APGHN
Archives of Pediatric Gastroenterology, Hepatology, and Nutrition

Original Report

Clinical Characteristic of Bloody Diarrhea in Under-Five Pediatric Inpatients

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Published:
13 May 2022

DOI:
https://doi.org/10.58427/apghn.1.1.2022.9-16

Citation:
Susianto SC, Atthiyah AF, Paramitha AA, Koendhori EB, Sumitro KR, Darma A, et al. Clinical Characteristic of Bloody Diarrhea in Under-five Pediatric Inpatients. *Arch Pediatr Gastr Hepatol Nutr.* 2022(1):9-16.

Abstract:

Background: Diarrhea is the most common cause of death in under-five children. Bloody diarrhea comprises around 10% of all cases of diarrhea and may lead to severe complications until death. This study examined the characteristics of bloody diarrhea in children under five years old in Dr. Soetomo General Hospital Surabaya from 2013 to 2017.

Material and Methods: A retrospective, cross-sectional study was conducted using secondary data from Dr. Soetomo General Hospital's inpatients with bloody diarrhea from 2013 to 2017. Gender, age, nutritional status, clinical symptoms, degree of dehydration, and laboratory results were assessed, and the data were presented in percentage (%)

Results: Fifty-six samples were included in this study. The main demographics were male (58,9%), aged 7-24 months (44,6%), and normal nutritional status (66,1%). Meanwhile, the most notable manifestations were stool mucous (55,3%), mild to moderate degree of dehydration (60,7%), and leukocytosis (62%). Eleven patients (39,2%) had temperatures ≥38^{0}C. Leukocytes were positive in 93.7% of the stools. Furthermore, amoeba was found in 46,8% of samples. The serum electrolyte result showed hyponatremia (18%) and hypokalaemia (15%).

Conclusion: The primary demographics of bloody diarrhea in under-five children admitted to Dr. Soetomo General Hospital were males, 7-24 months of age, and with normal nutritional status. The most frequent manifestations were mucous in stool, mild to moderate dehydration, leucocytosis, as well as positive leucocytes and amoeba in the stool.

Keywords: characteristics, diarrhea, bloody diarrhea, children, amoeba

Introduction

Diarrhea is the second leading cause of death in children under five years old after pneumonia. It accounts for 9% of all deaths in the under-five population and is estimated to kill more than 1.400 children worldwide every day.[1,2]A study conducted by RISKESDAS (*Riset kesehatan Dasar*) 2011 in Indonesia found that the number of deaths due to diarrhea in infants and toddlers from 15 districts and cities were 17.4% and 13.3%, respectively. Furthermore, the results of a morbidity study conducted by Ministry of Health showed that the mortality rate caused by diarrhea in children under five was 75.3 per 100,000, with a morbidity rate of 900 per 1,000 for children under five years old and 23.2 per 100,000 population for all ages in 2012.[3,4]

Bloody diarrhea contributes to nearly 10% of all diarrheal episodes globally and accounts for 5-15% of all deaths due to diarrhea in children under five.[5,6] Bloody diarrhea in children is still becoming a concern in developing countries. This type of diarrhea is characterized by blood in runny stools that occur three or more times in one day. The blood should originate from the gastrointestinal tract. However, it is necessary to distinguish whether the etiology of the bloody stool is bloody diarrhea or intestinal inflammation.[7] Bloody diarrhea is mainly caused by food or drinks contaminated by stool containing bacteria (*Shigella, Salmonella, Campylobacter, Enterohemorrhagic Escherichia coli*), virus, or parasite (*Entamoeba histolytica*).[8] Previous studies showed various characteristics, clinical symptoms, laboratories profile, and parasite stool profiles. Varying clinical symptoms of bloody diarrhea can delay the diagnosis and determination of appropriate therapy. Thus, the success of bloody diarrhea management in children under five requires effective and efficient health service strategies.

This study examined the clinical characteristics and laboratory profile of bloody diarrhea in under-five children, which can be used as additional information on determining the proper diagnosis and therapy to reduce the mortality rate of bloody diarrhea.

Material and Methods

This was a retrospective, descriptive, cross-sectional study conducted in Dr. Soetomo General Hospital Surabaya. Medical records of the pediatric inpatients under-five children with bloody diarrhea were obtained from January 2013 to December 2017. This study had been approved by The Health Research Ethical Committee at Dr. Soetomo General Hospital, Surabaya, Indonesia. Data on age, gender, nutritional status, exclusive breastfeeding, clinical sign and symptoms such as vomiting, abdominal pain, mucous in stool, dehydration state, temperature, complete blood count, complete stool examination, and serum electrolytes were recorded. Incomplete medical records were excluded from the study.

