%) and malnutrition of both

moderate and severe in 2.5%. The most common age group were infants 2-12 month old (40%).Children with adverse outcomes had shown a higher frequency of being older children ($p = 0.045$), loss of consciousness ($p = 0.046$), seizure at admission ($p < 0.01$), and a positive CSF culture ($p = 0.03$). (21)

In Study done at Felege Hiwot Referral Hospital about 15% children with meningitis developed poor outcomes. Season of admission was significantly associated with clinical outcome of meningitis. Children who were admitted in winter season were 5 times higher to have good outcome than those admitted in summer season [AOR= 5 (1.191, 20.991)]. Patients who completed their immunization were almost 20 times higher to have good outcome than those who didn't complete their vaccination [AOR= 20.912 (3.325, 131.502)].Children with worse clinical presentation were almost 9 times more likely to develop poor outcome than those with better presentation [AOR= 8.779 (1.599, 48.192)](22)

3 Conceptual frameworks

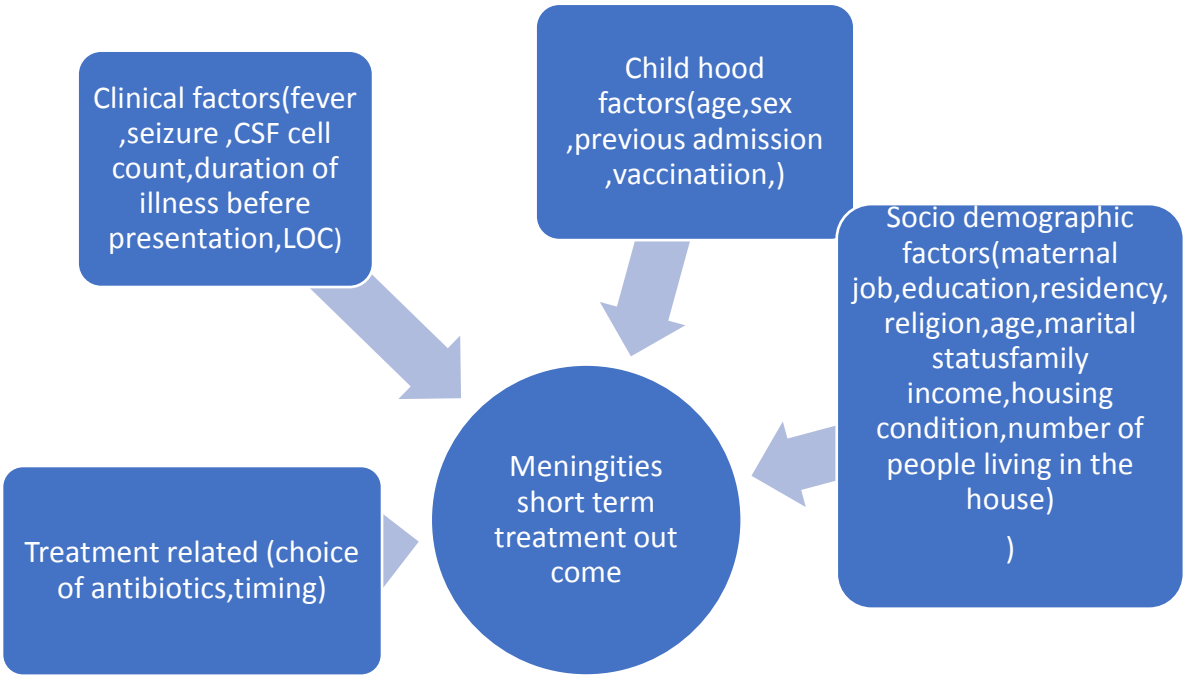

Figure 1 conceptual framework developed by principal investigator from literature review

4 Objectives of the study

4.1General objective

- To assess short term treatment outcomes and associated factors of meningitis among children beyond neonatal age admitted at TGSH.

4.2 Specific objectives

- To determine the proportion of poor short term treatment outcome of meningitis among children beyond neonatal age admitted at TGSH with meningitis.
- To identify factors associated with poor treatment outcome of meningitis among children beyond neonatal age admitted at TGSH with meningitis.

