Original Article

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Clinico-bacteriological Profile of Pneumonia, Meningitis and Sepsis in under Five Children from a Tertiary Care Hospital in Central India

Paediatrics Section

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ABSTRACT

Introduction: Invasive Bacterial Diseases (IBD) are the major causes of morbidity and mortality in under five children in India. There is difference in the pattern and aetiology of IBD according to the geographical variation and the antimicrobial susceptibility of causative organisms are also variable. There is lack of data on patterns of IBD from central India.

Aim: To generate the data on the burden of pneumonia, meningitis and sepsis among under five children in central India and the microorganisms associated with them.

Materials and Methods: This prospective observational study was conducted from August 2019 to July 2020 at the Department of Paediatrics at Mahatma Gandhi Memorial Medical College and MY Hospital, indore, India on children of 1-59 months of age admitted with pneumonia, meningitis and sepsis. A detailed history was recorded for all the participants and thorough physical examination was done along with chest X-ray , routine laboratory examination and blood cultures were performed. Latex Agglutination Test (LAT) and Antibiotic Susceptibility Testing (AST) were performed on Cerebrospinal Fluid (CSF) samples. All the data collected were recorded in Microsoft (MS) excel sheet and frequency (n), percentages (%) and chi-square test for significance level, were calculated to analyse the collected data.

Results: Of the total 450 cases enrolled, 283 (62.8%) had confirmed IBD. Out of the confirmed cases, 183 (64.6%) had pneumonia, 52 (18.3%) had meningitis and 48 (16.9%) had sepsis. Highest case fatality rate was seen with sepsis followed by meningitis and pneumonia. The most common organism isolated was *Staphylococcus aureus*. Overall, gram negative bacilli were found to be more resistant to the conventional antibiotics than gram positive organisms. An 40 (83%) of *Staphylococcus aureus* were susceptible to methicillin whereas only 12 (45%) of *Klebsiella pneumoniae* were susceptible to amikacin.

Conclusion: The present study highlights the predominance of *staphylococcus aureus* and adverse outcomes of IBD in children with Severe Acute Malnutrition (SAM) and incomplete immunisation. Emergence of resistant bacterial strains to conventional antibiotics warrants the need to consider the locally prevailing antimicrobial susceptibility patterns for the effective management of these diseases.

Keywords: Bacteria, Invasive bacterial diseases, Meningitis, Pneumonia

INTRODUCTION

The common causes of childhood mortality and morbidity include undernutrition, diarrhea, anaemia and IBD [1]. IBD like meningitis, pneumonia and sepsis are a serious group of diseases that can be rapidly progressive with resultant significant morbidity and mortality. Moreover, the clinical presentation of these diseases especially sepsis and meningitis are vague and no pathognomonic signs and symptoms can help in accurately diagnosing their cause, making the aetiological diagnosis dependent on the microbiology lab. Early detection of these diseases aids the clinician in providing a timely intervention and to institute appropriate antibiotic therapy, as providing therapy early is imperative in reducing the morbidity and mortality. Many a times empirical antibiotics have to be started even before the complete laboratory results are available. Such a blind prescription requires knowledge on the most frequent aetiological agents of these diseases existent in the local geographical area. No data is available on the clinical pattern of these diseases and the organisms associated with them in central India.

Multicentric Invasive Bacterial Infection Surveillance conducted at six Indian centers (Delhi, Lucknow, Nagpur, Vellore, Chennai, and Trivandrum) and hospital based surveillance of invasive pneumococcal diseases conducted in South Bangalore are some of the few studies from India describing the clinical pattern and microbiology of IBD [2,3]. But no such data from Madhya Pradesh is available. Further more robust data regarding the antimicrobial sensitivity pattern of the causative organisms of these diseases is also not available. Hence, we conducted this study to generate data on the clinical pattern, laboratory profile and antibiotic sensitivity pattern of causative microorganisms of pneumonia, meningitis and sepsis in patients admitted in present hospital. Various factors affecting the course and outcomes of IBD in under five children were also studied.

MATERIALS AND METHODS

This prospective observational study was conducted at a tertiary care hospital in Indore, Madhya Pradesh, India. The project was an extension of the Hospital Based Sentinel Surveillance for Pneumonia and Invasive Bacterial Diseases (HBSSPIBD) carried out by Indian Council of Medical Research (ICMR) [4]. The study was conducted from August 2019 to July 2020 after clearance from the Institutional Ethics Committee (Reg No. ECR/397/Inst/MP/2013/RR-16). All patients fulfilling the inclusion criteria and reporting to the hospital during the study period were included and no formal sample size calculation was done.