The dehydration status was assessed using the World Health Organization (WHO) standard and divided into no dehydration, mild to moderate dehydration, and severe dehydration.[9] The nutritional status was measured and classified into severely wasted (weight for length/height <-3 SD), wasted (-3 SD ≤ weight for length/height <-2 SD), normal nutrition (-2 SD ≤ weight for length/height ≤ 2 SD, overweight (2 SD < weight for length ≤3 SD) and obese (weight for length >3 SD) using the WHO weight for length/ height chart.[10] Complete blood counts were assessed for hemoglobin, hematocrit, leukocyte, and thrombocyte. A complete stool examination was conducted to assess the presence of erythrocytes and leukocytes and determine the stool's parasite profile. Serum electrolyte was measured to identify the potassium, sodium, and chloride levels. All data were presented in numbers and percentages and analysed using IBM SPSS Statistics 20.0 for Windows.

Result

Fifty-six subjects were included in the final analyses. Most of the study participants was male (58.9%), aged 7-24 months old (39.3%), and had normal nutritional status (66.1%). Mucous in stool was found in 55.3% of subjects, while vomiting occurred in 39.3% of subjects. Thirty-six subjects had mild-moderate dehydration. Other characteristics are described in **Table 1**.

Table 1. Subject demographics and clinical characteristics (continued).

Characteristics	Number (%)
Gender	
Male	33 (58.9)
Female	23 (41.1)
Age group	
0-6 months	15 (26.8)
7-24 months	22 (39.3)
>24 months	19 (33.9)
Nutritional Status	
Severely wasted	6 (10.7)
Wasted	11 (19.6)
Normal	37 (66.1)
Overweight	2 (3.6)
Obesity	0 (0.0)
Vomiting	
Yes	22 (39.3)
No	34 (60.7)
Form of stool	
Watery	19 (33.9)
Watery and dregs	32 (57.1)
Mushy	5 (9.0)
Mucous in stool	
Yes	31 (55.3)
No	25 (44.7)

Table 1. Subject demographics and clinical characteristics (continued).

Characteristics	Number (%)
Dehydration status	
No dehydration	20 (35.7)
Mild-moderate	34 (60.7)
Severe	2 (3.6)
Temperature (n=49)	
36-36.9	19 (33.9)
37-37.9	19 (33.9)
38-38.9	9 (28.6)
39-40.0	2 (3.6)

The laboratory result showed that 29 subjects had leucocytes count >10,000/mm^3, while 30 subjects had a normal range of thrombocytes (Table 1). From the complete stool examination, 93.7% of the stools were positive for leukocytes. Furthermore, some of the stool specimens exhibited the presence of amoeba (43,8%). Further findings are described in **Table 2 and 3**.

Table 2. Complete blood count and serum electrolyte findings

Laboratory findings	Number (%)
Complete blood count (n=47)	
Leucocyte (/mm^3)	
<4,000	1 (2.1)
4,000-10,000	17 (36.2)
>10,000	29 (61.7)
Hemoglobin (g/dl)	
<11	21 (44.7)
≥11	26 (55.3)
Hematocrit (%)	
<33	19 (40.4)
33-49	27 (57.5)
>49	1 (2.1)
Thrombocyte (/mm^3)	
<150,000	2 (4.3)
150,000-450,000	30 (63.8)
>450,000	15 (31.9)
Serum Electrolyte (n=33)	
Natrium (mEq/L)	
<135	6 (18.2)
135-144	26 (79.8)
>144	1 (3.0)
Potassium (mEq/L)	
<3.6	5 (15.2)
3.6-5.2	25 (75.7)
>5.2	3 (9.1)
Chloride (mEq/L)	
<97	1 (3.0)
97-106	13 (39.4)
>106	19 (57.6)

Table 3. Complete stool examination

Laboratory findings	Number (%)
Complete stool examination (n=16)	
Stool erythrocytes	
Positive	14 (87.5)
Negative	2 (12.5)
Stool leukocytes	
Positive	15 (93.7)
Negative	1 (6.3)
Parasite stool examination (n=16)	
Amoeba	7 (43.8)
Helminth Eggs	0 (0.0)

Discussion

Our study found that males gender and aged 7-24 months old had a higher rate of bloody diarrhea in Dr. Soetomo General Hospital Surabaya. A previous study in Baghdad, Iraq, showed that prevalence of blood diarrhea in males was higher than in females.[5] The difference in activity patterns between males and females might the reason as boys tend to play in the outdoor environment, putting them in high exposure to microbial agents. This results in increased susceptibility to diarrhea compared to females.[11] Children aged 6-11 months old have started getting complimentary food. Thus, they tend to be more active and have direct contact with the environment, which can be the source of pathogens transmission. Meanwhile, the 0-5 months age group still received immunity directly from breastfeeding, lowering the risk of diarrhea.[12,13]

