ORIGINAL ARTICLE

Etiology Based on Clinical Manifestation of Acute Diarrhea Incidence of Children Hospitalized in Dr. Soetomo General Hospital Surabaya Period 2011-2013

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ARTICLE INFO

ABSTRACT

Introduction: Diarrhea is one of the most common causes of morbidity and mortality of children worldwide, especially in developing countries. Acute diarrhea can occur from a large number of causes. We aim to describe the clinical manifestation characteristics of acute diarrhea on pediatric patients that are presented to the hospital.

Methods: A cross-sectional study from all pediatric patients treated in Dr. Soetomo General Hospital Surabaya in 2011-2013. Age, gender, nutritional status, length of hospital stay, duration of breastfeeding, clinical signs and symptoms, as well as laboratory results collected and analyzed descriptively.

Results: One hundred and fifty patients were included with characteristics of male(54%), infant (55.3%)with a mean age of 6-7 month. History of being exclusively breastfed(54%) and lack of nutrition(48%). Vomiting is mostly present (72.7%) and commonly come with a combination of two symptoms (42%) which were vomiting and fever. Mild to severe dehydration degree could be found on the patient who had vomiting, seizure, and fever. The most length of stay was frequently >72 hours. The occurrence of acute diarrhea on a child who was treated in Dr. Soetomo General Hospital Surabaya is dominated by vomiting and it could be inferred that the most acute diarrhea has a tendency of being caused by a virus, where liquid acute diarrhea without blood, mucus, or fever is found.

Conclusion: The etiology of acute diarrhea is mostly caused by viruses and symptoms dominated by a combination of vomiting, fever, and diarrhea without blood caused by villi damage.

Introduction

Acute diarrhea is defined as the passage of abnormally liquid or unformed stools associated with increased frequency of defecation. Increased frequency is defined by three or more bowel movements a day.[1] Acute diarrhea can be caused by either an infectious or non-infectious issue. The infectious pathogens include viruses, bacteria, or parasites. While non-infectious diarrhea was caused by allergies, anatomical defects, malabsorption, food poisoning, and neoplasm.[2] Pathogenesis of diarrhea caused by a bacteria is different from one caused by a virus, but the principle is almost the same in that they can cause an electrolyte imbalance. The difference is bacteria can invade the mucous cells of the small intestine thus causing blood to be present in the feces, otherwise known as dysentery and systemic reaction.[1]

Clinical descriptions of diarrhea with watery stool, frequency of defecation of four times or more in a day, often accompanied by vomiting, weak body, fever, lack of appetite, nausea and vomiting sensation may precede viral-induced diarrhea.[3] This diarrhea normally does not occur for very long, lasting just a few days (3-4 days) as it is a self-limiting disease.[4] Parasites which cause diarrhea generally does not produce leucocytes in large quantities. Normally it is not necessary to perform an examination in order to find a parasite or its egg except if the patient has a history of traveling to high-risk regions, negative stool culture for enteropathogen, diarrhea was more than 1 week or in an immunocompromised patient. This study aims to study clinical conditions and make efforts to identify etiological

features based on clinical conditions found in patients with acute diarrhea treated at Dr. Soetomo General Hospital Surabaya period 2011-2013.

Methods

This research is done with a cross-sectional model. All data are taken from the medical records of children with acute diarrhea who were hospitalized in Dr. Soetomo General Hospital Surabaya between a time period of 2011-2013 and the nutritional status is obtained from the WHO z-score method. Exclusion criteria in this research sample include; incomplete medical record and children with acute diarrhea who weren't examined by laboratory tests. Variables observed in this research are: general status of patient, symptoms, sign, and laboratory examination. All data is then analyzed using quantitative-descriptive.

Results

The total number of patients in the period of 2011-2013 was 2870, but only 150 patients met the inclusion criteria.

Table 1 shows that the highest distribution was male in the age group of 6-7 month infants. Meanwhile, the nutritional status found most frequently in a child patient

with acute diarrhea was malnutrition. A Total of 81 children received exclusive breastfeeding (54%) but there were still high levels of nutritional inadequacy. The longest hospitalization was >72 hours. Acute diarrhea experienced by the patient resulted in several manifestations which could be seen in table 2.

Table 2 explains the combination of symptoms, the 2 symptoms most frequently found together in a combination was vomiting and fever. Rarely do clinical manifestation result in all 5 symptoms with vomiting, bloody diarrhea, mucous and bloody stool, then fever.

Patient from table 3 that experiences symptoms and not, has a general tendency to enter a heavily dehydrated state. State of dehydration could be linked to the result of laboratory examinations of hematocrit An electrolytes which could be seen in table 4.

Table 4 showed the result of laboratory examination of hematocrit and electrolytes, where examination for electrolytes sodium and potassium normal average for all categories of dehydration (table 5.4). The difference in hematocrit levels is not very significant because it was unknown whether the children had received first treatment at home.