5 Methods

5.1 Study area and period

The study was conducted at TGSH, Bahir Dar city. Bahir dar is the capital city of Amhara national regional state and is located at 565 km in North West of Addis Ababa, Ethiopia. TGSH is one of the teaching hospitals in Ethiopia. Pediatrics department at TGSH was established on January, 2011 EC. It has both inpatient and outpatient units. There are 5 inpatient unites of these four are for children beyond neonatal age. There are 16 senior pediatrician and one subspecialist cardiologist. And also 34 residents are currently attaching to pediatrics department. The study was conducted on those admitted patients from January 1, 2019- August, 30, 2021 GC. at Tibebe Ghion Specialized Hospital.

5.2 Study design

Institutional based cross sectional study design was conducted

5.3 Population

5.3.1 Source population

All Children admitted to Tibebe Ghion Specialized Hospital during the time January 1, 2019- August, 30, 2021 GC.

5.3.2 Study population

Children admitted to Tibebe Ghion Specialized Hospital with meningitis during the time, January 1, 2019- August, 30, 2021 GC.

5.4 Eligibility criteria

5.4.1 Inclusion criteria

All Children beyond neonatal age admitted to Tibebe Ghion Specialized Hospital with meningitis

5.4.2 Exclusion criteria

1. Children whose cards not complete

2. Children disappear or went against medical advice.

3. Patients with major congenital anomaly

5.5 Data collection tools.

Check list were used

5. 6 Data collection procedure

Data was collected from documentary source (patient charts) and, was collected by trained two health professionals with one supervisor.

5.7 Data quality Control

Data collectors and supervisor were oriented. Demonstrated on how to collect all necessary data. There was open communication between data collectors, supervisor and investigator to ascertain quality and completeness of data.

5. 8 Sample size determination

The sample size for the study was determined using the assumption of level of confidence taken to be 95%, 5 % margin of error and p is the proportion of poor treatment outcomes of meningitis in children is 15% in the proposed study area based on this assumption the total sample size for the study was computed using the formula for single population proportion.

$n= (Z\alpha/2)2\ p\ (1-p)\ /d2$

Where n is sample size

$Z\alpha/2$=critical value is 1.96 $n= (Z\alpha/2)2\ p\ (1-p)/d2$

Where n is sample size

Zα/2=critical value is 1.96

P proportion of meningitis poor treatment outcomes is 0.15

d= precision (margin error) =0.05

Then n= (1.96)2× 0.15(1-0.15)/ (0.05)2

n=195 + 10% nonresponse rate=215

5.7 Sampling procedure

The study subjects were selected based on simple random sampling technique. There were 262 children admitted with meningitis in TGSH during the period January 1, 2019- August 30, 2021 GC.From these, 215 patient charts selected by using simple random sampling technique. Patient's registration book was taken as a sampling frame.

5.8 Variables

5.8.1 Dependent variables

Treatment outcome of Meningitis

5.8.2 Independent variables

- ✓ Age of the child
- ✓ Vaccination status
- ✓ Maternal factor (educated or not,)
- ✓ patient presentation
- ✓ Nutritional status
- ✓ treatment

5.9 Term definition

Cured; discharged home without complication.

Complication; related to the disease (persistent seizure, subdural effusion, brain abscess, focal neurological deficit, hydrocephalus)

Death; when life ends due to the meningitis or due to its complication while in the hospital or before discharge

Good treatment outcome: discharged with no complication

Poor short term outcome: Is defined as death or an adverse neurological outcome (persistent seizure, subdural effusion, brain abscess, focal neurological deficit, and hydrocephalus) that was noted at the time of discharge from the hospital and that was attributable to the episode of meningitis.

5.10 Data management and analysis

Data was checked, cleaned and entered in to SPSS version 25.0 software for analysis. The result is expressed as percentage and frequency. Associations between independent variables and dependent variables were analyzed using bivariate and multivariate analysis to identify factors which are significantly associated with the outcome variable and P value less than 0.05 is considered as statistically significant level throughout the study.

6 Ethical consideration

Ethical clearance was obtained from CMHS, ethical committee. Formal letter cooperation was secured in TGSH.Name and other personal information which can violate the confidentiality of the patient was not exposed to the third party for any other reason. All information revealed will be kept in the way that could not interfere in personal confidentiality **and it will never be for other purpose**.