This study showed that patients with bloody diarrhea in our centre mostly had normal nutritional status. Children with normal nutritional status were usually more active and at higher risk of suffering bloody diarrhea than undernourished or overnourished children. Ticket et al. found no difference in the prevalence of pathogens within the nutritional status group, however, wasted children presented with more severe disease.[14] Our subjects mostly came with the chief complaint of diarrhea. Twenty-two subjects also had symptoms of vomiting, and 55.3% of subjects experienced mucous in stool. The previous study on bloody and watery diarrhea demonstrated that the diarrhea frequency and presence of mucous in stool were more prevalent in bloody diarrhea. The study also reported lower vomiting incidents in the bloody diarrhea group.[7]

Bloody diarrhea involves the large bowel, which produces frequent and small volume stools. Mucous in the stool is caused by hypersecretion of mucous in the colonic mucosal wall due to infection, inflammation, or an anatomical abnormality. Vomiting is considered a natural circumstance for protecting the body against stimulants and toxins in food. It is stimulated by certain conditions, particularly the involvement of the small bowel.[15,16] Our result showed that more than half of the patients (60.4%)

experienced mild-moderate dehydration. Dehydration often accompanies diarrhea and causes deaths due to water loss and electrolytes. Bloody diarrhea is mainly caused by parasitic agents and *Shigella sp*., which damage the colonic mucosa that only absorbs approximately 10% of water. Diarrhea resulting from large intestine mucosa damage is more often and probably causes mild to moderate dehydration in smaller volumes.[17,18] Our study found 11 patients with temperatures ≥38^{0}C. Based on a previous study, higher temperatures suggest Shigella infections, whereas the absence of fever is more likely to indicate *Escherichia coli* or parasite infection.[19]

More than half (61.7%) of the subjects showed a high level of leukocytes (> 10,000 cells/mm^3). Meanwhile, most participants exhibited normal hemoglobin, hematocrit, and thrombocyte level. Leukocytosis indicates an infectious process in the body related to diarrhea, which is often a marker of bacterial infections.[20] However, in the case where bacterial and non-bacterial infections overlap, some research suggests using CRP and procalcitonin as markers.[21] Both stool leukocytes and erythrocytes were found in patients under five with bloody diarrhea. However, the diagnostic performance of fecal leukocytes on bloody diarrhea due to bacteria is suboptimal, particularly in the condition of mild inflammatory response. Confirmation using stool culture is still the gold standard for identifying the bacterial species that cause bloody diarrhea.[22,23]

The stool examination results showed positive amoeba in 43,8% of subject. Northern Jordan study found visible blood in stool was higher in *Shigella* spp, (60%) *Salmonella,* spp. (20%) as bacterial cause and *Entamoeba histolytica* in 25% of patients as parasite infection cause.[24] In Iraq Study, 92,9% of childhood bloody diarrhea distribution originated from *E. histolytica,* particularly in children aged 0-3 years. Parasites had been the common cause of childhood bloody diarrhea and varied symptoms, treatment, and prognosis. A higher prevalence of parasite infection in the country is strongly associated with unhealthy behavior, poor sanitation, and an unhygienic environment.[5,25] However, this study did not differ on the bacterial cause of bloody diarrhea. The limitation of this study is that there are no results of bacterial culture and PCR data to determine the appropriate etiology of each cause of bloody diarrhea.

Our study exhibited normal serum electrolytes in patients; however, 18,2% of patients were hyponatremic. Electrolyte imbalance is common in those under five years. It is related to the severity of dehydration, which increases mortality and length of stay that need urgent active oral or intravenous rehydration. The etiologic cause of bloody diarrhea rarely causes dehydration and electrolyte imbalance in patients under five years.[26,27]

Conclusion

The main characteristics of under-five children with bloody diarrhea in the pediatric ward of Dr. Soetomo General Hospital, Surabaya, Indonesia from 2013 to 2017 were male, 7-24 months of age, and normal nutritional status. The most frequent clinical symptoms were mucous in stool, mild to moderate dehydration, leukocytosis, positive stool leukocytes, and the presence of amoeba in the complete stool analysis. This study could become the primary data for the enforcement of diagnosis and therapy for pediatric patients under five years of age with bloody diarrhea in tertiary hospitals. Further research is needed to evaluate the therapy and long-term follow-up of the patient.

Acknowledgement

The authors declare that there is no potential conflict of interests.

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