Inclusion criteria: All the children aged 1-59 months who fulfilled the case definitions of pneumonia, meningitis and sepsis as defined by HBSSPIBD were recruited after obtaining the informed consent from their parents [4].

Exclusion criteria: Postoperative or post lumbar puncture meningitis or hospitalisation for different illness within past 10 days of the visit where recruitment diagnosis is not meningitis in expanded surveillance or children with recurrent wheezing and meeting pneumonia case definition by respiratory rate criteria only.

Study Procedure

Detailed anthropometric measurements of weight, height/length, weight for height/length, Mid Upper Arm Circumference (MUAC)

were recorded for each patient. Patients were classified as SAM (Severe acute malnutrition) if any of the following were present:

a) Weight for height/length was <-3SD and/or

b) MUAC <11.5 cm and/or

c) Bi-pedal oedema (no known cause of oedema like nephrotic or congestive heart failure present)

Case Definitions [4]

Pneumonia: Previously healthy children of 1-59 months of age hospitalised with World Health Organisation (WHO) criteria for pneumonia, with history of cough, fever and/or difficult breathing, and tachypnea (as defined >60 breaths/minute if <2 months of age; >50 breaths/minute if two months to <12 months age; >40 breaths/minute if 12 months to <5 years age) and/or chest indrawing and/or hypoxia and pneumonia patients with positive blood culture and/or chest X-ray suggestive of bacterial pneumonia [5].

Meningitis: Children aged 1-59 months with clinically suspected meningitis as defined by following criteria. Suspected meningitis (fever <7 days) either by history of fever based on parent/guardian recall or clinical finding of temperature -38°C axillary or >38.5°C rectal or hypothermia (<36°C) and one or more of the following symptoms or signs: neck stiffness/bulging fontanelle (if fontanelle is open)/ altered or reduced level of consciousness or prostration or lethargy defined as abnormally difficult to rouse/convulsions in a child who does not have a documented seizure disorder, defined as clear history of jerking or stiffness or clinical suspicion of bacterial meningitis by the physician. Probable meningitis children with suspected meningitis and CSF examination (turbid appearance/white cell count >100 cell/mm^3/white cell count 10-100 cell/mm^3 and glucose <40 mg/dL or protein >100 mg/dL) and laboratory confirmed by CSF culture or blood culture positive.

Sepsis: History of fever >38°C or hypothermia <36°C within the past five days without evidence of meningitis or pneumonia and clinical signs.

After recruitment of the participants, a detailed history was taken and a thorough physical examination done. A clinical case report form was filled at this stage to record all the relevant details. Chest X-ray was done for all cases recruited for pneumonia. For all patients recruited for the study, 5 mL blood was collected for routine examination and blood culture. Cultures grown were followed-up with standard biochemical tests for isolate identification and confirmation. Similarly, 2 mL CSF samples were obtained from cases recruited for meningitis. CSF was examined for routine biochemistry and microbiological culture. Latex Agglutination Test (LAT) for identification of *Streptococcus pneumoniae*, *Neisseria meningitidis* and *Haemophilus influenzae* antigens was applied on all CSF samples. Antibiotic susceptibility testing was performed for both blood and CSF isolates on Muller Hinton Agar using Disc Diameter method. All the laboratory findings were recorded in Laboratory Case Record Form (CRF).

STATISTICAL ANALYSIS

The data from each patient was compiled on Microsoft Excel 2007 as descriptive statistical analysis was done. Chi-square test was applied and p-value was calculated wherever applicable.

RESULTS

Total 450 cases with suspected IBD were enrolled in the study, of which 283 (62.8%) had confirmed IBD. Out of the confirmed cases, 183 (64.6%) had pneumonia, 52 (18.3%) had meningitis and 48 (16.9%) had sepsis [Table/Fig-1]. More than half of patients 183 (64.6%) of IBD were infants. More than half of the patients of IBD were males 161 (56.8%). Nearly half of the patients 157 (55.4%) of IBD had SAM. The 152 (53.7%) patients were completely immunised for age, 48 (16.9%) patients were incompletely immunised and 83 (29.3%) were unimmunised. A 57 (20.1%) patients died during the study period. A 210 (74.2%) patients got discharged while 16 (5.6%) patients Left Against Medical Advice (LAMA).