7 RESULTS

7.1 Socio demographic characteristics of children with meningitis: Two hundred fifteen pediatric files were studied. Of the total, 128(59.5%) were males and the majority (68%) were between age of 1 month-2 years. From all, 48 (22.3%) mothers of children were not educated, and 97 (45.1%) of them were farmer. Regarding vaccination status, 146 (67.9%) were completed according to EPI schedule. About 3 (1.4%) of them had HIV coinfection, and 64(29.8%) were malnourished.

Table 1: Socio demographic characteristics of children with meningitis who were admitted in TGSH, from January1, 2019-August 30,2021, Bahir Dar, Ethiopia, 2021 (n= 215)

Variables		Frequency	Percent
Age	1 month-1 year	93	43.3
	1 year -2 year	53	24.7
	2 year-5 year	22	10.2
	5 year-14 year	47	21.9
Sex	Male	128	59.5
	Female	87	40.5
Maternal education	No formal education	48	22.3
	Primary education	61	28.4
	Secondary education	42	19.5
	Tertiary education	35	16.3
	Not known	29	13.5
Maternal occupation	Employed	35	16.3
	Merchant	38	17.7
	Farmer	97	45.1
	House wife	25	11.6
	Not documented	20	9.3
Residence	Urban	89	41.4
	Rural	126	58.6
Season of admission	Summer	88	40.9
	Winter	80	78.1
	Autumn	22	10.2
	Spring	25	11.6
History of admission	Yes	31	14.4
	No	184	85.6
Nutritional status	Malnourished	64	29.8
	Well-nourished	151	70.2
Co infection with TB	Yes	5	2.3
	No	210	97.7
Co infection with HIV	Yes	3	1.4
	No	197	91.6
	Not screened	15	7.0
Maternal Religion	Orthodox	165	76.7
	Muslim	9	4.2
	Protestant	18	8.4
	Not known	23	10.7
Marital status	Married	197	91.6

	Divorced	10	4.7
	Not known	8	3.7
Child vaccination	Complete	146	67.9
	Incomplete	42	19.5
	Not started	27	12.6

Table 2: Clinical presentations of meningitis in children beyond neonatal age who were admitted in TGSH, from January 1,2019-Augus 30, 2021, Bahir Dar, Ethiopia, 2021 (n=215)

Variables	Clinical features	Frequency	Percent
Duration of illness before presentation	1-2 days	89	41.4
	3-7 days	77	35.8
	>7 days	49	22.8
Fever	Yes	200	93.0
	No	15	7.0
Seizure	Yes	28	13.0
	No	187	87.0
Vomiting	Yes	107	49.8
	No	108	50.2
Loss of consciousness	Yes	25	11.6
	No	190	88.4
Deceased feeding	Yes	28	13.0
	No	187	87.0
Fast breathing	Yes	22	10.2
	No	193	89.8
Temperature at Admission	Febrile	184	85.6
	Hypothermic	8	3.7
	Normal	23	10.7
CSF Cell count	<1000	182	84.7
	1000-5000	31	44.4
	>5000	2	0.9
Gram stain	Positive	5	2.5
	Negative	190	97.4
	Not done	20	9.3

Blood culture	Positive	6	2.8
	Negative	12	5.6
	Not done	197	91.6
Treatment	Empirical	209	97.2
	Based on culture &sensitivity	6	2.8

7.2 Clinical presentations and laboratory findings of children beyond neonatal age with meningitis:

About 89 (41.4%) arrived at the health facilities within 1-2 days of the onset of illness. From all patients, 28 (13%) and 25(11.6%) had seizure and impaired consciousness at presentation respectively. Cerebrospinal fluid (CSF) analysis was done for all patients .Gram stain was done for 195 (90.6%), and most of them, 190(97.4%), were no gram reaction.

