Original article

Infectious bloody diarrhea in children 2 month – 5years, Descriptive hospital Based Study

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Summary:

Background: Dysentery is an important cause of morbidity and mortality associated with diarrhea. About 10% of all diarrheal episodes in children less than 5 years are dysenteric, but these cause about 15% of all deaths attributed to diarrhea.

Objective : To demonstrate the most common pathogens causing bloody diarrhea in children between 2 months and 5 years old, to describe some of the associated factors accompanying bloody diarrhea and to highlight the most important clinical features.

Patients and methods: A descriptive study of 82 children, between the age of 2 months to 5 years with bloody diarrhea, who were admitted to the Children Welfare Teaching Hospital/ Medical City/ Baghdad during the period between 1st of March 2009 to 28th of February 2010. Information regarding demographic data was taken from their parents. All the patients were examined carefully mainly for the signs and degree of dehydration. General stool examination and stool culture done for patients with bloody diarrhea. Other 100 patients with acute watery diarrhea were also taken as a comparison group.

Results: *Entamoeba histolytica* trophozoite was the most common isolated pathogen in the study group specimens. It was identified in 38 (46.3%) of patients followed by Shigella species in 10 (12.2%) cases and the least was non typhoidal salmonella in 5 (6.1%) cases. The most vulnerable age was 2-24 months 51(62.2%) cases. Fifty eight and half percent of patients were from urban areas. Half of the patients (50%) were bottle fed. The majority had chlorinated tap water supply (82.9%). This study showed a higher frequency of the following symptoms: Fever (73.2%), Tenesmus (46.3%), Rectal prolapse (1.2%) and convulsion (4.9%) in patients with bloody diarrhea; while in patients with watery diarrhea, the frequencies of these symptoms were: (62%, 28%, 0% and 1% respectively), Severe dehydration was observed in only (15.9%) of cases and the majority of them were seen in patients with bacterial bloody diarrhea.

Conclusions: *Entamoeba histolytica* was the most frequent offending pathogen in patients with bloody diarrhea in this study. Infants 2-24 months old were the main affected group. Bottle feeding preference, and non-boiling of drinking water made children more prone to have bloody diarrhea. High fever and tenesmus were the most frequent clinical symptoms associated with bloody diarrhea. More frequent bowel motions, high fever, and convulsion were all more commonly seen with bacterial bloody diarrhea than in amebic bloody diarrhea.

Keyword: bloody diarrhea, Children Welfare Teaching Hospital, infections

Introduction:

Dysentery is defined as diarrhea with visible blood and/ or mucous in the stools. It is an important cause of morbidity and mortality, about 10% of all diarrheal episodes in children less than five years are dysenteric, but these cause about 15% of all deaths attributed to diarrhea. Diarrheal episodes that begin with dysentery are more likely to become persistent than with watery stools. (1) Most dysentery cases in the tropics are caused by Shigella, whereas dysentery in the developed countries is usually caused by Salmonella The World Health Organization recommends that all episodes of diarrhoea with blood in the stool be treated with antibiotics (2) Although the range of possible causes of acute bloody diarrhea is broad, infectious considerations are prioritized in the evaluation of such patients.(3) A number of pathogens can cause bloody diarrhea in children, as Campylobacter, Shigella, Escherichia coli, Salmonella, Yersinia, Clostridium difficile, and Entamoeba histolytica. Neisseria gonorrhea, Chlamydia trachomatis, and Herpes simplex virus (HSV) also occasionally produce bloody stools. (4)

Shigellosis is an important public health problem, especially in developing countries. Also it is common among children less than five years of age in developing countries and in persons who travel from industrialized to less developed countries. (5) Shigella causes a broad spectrum of gastrointestinal illness, ranging from mild diarrhea to life-threatening dysentery. Shigella is spread rapidly through fecal-oral and oral-anal contacts as well as indirectly through houseflies and contaminated fomites.(6) Shigellosis, has a worldwide distribution with an estimated annual incidence of 164.7 million cases, of which 163.2 million occur in developing