Variable	Parameter	Pneumonia (n=183)	Meningitis (n=52)	Sepsis (n=48)	Total (n=283)	
Age	1-11 months	118 (64.4)	34 (65.3)	32 (66.6)	184 (65)	
	12-59 months	65 (35.5)	18 (34.6)	16 (33.3)	99 (34.9)	
Gender	Male	104 (56.8)	32 (61.5)	25 (52.1)	161 (56.8)	
	Female	79 (43.2)	20 (38.5)	23 (47.9)	122 (43.1)	
Nutrition	SAM	104 (56.8)	28 (53.8)	25 (52.1)	157 (55.4)	
	Not SAM	79 (43.2)	24 (46.3)	23 (47.9)	126 (44.5)	
Immunisation status	Complete	108 (59)	23 (44.2)	21 (43.7)	152 (53.7)	
	Incomplete	25 (13.6)	10 (19.2)	13 (27)	48 (16.9)	
	Unimmunised	50 (27.3)	19 (36.5)	14 (29.1)	83 (29.3%)	
Outcome	Death	26 (14.2)	9 (17.3)	22 (45.8)	57(20.1)	
					SAM:41 (14.4)**	No SAM:16 (5.7)
	Discharge	154 (84.2)	35 (67.3)	21 (43.8)	210 (74.2)	
	LAMA*	3 (1.6)	8 (15.4)	5 (10.4)	16 (5.6)	

[Table/Fig-1]: Demographic profile of the cases.
*LAMA: Left against medical advice; SAM: Severe acute malnutrition
**p-value: 0.005 (Mortality in SAM patients was significantly more than non-SAM)

The most common presenting symptom in pneumonia was fast breathing [Table/Fig-2]. Majority of patients 174 (95.1%) had complaint of fast breathing on admission. Of 183 cases of bacterial pneumonia, 124 (67.7%) had consolidation on chest X-ray, 36 (19.7%) had pleural effusion, 17 (9.2%) had perihilar infiltrates, 13 (7.1%) had pneumothorax, 10 (3%) had hyperinflation, seven had cavitation and 1 (0.5%) case had hydropneumothorax on chest X-ray. Overall positive bacterial cultures were obtained in 60 (32.7%) out of 183 pneumonia cases. The most commonly isolated pathogens were *Staphylococcus aureus (S. aureus)* 28 (15.3%), *Klebsiella* 15 (8.1%), *Escherichia coli (E. coli)* 8 (4.3%), *Enterococcus* 5 (2.7%), *Pseudomonas* 3 (1.6%) and *Acinetobacter* 1 (0.5%) in descending order [Table/Fig-3].

Symptom	Pneumonia n (%)	Meningitis n (%)	Sepsis n (%)
Fever	172 (93.9)	51 (98)	39 (81.2)
Cough	121 (66.1)	-	-
Tachypnea	174 (95.1)	-	-
Chest indrawing	164 (89.6)	-	-
Severe respiratory distress (Grunting, shortness of breath, Dyspnea)	125 (68.3)	-	-
Hypoxia	133 (72.6)	-	-
Neck rigidity	-	16 (30)	-
Altered sensorium	-	42 (80)	-
Convulsions	-	47 (90)	-
Lethargy	-	39 (75)	38 (79.1)
Bulging fontanelle	-	24 (46.1)	-
Inability to drink	-	-	36 (75)
Incessant vomiting	-	-	38 (79)
Hypothermia	-	-	18 (37.5)

[Table/Fig-2]: Clinical profile of invasive bacterial diseases.

The most common clinical symptoms found in confirmed bacterial meningitis cases in present study were fever 51 (98%). Majority 39 (75%) of meningitis patients had more than 100 Total Leukocyte Count (TLC) on CSF routine microscopy. 13 (25%) patients had a TLC between 10-99 with CSF protein >100 g/dL and/or CSF glucose <40 mg/dL. Overall positive bacterial cultures were obtained in 18 (34.6%) out of 52 meningitis cases. The most commonly isolated pathogens were *Klebsiella* 8 (15.3%), *Enterococcus* 3 (5.7%), *E. coli* 3 (5.7%), *S. aureus* 2 (3.8%), *Streptococcus pneumoniae* 1 (1.9%),