Table 3: Complications and Outcome of meningitis in children beyond neonatal age who were admitted in TGSH, from January 1, 2019-Augus 30,2021, Bahir Dar, Ethiopia, 2021 (n=215)

Variable	Complications	Frequency	Percent
Persistent seizure	Yes	15	7.0
	No	200	93.0
Brain abscess	Yes	6	2.8
	No	209	97.2
Subdural effusion	Yes	2	0.9
	No	213	99.1
Hydrocephalus	Yes	18	8.4
	No	197	91.6
Focal neurological deficit	Yes	6	2.8
	No	209	97.2
Treatment outcome	Cured	174	80.9
	With complication	36	16.7
	Died	5	2.3
Overall outcome	Good	174	80.9
	Poor	41	19.1

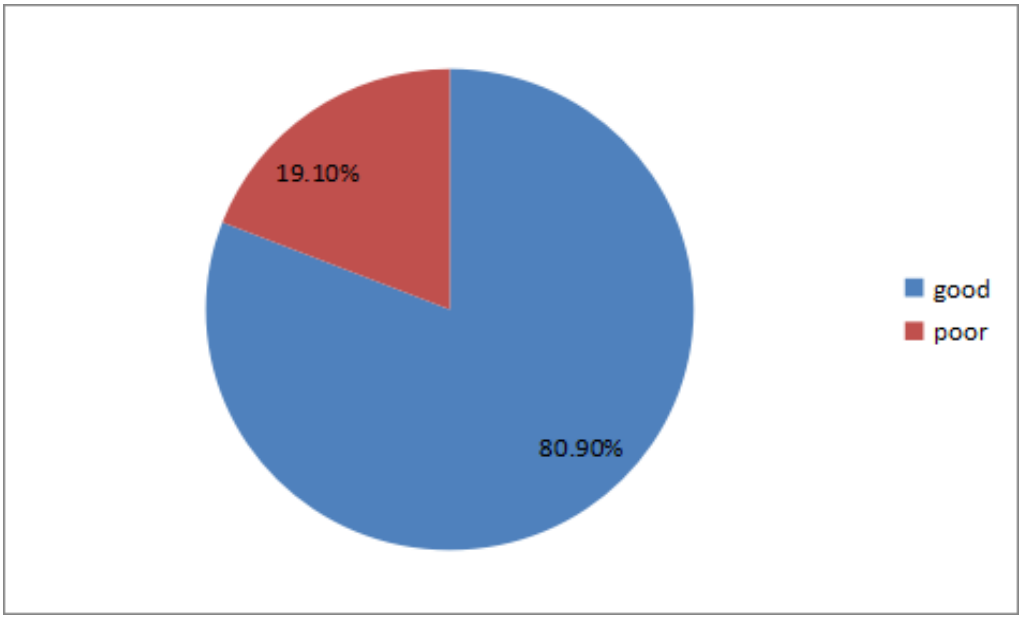

Figure 2 treatment outcome of meningitis

7.3 Complications and outcome of meningitis in children beyond neonatal age

Most patients 174 (80.9%) discharged after improvement. From all patients studied, 2.3% cases died. Among the total participants of the study, 18 (8.4%) developed hydrocephalus and 15 (7.0 %) developed persistent seizure. In addition: 6(2.8%), 6(2.8%), 2 (0.9%) developed focal neurological deficit, brain abscess, and subdural effusion, respectively (Table 3).

7.4 Factors associated with poor treatment outcome of meningitis:

To identify factors associated with poor treatment outcome of meningitis, each variable was assessed independently whether they were predictors of poor outcome or not. First, variables were tested using bivariate analysis. Variables which had $P<0.05$ were: age, duration of illness before presentation, the presence of seizure at presentation, loss of consciousness, CSF cell count and nutritional status.

Variables which were selected in the bivariate analysis were tested in the multivariate analysis to see their significant effect on outcome meningitis. After adjusting for potential con founders in multivariate logistic regression analysis, age, the presence of seizure at presentation, CSF cell count and nutritional status, remained significant.

Age was significantly associated with clinical outcome of meningitis. Children who were below one year were 18 times higher to have poor outcome than those above one year. [AOR= 17.931(2.983, 107.779)

Children who had seizure at presentation were also associated with clinical outcome of meningitis. Patients who had seizure at presentation were 4 times higher to have poor outcome than those didn't have. [AOR= 4.321(1.250, 14.941)].

Regarding to CSF cell count, children with CSF cell count >1000 were almost 4 times more likely to develop poor outcome than those with CSF cell count <1000 [AOR= 4.218(1.171, 15.194)].

Children with malnutrition were almost 2 times higher to develop poor outcome than those wellnurshed children [AOR= 2.737(1.049, 7.141)] (Table 4).