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countries(7) Amebiasis is the 3rd leading parasitic cause of death worldwide. Prospective studies have demonstrated that 4-10% of individuals infected with E.histolytica develop amebic colitis. Food or drink contaminated with Entamoeba cysts and direct fecal-oral contacts are the most common means of infection. Untreated water and human feces used as fertilizer are important sources of infection. Food handlers carrying amebic cysts can play a role in spreading the infection.(8). A number of severe and potentially fatal complications can occur during dysentery, They include intestinal perforation, toxic mega colon, rectal prolapse , septicemia, haemolytic-uraemic syndromem and rapid worsening of nutritional status. Death from dysentery is usually caused by extensive damage to the ileum and colon, complications of sepsis, secondary infection (e.g. pneumonia), or severe malnutrition. Children convalescing from dysentery are also at increased risk of death from other infections, owing perhaps to their poor nutritional state or impaired immunity. (1)

Patients & Methods:

A descriptive study was done on 82 children, between the ages of 2 months to 5 years with bloody diarrhea, who were admitted to the Children Welfare Teaching Hospital/ Medical City/ Baghdad during the period between 1st of March 2009 to 28th of February 2010. Patients who had received antibiotics during their illness were excluded from the study. Other 100 patients with acute watery diarrhea were also taken as a control group. Information regarding age, sex and residence, complaint:diarrhea (frequency, presence of blood and mucus), vomiting, fever, tenesmus, rectal prolapse and convulsion, types of feeding: breast, bottle, mixed and solid food, water supply , history of boiling the drinking water, all were taken from their parents .Full systemic examination was done to all patients including signs and degree of dehydration. Two fresh stool samples were collected from these patients and sent to the laboratory for general stool examination and stool culture. In general stool examination two direct smears were prepared by mixing a small amount of freshly passed fecal materials (2g within 30 minutes of defecation), one with saline and other with iodine. The saline preparation was used primarily to detect RBCs, pus cells and motile trophozoites containg RBC, and the iodine preparation was used to detect cysts of Entamoeba histolytica. This was repeated 3 times. Fresh stool is cultured on MacConkey agar, Shigella-Salmonella (SS) agar and tetrathionate broth, incubated aerobically for 18-24 hours at 37 c˚. Growth from tetrathionate broth was subcultured on SS agar for additional 24 hours at 37 c˚ in order to enhance the growth of bacteria and yield better results, and used to isolate Salmonella and Shigella species. (9). Strains of E. coli could not be determined whether they are pathogenic or not so were not counted in the documented etiological factors of bloody diarrhea in this study. Cultures and tests for other microorganisms (e.g. Campylobacter and Yersinia species) are not available in our laboratory. Isolates of Entamoeba histolytica cysts in the general stool examination were classified under the (others) group as it is not a cause of bloody diarrhea. (9). The data were analyzed statistically by Fisher's Exact Test Chi-square ($\chi 2$) test , P value was calculated and if less than 0.05 was considered as statistically significant .

Results:

Enteropathogens were detected in 53 (64.3%) cases, Thirty eight (46.3%) of patients had Entamoeba histolytica trophozoites. The stool culture showed growth of pathogenic bacteria Shigella species in 10 (12.2%) cases and non typhoidal salmonella 5 (6.1%) cases as shown in table 1 .Twenty nine (35.4%) of cases stool culture had no pathogenic bacteria , thirteen of them (15.8%), had Entamoeba histolytica cysts in their general stool examination **.** In this study 2-12 months old children are at more risk to develop bloody and watery diarrhea (42.7% versus 34% respectively) with no statistically significant difference ($\chi 2$ = 2.846 , P value > 0.05).Also amebic and bacterial infections occur more in this age group with no statistical significant difference ($\chi 2$ = 1.609, P value > 0.05) as shown in table 2 . In this study the patients on bottle feeding were more vulnerable to have bloody diarrhea (35.4%) and watery diarrhea (36%) than patients on breast feeding (12.2% and 11% respectively), but with no statistical significant difference (both P values >0.05). Also patients on bottle feeding were more vulnerable to have amebic rather than bacterial bloody diarrhea with no significant statistical difference ($\chi 2$ were 2.995, P value >0.05) as shown in table 3 .The majority of patients with bloody diarrhea (58.5%) from urban areas, with no statistically significant difference between types of diarrhea ($\chi 2$ were 0.003994, P value >0.05), on the other hand Entamoeba histolytica is more common in urban areas (63.2%) in contrast to bacterial etiology (26.7%) with statistical significant difference ($\chi 2$ = 5.747, P value <0.05) (Table 3).