Invasive bacterial disease	Organisms identified in various IBD by culture	n (%)	Total organisms identified by culture	Organisms identified in various IBD by LAT*
Pneumonia	*Staphylococcus aureus*	28 (15.3%)	60	
	Klebsiella	15 (8.1%)		
	E. coli	8 (4%)		
	Enterococcus	5 (3%)		
	Pseudomonas	3 (2%)		
	Acinetobacter	1 (1%)		
Meningitis	*Klebsiella*	8 (15%)	18	
	Enterococcus	3 (6%)		
	E. coli	3 (6%)		
	Staphylococcus aureus	2 (4%)		
	Streptococcus pneumoniae	1 (2%)		4 (1.4)
	Acinetobacter	1 (2%)		
	Neisseria meningitidis			3 (1.0)
Sepsis	*Staphylococcus aureus*	15 (31%)	30	
	E. coli	8 (16%)		
	Klebsiella	4 (8%)		
	Enterococcus	2 (4%)		
	Pseudomonas	1 (2%)		
Total			108	7

[Table/Fig-3]: Organisms identified in Invasive Bacterial Diseases (IBD).
*LAT: Latex agglutination test

Acinetobacter 1 (1.9%). Four cases showed *Streptococcus pneumoniae* and three cases showed *Neisseria meningitidis* on LAT of CSF.

The most common presenting symptom of sepsis was fever 39 (81%). Overall positive bacterial cultures were obtained in 30 (62.5%) out of 48 Sepsis cases. The most commonly isolated pathogens were *S. aureus* 15 (31%), *E. coli* 8 (16%), *Klebsiella* 4 (8%), *Enterococcus* 2 (4%), *Pseudomonas* 1 (2%). The mortality in IBD was 57 (20.1%). The case fatality rate was highest for sepsis 22 (45.8%) followed by meningitis 9 (17.3%) and pneumonia 26 (14.2%). Of the total 57 deaths in IBD, only 18 (31.5%) had received complete vaccination, rest 39 (68.4%) patients were either completely unimmunised or had received incomplete vaccination i.e., not received pneumococcal vaccine. Mortality of IBD in patients with SAM 41 (26%) was significantly more (p-value=0.005) than that in patients who did not have SAM 16 (12.5%) [Table/Fig-1].

Staphylococcus aureus showed a high level of resistance to trimethoprim/sulfamethoxazole (TMP-SMX) whereas a low level of resistance to methicillin, vancomycin and linezolid [Table/Fig-4]. *Streptococcus pneumoniae* that was isolated was susceptible to all the conventional antibiotics. The gram negative species were more resistant to conventional antibiotics with only 40% sensitivity of *Klebsiella* to cefotaxime and amikacin, 60% sensitivity to ciprofloxacin. However, sensitivity to Imipenem was found to be high in gram negative species [Table/Fig-5].

Antibiotic	*Staphylococcus aureus* (n=45) (%)	*Streptococcus pneumonia* (n=1) (%)	*Enterococcus* (n=10) (%)
Cotrimoxazole (TMP-SMX)	17 (38)	1 (100)	-
Methicillin(M)	40 (88.8)	-	-
Gentamycin (Gen)	45 (100)	1 (100)	7 (70)
Cefoxitin (Cfx)	20 (44)	0	-
Vancomycin (Va)	43 (95)	1 (100)	8 (80)
Linezolid (Lz)	45 (100)	1 (100)	10 (100)

[Table/Fig-4]: Antibiotic susceptibility of gram positive isolates.

Antibiotic	*Klebsiella* (n=27) (%)	*E. coli* (n=19) (%)	*Pseudomonas* (n=4) (%)	*Acinetobacter* (n=2) (%)
Amikacin (Ak)	12 (45)	14 (73.6)	1 (25)	1 (50)
Ciprofloxacin (CIP)	16 (60)	13 (68.4)	1 (25)	1 (50)
Cefotaxime (CTX)	11 (40.7)	9 (47.3)	1 (25)	0
Piperacillin (P)	3 (11.1)	2 (10.5)	0	1 (50)
Piperacillin-tazobactam (PIT)	18 (66.6)	13 (68.4)	2 (50)	2 (100)
Imipenem (IMP)	24 (88.8)	18 (94.7)	2 (50)	2 (100)

[Table/Fig-5]: Antibiotic susceptibility of gram-negative isolates.