Table 4: Distribution of clinical outcome of meningitis in children beyond neonatal age who were admitted in TGSH, from January 1, 2019-Augus 30, 2021, Bahir Dar, Ethiopia, 2021 (n=215).

Variables		Clinical outcomes		COR (95% CL)	AOR(95% CL)	p-value
		Good (N & %)	Poor (N & %)			
Age	Up to 1 year	63	30	10.7(2.43,47.14)	17.931(2.983,107.779)	0.002
	Above 1 year	111	11	1	1	
Duration of illness before presentation	<7 days	146	20	1		
	>7 days	28	21	5.318(2.278,12.414)		
Seizure at presentation	Yes	12	16	8.640(3.660,20.394	4.321(1.250,14.941)	0.021
	No	162	25	1	1	
Loss of consciousness	Yes	14	11	4.190(1.737,10.110)		
	No	160	30	1		
Immunization	Completed	126	20	1		
	Not complete	48	21	3.500(1.592,7.696)		
CSF cell count	<1000	158	24	1	1	
	>1000	16	17	7.022(3.077,16.023	4.218(1.171,15.194)	0.028
Nutritional status	Malnourished	43	21	3.199(1.584,6.458)	2.737(1.049,7.141)	0.04
	Well-nourished	131	20	1	1	

8 DISCUSSIONS

Meningitis is one of the most severe diseases accounting for numerous complications deaths. Infants and young children have high risk to develop meningitis and its complications.

The aim of this study was to assess short term treatment outcome of meningitis in children. Accordingly, our finding found that the prevalence of poor short term treatment outcome of meningitis in children beyond neonatal age is 19.1 % .This is higher than a study conducted in FHRH in 2016 where the proportion of poor outcome was 15 %.This can be due to many referral cases as TGSH is tertiary hospital and there can be a delay in presentation.(22) There was also a similar finding to our study in Norway where the proportion of poor outcome was 19.5 %.(19)

In this study meningitis was common between the ages of 1 month to one year (43.3%) which is consistent with the study done in Benin which is 44.5%.(25)

This study shows that meningitis was more common in males than in females (59.5%) which are consistent to a study done in Benin which was 53%.(25)

Age < one year was one of the predictor for poor clinical outcome of meningitis in this study which is consistent to a study done in Jordan in which most of the complications and mortality are below one year of age.(17)and Irak.(23)

CSF cell count >1ooo is the predictor for poor treatment outcome of meningitis in children in this study. A similar study done in Greece showed that CSF cell count >1000 didn't predict poor treatment outcome of meningitis. This difference can be due to etiological difference, different setup, different sample size and treatment guidelines between the two countries.(18)

Seizure at presentation also one of the independent determinate for poor treatment outcome of meningitis in children beyond neonatal age in this study which is consistent with a similar study done at Jima university Hospital.(20) and similar study done in Angola.(27)

The other predictor of poor treatment outcome of meningitis in children in this study is malnutrition. Children with malnutrition had poor outcome 2 times higher than those who didn't have malnutrition. Similar study done in Bangladish showed that children with meningitis who had malnutrition had more complication and mortality than who didn't have.(24)

In this study, children with meningitis, 8.4% developed hydrocephalus, 7 % patients developed persistent seizure, and 2.8% focal neurological deficit, 2.8% developed brain abscess, and 0.9% developed subdural effusion. The most complications in the study done in Jordan showed subdural effusion(14%), recurrent convulsions(8%), Hydrocephalus(6%), Deafness(4%) ,Cerebral atrophy(4%), Facial palsy(2%), cortical blindness(2%), Hemi paresis(4%).(17)

9 Conclusions

This study showed that one out of five of pediatrics patients with meningitis developed poor outcomes. Patients age less than one year, who had seizure at presentation, those with CSF cell count >1000 and those patients who were Malnourished had poor prognosis than their counter parts.

10 Limitation of the study

Since the study was based on the documented data (chart review) and May not display all factors that were not documented in the patient's file.

Culture is not done for the majority of patients

11 Recommendations

For children care givers improving nutritional status of children and homecare are recommended to improve clinical outcome.

Proper and strict seizure management is recommended to the hospital to improve clinical outcome in children with meningitis.

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