Most of the cases of bloody and watery diarrhea received tap water (82.9% and 79% respectively) and there was no statistically significant difference ($\chi 2$ were 0.4473, P value > 0.05), also there was no statistically significant difference between causative agents of bloody diarrhea ($\chi 2$ were 0.007245, P value > 0.05) Table. 4 . In this study, the majority of patients with bloody and watery diarrhea did not boil their drinking water (79.3% and 64% respectively) but more susceptible to have bloody rather than watery diarrhea with statistically significant difference ($\chi 2$ were 5.089, P value <0.05), boiling habit did not differ among etiological factors of bloody diarrhea with no statistically significant difference (two-sided P value >0.05)(Table. 4). This study showed a higher frequency of the following symptoms: Fever (73.2%), Tenesmus (46.3%), Rectal prolapse (1.2%) and convulsion (4.9%) in patients with bloody diarrhea ; while in patients with

watery diarrhea, the frequencies of these symptoms were: (62%, 28%, 0% and 1% respectively), and there was statistically significant difference regarding fever and tenesmus (P value < 0.05) while no statistically significant difference regarding Rectal prolapse and convulsion (P value > 0.05); while vomiting was more common in patients with watery diarrhea (71%) than in those with bloody diarrhea (54.9%) with statistically significant difference (P value < 0.05). However, patients with bacterial bloody diarrhea in comparison with patients with amebic bloody diarrhea had more fever and convulsion (80% versus 68.4% and 20% versus 2.6% respectively) and had less vomiting, tenesmus and rectal prolapse (53.3% versus 63.2%, 46.7% versus 52.8% and 0% versus 2.6% respectively) with no statisticaly significant difference (all P values > 0.05) as shown in table 5.Patients with bloody diarrhea had tendency to have less bowel motions per day than patients with watery diarrhea with no statistically significant difference (P value>0.05), however patients with bacterial bloody diarrhea had a higher frequency of bowel motions (60% of them have >10/day) than those with amebic bloody diarrhea (31.6%) with no statistically significant difference as shown in table 5.Thirty-three percent of patients with watery diarrhea had severe dehydration while (15.9%) of patients with bloody diarrhea had severe dehydration, with a high statistically significant difference (P value < 0. 01). On the other hand (26.7%) of patients with bacterial bloody diarrhea had severe dehydration while 13.1% of patients with amebic bloody diarrhea had severe dehydration, with a statistically significant difference (P value < 0. 05) as shown in table 5.

Table. 1: The isolation rate of enteropathogens in children with bloody diarrhea.

Enteropathogens isolated	***Number***	***Percentage***
E.histolytica (trophozoite)	38	46.3
Shigella	10	12.2
Salmonella	5	6.1
Others	29	35.4
Total	82	100

Table. 2: the relation of type of diarrhea and age groups .

Age (Months)	***Bloody diarrhea***				***Watery diarrhea***	***Total***
	Bacterial No%	***Amebic No%***	***Others No%***	***Total No%***		
2-12mo.	7(8.5%)	12(14.6%)	16(19.5%)	35(42.7%)	34(34%)	69
>12-24mo.	3(3.6%)	9(11%)	4(4.9%)	16(19.5%)	27(27%)	43
>24-36mo.	3(3.6%)	7(8.5%)	4(4.9%)	14(17.1%)	16(16%)	30
>36-48mo.	1(1.2%)	6(7.3%)	1(1.2%)	8(9.7%)	14(14%)	22
>48-60mo.	1(1.2%)	4(4.9%)	4(4.9%)	9(11%)	9(9%)	18
Total	15	38	29	82	100	182

loody &watery diarrhea $\chi 2 = 2.846$, P value = 0.5840
Bacterial & Amebic $\chi 2 = 1.609$, P value = 0.8072

Table. 3: The relation of infectious bloody and watery diarrhea with type of feeding and residence.