DISCUSSION

This study was conducted to generate data on the clinical pattern, laboratory profile and antibiotic sensitivity pattern of causative microorganisms of pneumonia, meningitis and sepsis in under five children admitted in a tertiary care hospital in central India. In present study, out of the confirmed cases, 183 (64.6%) had pneumonia, 52 (18.3%) had meningitis and 48 (16.9%) had sepsis. The findings were similar to a study by Shah A et al., in Bangalore in 2006, wherein the proportion of pneumonia, meningitis and sepsis cases was 44%, 21% and 35%, respectively [6]. However, the Issue-Based Information System (IBIS) study found majority (37%) of the enrolled children had meningitis, 30% had pneumonia and 8% had sepsis [2].

The age wise analysis of present study revealed that the proportion of IBD was higher in 1-11 months of age group 184 (65%) as compared to 12-59 months 99 (34.9%). Similar finding has been reported by Mehendale S et al., in a study on burden of bacterial meningitis in India in 2012-13 in which 55.3% cases of bacterial meningitis occurred in infants [7]. Incidence of IBD is high in infants which may be attributable to lack of immunity to specific pathogens associated with young age [8]. Under developed immune system in these very young children could possibly be making them more susceptible to IBD [9].

Current study had a male preponderance as 161 (56.8%) patients of IBD were males. Several similar studies have noted male preponderance and this may reflect the admission bias seen in hospital studies in developing countries like India [2,7,8]. More than half 157 (55.4%) of the patients in this study had SAM. Various studies have reported an increased incidence and poor outcome of IBD in children with SAM [9,10]. SAM results in alterations of host defense mechanisms, which leads to increased susceptibility to infections. A 155 (54.7%) of the enrolled patients had received antibiotics prior to hospitalisation. Inclusion of cases known to have been managed with antibiotics probably reduced the number of cultures with positive results. Most patients admitted in tertiary care centers have received antibiotics from private practitioners or over the counter as community antibiotic use is very prevalent in India [2].

Of 183 cases of bacterial pneumonia, 124 (67.7%) had consolidation on chest X-ray. In the multisite Pneumonia Etiology Research for Child Health (PERCH) study, overall 54% of interpretable chest X-rays were abnormal of which 50% had consolidation and 50% had other infiltrate [11]. In this study, overall positive bacterial cultures were obtained in 60 (32.7%) out of 183 pneumonia cases. The most commonly isolated pathogens were *S. aureus* 28 (15%), *Klebsiella* 15 (8%), *E. coli 8 (4%), Enterococcus* 5 (3%), *Pseudomonas* 3 (2%) and *Acinetobacter* 1 (1%). Similarly, Chaudhary GS et al., in their study reported *S. aureus* to be the most common bacterial pathogen associated with community acquired pneumonia in children [12]. However, Das A et al., in their study reported a 64.4% culture positivity with *S. pneumoniae* and *H. influenzae* being the most common causative organisms in childhood pneumonia [13]. *S. aureus* and

some gram negative bacilli like *K. pneumoniae* were detected as the leading cause of pneumonia by Johnson AW et al., [14].

The most commonly isolated pathogens in CSF in present study were *Klebsiella* 8 (15.3%), *Enterococcus* 3 (6%), *E. coli 3 (6%), S. aureus* 2 (4%), *Streptococcus pneumoniae* 1 (2%), *Acinetobacter* 1 (2%). De AS et al., reported a CSF culture positivity of 12.6% cases whereas Wu HM et al., have shown a culture positivity of 22.2% [8,15]. Overall culture positivity of *Streptococcus pneumoniae* in various studies varies from as low as 2.4% from Bengaluru to as high as 77% from Ghana [6,16]. In the present study, no *Neisseria meningitides* were isolated on culture. Three CSF samples were positive for *N. meningitidis* antigen on LAT. Isolation of *Neisseria meningitidis* in CSF is verylow in India, 1% from Bengaluru, and varying from 1-25% in western countries [15-17]. A study from Niger had high isolation rate (63%) of *N. meningitidis* from CSF [18]. Current study failed to recover *Haemophilus influenzae* even though selective media were used to isolate this organism. The *H. influenzae* Type b (Hib) study working group has reported a high culture positivity of *H. influenzae* 34 (62%) [19]. In all other studies, *H. influenzae* positivity rate varied from 0.9-12.6% [15,17,18,20].

Positive bacterial cultures were obtained in 30 (62.5%) out of 48 sepsis cases. The three most commonly isolated pathogens in current study were *S. aureus* 15 (31%), *E. coli* 8 (16%), *Klebsiella* 4 (8%) as against a study conducted by Pawar A et al., on paediatric sepsis where the commonest organisms were *Klebsiella* (28.1%), *Enterococcus* (15.6%), *S. aureus* (12.5%) and *E. coli* (12.5%) [21].

In this study, mortality of IBD was 57 (20.1%). The case fatality rate was highest for sepsis 22 (45.8%) followed by meningitis 9 (17.3%) and pneumonia 26 (14.2%). Nisarga R et al., in their study on invasive pneumococcal diseases reported a case fatality rate of 24.6% in sepsis, 12.5% in pneumonia and 7.7% in meningitis [3]. Pawar A et al., reported a 32.7% mortality rate of sepsis [21]. Sepsis in Indian children is associated with high mortality [22]. The high mortality in sepsis could be attributed to its subtle signs and symptoms like inability to feed and drink and hypothermia which could have been overlooked by the caregivers as compared to tachypnea, chest indrawing in pneumonia and convulsions in meningitis which are easily noticeable.

Among the total deaths that occurred in this study, almost two-thirds 39 (68.4%) of the patients belonged to the incompletely immunised/ unimmunised group indicating the protective effect of vaccination against IBD, however the difference was not statistically significant (p-value:0.23). Mortality of IBD in patients with SAM 41 (26%) was significantly more than that in patients who did not have SAM 16 (12.5%) indicating poor outcome of IBD in patients of SAM.

In present study, only 38% of the total *S. aureus* isolates were susceptible to TMP-SMX, 88% were susceptible to methicillin and 95% to vancomycin which were similar to findings by De AS et al., where sensitivity reported was 50% to TMP-SMX, 50% to methicillin and no resistance to vancomycin [8]. However, a study from Aligarh has reported increase in prevalence of Methicillin Resistant *Staphylococcus aureus (MRSA)* causing meningitis from 44.4-69.4% over four years from 2005-2009 [23]. Similarly a multi-centric study in young infants revealed rising (66%) resistance of Staphylococcal isolates to inexpensive conventional antibiotic like TMP-SMX [24]. *Enterococcus* isolated in the present study showed 70% sensitivity to aminoglycoside group, as against the study by Khan F et al., from Aligarh reported a rising trend of aminoglycoside resistance among Enterococcal isolates [23].

In present study, only one *Streptococcus pneumoniae* was isolated, which was susceptible to TMP-SMX, methicillin, gentamycin, which was similar to study by De AS et al., which reported the susceptibility of all the *S. pneumoniae* isolates to penicillin, cefuroxime, gentamycin [8]. However, Jain A et al., from Delhi have reported high TMP-SMX resistance and low penicillin resistance in *S. pneumoniae* isolates [25].

Among gram negative organisms of the 27 *Klebsiella* isolates, only 40% were sensitive to cefotaxime, 45% to amikacin and 60% were susceptible to ciprofloxacin and 90% to imipenem. In this study susceptibility of *E. coli* to piperacillin-tazobactam and ciprofloxacin was 70%, to amikacin was 77% and to imipenem was 94%. Similarly, De AS et al., in their study reported that among the first line antibiotics, susceptibility of Enterobacteriaceae was 60% to ciprofloxacin and 20% each to amikacin, cefotaxime, and piperacillin [8], both suggesting increasing resistance among gram negative organisms to conventional antibiotics.

Limitation(s)

This study was conducted on a small number of patients. A large number of patients had received antibiotics prior to admission which reduced the yield of organisms from blood and CSF culture. Serotyping of the bacterial isolates could not be done.

CONCLUSION(S)

The present study describes the burden of IBD among under five children presenting to the largest tertiary care public health institute and highlights the predominance of *Staphylococcus aureus* as an aetiological agent. The study also highlighted the adverse outcomes of IBD in children who have SAM and incomplete immunisation. Hereby, it was concluded that, hospital based surveillance of community acquired infections can provide important data for informed policy decisions. A combination of clinical and laboratory parameters needs to be taken into consideration to arrive at the right diagnosis. Continued monitoring to understand the emerging patterns of antibiotic resistance and to formulate the antibiotic policy accordingly is the need of the hour. Larger studies conducted over longer duration are recommended in future to generate data on incidence, prevalence, clinical profile and antibiotic susceptibility of causative organisms.

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