Type of feeding	Bloody diarrhea				Watery diarrhea	Total
	Bacterial	Amebic	Others	Total		
Breast	3 (20%)	2 (5.3%)	5 (17.2%)	10 (12.2%)	11 (11%)	21
Bottle	5 (33.3%)	15 (39.5%)	9 (31%)	29 (35.4%)	36 (36%)	65
Mixed	2 (13.4%)	4 (10.5%)	6 (20.8%)	12 (14.6%)	14 (14%)	26
Solid food	5 (33.3%)	17 (44.7%)	9 (31%)	31 (37.8%)	39 (39%)	70
Total	15	38	29	82	100	182
	Bloody &watery diarrhea $\chi 2 = 0.09026$, P value = 0.9930 Bacterial & Amebic $\chi 2 = 2.995$, P value = 0.3924					
Residence	*Bloody diarrhea*				Watery diarrhea	Total
	Bacterial	Amebic	Others	Total		
Urban	4 (26.7%)	24(63.2%)	20 (69%)	48(58.5%)	59 (59%)	107
Rural	11(73.3%)	14(36.8%)	9 (31%)	34(41.5%)	41 (41%)	75
Total	15	38	29	82	100	182
	Bloody & watery diarrhea $\chi 2 = 0.003994$, P value = 0.9496 Bacterial & Amebic $\chi 2 = 5.747$, P value = 0.0165					

Table. 4: The relation of infectious bloody and watery diarrhea with water supply and Boiling o f water .

Water supply	*Bloody diarrhea*				*Watery diarrhea*	*Total*
	Bacterial	*Amebic*	*Others*	*Total*		
Tap water	12(80%)	30(78.9%)	26(89.6%)	68(82.9%)	79(79%)	147
*Other sources**	3(20%)	8(21.1%)	3(10.4%)	14(17.1%)	21(21%)	35
Total	15	38	29	82	100	182
	Bacterial & Amebic $\chi 2 = 0.007245$, P value = 0.9322 Bloody &watery diarrhea $\chi 2 = 0.4473$, P value = 0.5036					
Boiling o f water	*Bloody diarrhea*				*Watery diarrhea*	
	Bacterial	*Amebic*	*Others*	*Total*		
Yes	4 (26.7%)	5 (13.2%)	8 (27.6%)	17 (20.7%)	36 (36%)	53
No	11(73.3%)	33(86.8%)	21 72.4%)	65(79.3%)	64 (64%)	129
Total	15	38	29	82	100	182
	Bacterial & Amebic two-sided P value = 0.2520 Bloody &watery diarrhea $\chi 2 = 5.089$, P value = 0.0241					

*** Rivers, wells or irrigation canals.**

Table 5: Other clinical manifestations of infectious bloody and watery diarrhea

Clinical Presentation		*Bloody diarrhea*				*Watery diarrhea No%*	*x2 and P value*
		Bacteria No%	*Amebic No%*	*other*	*Total No%*		
Fever	*No fever*	3(20%)	12(31.6%)	7(24.1%)	22(26.8%)	38(38%)	Bloody & watery diarrhea P value = 0.0200 Bacterial & Amebic P value = 0.3487
	Low grade	5(33.3%)	16(42.1%)	15(51.8%)	36(43.9%)	49(49%)	
	High grade	7(46.7%)	10(26.3%)	7(24.1%)	24(29.3%)	13(13%)	
Tenesmus	*No*	8(53.3%)	18(47.4%)	18(62.1%)	44(53.7%)	72(72%)	Bloody & watery diarrhea P value = 0.0132 Bacterial & Amebic P value = 0.7664
	Yes	7(46.7%)	20(52.8%)	11(37.9%)	38(46.3%)	28(28%)	
Vomiting	*No*	7(46.7%)	14(36.8%)	16(55.1%)	37(45.1%)	29(29%)	Bloody & watery diarrhea P value = 0.0302 Bacterial & Amebic P value = 0.5465
	Yes	8(53.3%)	24(63.2%)	13(44.9%)	45(54.9%)	71(71%)	
Rectal prolapse	*No*	15(100%)	37(97.4%)	29(100%)	81(98.8%)	100(100%)	Bloody & watery diarrhea P value = 0.4505 Bacterial & Amebic P value = 1.0000
	Yes	0(0%)	1(2.6%)	0(0%)	1(1.2%)	0(0%)	
Convulsion	*No*	12(80%)	37(97.4%)	29(100%)	78(95.1%)	99(99%)	Bloody & watery diarrhea P value = 0.1762 Bacterial & Amebic P value = 0.0637
	Yes	3(20%)	1(2.6%)	0(0%)	4(4.9%)	1(1%)	
bowel motion /day	*<5*	1 (6.7%)	10 (26.3%)	7 (24.1%)	18 (21.9%)	15 (15%)	Bloody &watery diarrhea P value = 0.4770 Bacterial & Amebic P value = 0.1107
	5-10	5 (33.3%)	16 (42.1%)	10 (34.5%)	31 (37.8%)	42 (42%)	
	>10	9 (60%)	12 (31.6%)	12 (41.4%)	33 (40.2%)	43 (43%)	
Dehydration	*Mild*	3(20%)	24(63.2%)	11(37.9%)	38(46.3%)	15(15%)	Bloody &watery diarrhea P value = < 0.0001 Bacterial & Amebic P value = 0.0180
	Moder-ate	8(53.3%)	9(23.7%)	14(48.3%)	31(37.8%)	52(52%)	
	Severe	4(26.7%)	5(13.1%)	4(13.8%)	13(15.9%)	33(33%)	

Discussion:

The study revealed that *Entamoeba histolytica* trophozoite was the most common isolated pathogen as it was detected in stool samples of 46.3% of the patients. In contrast, Shigella species was detected only in 12.2% of patients. This finding was near similar to that observed in studies conducted in Iraq by Alaa *et al* (2002) (10) (*Entamoeba histolytica* trophozoite 24.6% versus Shigella species 10.6%), Basheer *et al* (2008) (11) (50% versus 7% respectively) , Also in other studies done by Lai-SW *et al* (2000) (12) (which shows 67.6% (cysts and trophozoites) versus 13.1% respectively). The opposite finding was reported in many studies in different countries which showed that shigella species were the most common agents associated with bloody diarrhea including Ronsmans *et al,* 1988(13) (*Entamoeba histolytica* trophozoite 30% versus Shigella species 50%), andTownes *et al* 1997(14) (0.7% versus 29% respectively). The reason for this difference could be explained by the fact that invasive amebiasis is an important public health problem and occurs globally in endemic area (WHO, 1985 (15). On the other hand, probably amebiasis is routinely over-diagnosed which may be due to wrong laboratory report (Walsh, 1986 (16)). It was not possible to identify the causative agent in 29 cases (35.4%). This is in agreement with other studies like Alaa et al (2002) (10) (15.5%), and Basheer et al (2008) (11) (21%). This could be due to infection with other organisms not routinely investigated in the stool samples or due to the lack of sensitivity of some laboratory procedures.The study showed most common age of presentation of bloody diarrhea was between 2 months and 2 years 51 cases (62.2%) as in Basheer et al study, 2008(11) (59%), in Khan mu et al, 1985(17) and Ahmed F et al, 1997(18).Susceptibility of this age group to bloody diarrhea may be explained by many factors such as declining level of maternal immunity, introduction of bottle feeding and solid food which may be contaminated by enteropathogens, together with introduction of foreign material to the mouth of these children as they have learned to crawl up and pick subjects in their hands by this age, which increases the risk of exposure to fecal pathogens. More than half of the patients (58.5%) were from urban area which is the same result of Alaa et al (2002) (57%), (10). This result Because most cases were collected from Children Welfare Teaching Hospital/ Medical City inside Baghdad city which is a urban area .This study showed that most of the patients of bloody and watery diarrhea aged less than 2 years were bottle fed (29 of 51 ases (56.9%) and 36 of 61 cases (59%) respectively), and this strengthens the protective value of breast milk against diarrhea, whether bloody or watery. Similar results were found by Alaa et al (2002) (10) (54.9% and 40% respectively) and Kenneth-H et al, 1989. (19) The majority of the patients included in the study had tap water supply (82.9%) which is in agreement with Alaa et al (2002) (10) (82.4%). However, even chlorination of water cannot kill amebic cyst or some other enteropathogens Mohsen Ziai (20), Chandy (8). Also Lai-sw et al, 2000(12) mentioned that contamination of water system by ground water was responsible for outbreak of amebic dysentery in Taichung in China. Majority of the patients with bloody diarrhea (79.3%) were consuming unboiled water. A similar result was found by Alaa et al (2002) (10) (82.3%), and Maurer, -A-M, et al, 2000 (21) (80.3%), who showed that the risk of illness was significantly higher among those who had drunk unboiled water. Also it is known that boiling of water decreases the risk of water-borne enteropathogens transmission WHO 1992 (1), Mohsen Ziai et al (20).Fever was reported in (73.2%) of cases with bloody diarrhea. Midizi, -S-M et al, 2000(22) and Alaa et al (2002) (10) found that (92% and 88.7%) of patients with dysentery had fever respectively) which may be due to colonic invasion and inflammation that leads to fever. It was significantly more frequent and higher in patients with bacterial bloody diarrhea than in patients with amebic bloody diarrhea (80% and 68.4% respectively). This is similar to that found by Alaa et al (2002) (10) (95% and 88.6% respectively), and Basheer et al (2008) (11) (86% and 60% respectively). Tenesmus was present in 46.3% of patients with bloody diarrhea. It occurs in both bacterial and amebic bloody diarrhea with no significant difference. But it was less than other studies as Abdul-Aziz, 1995(23), Alaa *et al* (2002) (10), and Basheer *et al* (2008) (11) reported tenesmus in 69%, 77.4% and 71% of their patients with bloody diarrhea respectively. Vomiting was more common in those with watery diarrhea (71%) than in those with bloody diarrhea (54.9%) which was consistent with the results observed by Alaa *et al* (2002)(10) (78% and 43.7% respectively). However, it was more common in patients with amebic bloody diarrhea (63.2%) than in bacterial bloody diarrhea (53.3%) which was against other studies like Alaa *et al* (2002)(10) (25.7% and 61% respectively) and Basheer *et al* (2008)(11) (30% and 69% respectively), which may be due to the small sample size in this study. Rectal prolapse was seen in one patient (2.6%) with amebic bloody diarrhea which is similar to Abdul-Aziz , 1995(23) that showed 3% of his patients had rectal prolapse, but less than in Alaa *et al* (2002) (10) (10.5%).Convulsion occurred in 4.9% of the cases with bloody diarrhea and it was mainly seen in patients with bacterial bloody diarrhea, probably because of associated high fever and/or toxic encephalopathy. This is in agreement with Khan *et al*, 1999 (17) (5%), but less than in Alaa *et al* (2002) (10) (9.8%). Severe dehydration was more evident in those with watery diarrhea (33%) than in those with bloody diarrhea (15.9%). This may be due to the pattern of bowel motion in amebic bloody diarrhea (the most common cause of bloody diarrhea) which is small volume and less frequent per day (WHO, 1992). (1) Due to the fact that watery diarrhea usually due to organism that involve small intestine which is responsible for most of fluid absorption.

However severe dehydration was more in those with bacterial bloody diarrhea than amebic bloody diarrhea (26.7% versus 13.1% respectively) probably because of higher frequency of bowel motion and higher fever in patients with bacterial bloody diarrhea. This is in agreement with Alaa *et al* (2002) (10) (who found severe dehydration in 36%, 9.09%, 12,2% and 2.85% of watery diarrhea, bloody diarrhea, bacterial bloody diarrhea and amebic bloody diarrhea respectively). Frequency of bowel motion more than 10 times/day was not significant between watery diarrhea (43%) and bloody diarrhea (40.2%) which was more obvious in Alaa *study* (2002)(10) (56% versus 38.7% respectively). However, 60% of those with bacterial bloody diarrhea had more than 10 times bowel motions per day, while those with amebic dysentery had 5-10 times bowel motions per day in 42.1% which is in agreement with Alaa *study* (2002)(10) (65.8% versus 48.5% respectively).

Conclusion:

Entamoeba histolytica was the most frequent offending pathogen in patients with bloody diarrhea & infants 2-12 months old are the main affected group**.** Bottle feeding and drinking non-boiled water were more prone to bloody diarrhea. High fever and tenesmus are the most frequent clinical symptoms associated with bloody diarrhea. More frequent bowel motions, high fever, and convulsion were all more commonly seen with bacterial bloody diarrhea than in amebic bloody diarrhea, while tenesmus occurs in both.

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