Table 1. Distribution of General Status Patient

General Status of Patient	Frequency n=150	Percentage (%)
Sex		
Male	81	54
Female	69	46
Age		
Neonates (0-28 days)	1	0.7
Infant (>28 days-12 months)	83	55.3
Toodler (>12-60 months)	62	41.3
Preschool (>60-180 months)	4	2.7
Nutritional status		
Malnutrition	6	4
Lack of nutrition	72	48
Good nutrition	65	43.3
Overweight	6	4
Obesity	1	0.7
Duration of breastfeeding		
< 6 months	69	46
≥ 6 months	81	54
Long of Hospitalized		
< 24 hours	1	0.7
24-48 hours	20	13.3
>48-72 hours	22	14.7
>72 hours	107	71.3

Table 2. Combination of clinical symptoms in Children with acute diarrhea which was hospitalized in Dr. Soetomo General Hospital General Hospital Surabaya period 2011-2013

	Combination of Symptoms	Frequency	Percentage (%)
	Not identified symptom	8	5.3
1 symptom	Vomiting	33	22.0
	Breathless	1	0.7
	Mucous stool	5	3.3
	Fever	11	7.3
2 symptoms	Vomiting and seizure	2	1.3
	Vomiting and breathless	3	2.0
	Vomiting and mucous stool	8	5.3
	Vomiting and fever	42	28.0
	Seizure and mucous stool	1	0.7
	Seizure and fever	3	2.0
	Mucous stool and fever	4	2.7
3 symptoms	Vomiting, seizure, and fever	3	2.0
	Vomiting, mucous stool, and fever	17	11.3
	Seizure, breathless, and fever	1	0.7
	Seizure, mucous stool, and fever	3	2.0
	Mucous stool, bloody stool, and fever	2	1.3
4 symptoms	Bloody diarrhea, mucous stool, bloody stool, and fever	2	1.3
5 symptoms	Vomiting, bloody diarrhea, mucous stool, bloody stool, and fever	1	0.7
	Total	150	100

Table 3. State of dehydration based on clinical symptoms in Children with acute diarrhea which was hospitalized in Dr. Soetomo General Hospital Surabaya period 2011-2013

Clinical symptoms		State of dehydration							
		Not dehydrated		Mild-moderate		Severe		Total	
		n	%	n	%	N	%	N	%
Vomiting	Yes	1	.9	18	16.5	90	82.6	109	100.0
	No	3	7.3	23	56.1	15	36.6	41	100.0
Seizure	Yes	1	7.7	6	46.2	6	46.2	13	100.0
	No	3	2.2	35	25.5	99	72.3	137	100.0
Fever	Yes	4	4.5	24	27.0	61	68.5	89	100.0
	No	0	.0	17	27.9	44	72.1	61	100.0

4. Result of laboratory examination based on dehydration state in Children with acute diarrhea which was hospitalized in Dr. Soetomo General Hospital Surabaya period 2011-2013.

State of dehydration	Result of Laboratory Test		
	Hematocrite (%) (35-40%)	Potassium (3,5-5,1 mEq/L)	Sodium (135-153 mEq/L)
Not dehydrated	32.9	4.8	140
Mild-moderate	33.2	4	137
Severe	33.9	4.1	140.6

Discussion

We found that common clinical characteristics were vomiting and fever. Research conducted at RSU NTB Mataram also yielded results, where vomiting (77.8%) and fever (77.8%) were the dominant expressed symptom.[5] Vomiting, was more common in diarrhea due to rotavirus and will usually be accompanied by dehydration and a longer length of stay, more than diarrhea non-rotavirus.[6] Rotavirus infects mature villous enterocytes, resulting in loss of the brush border and impaired absorption. Rotavirus may also cause villous ischemia, produce a viral enterotoxin, and even affect the enteric nervous system.[7]

The enzyme disaccharide damage can cause lactose intolerance which can prolong the occurrence of diarrhea. Diarrhea which was caused by viruses also rarely showed symptoms of abdominal pain.[8] This research was not done by virus examination with PCR because symptoms and epidemiology could be identified indirectly. It was found that the majority age distribution frequency was on infants or at the range >28 days-12 months with 83 patients (53.3%) (table 1). From that, the result of diarrhea morbidity survey in 2010 which was held by Ministry of Health obtained the biggest proportion of diarrhea patients for an infant was the age of 6-11 months (21.65%) and the smallest was the age of 54-59 months (2.06%).[9] Most episodes of diarrhea occurred in 2 years after birth and rotavirus is the etiology of 90% of acute diarrhea in children <2 years old. Generally, the highest incidence occurred in the age group of 6 to 11 months when complementary feeding has started.[10] Another research said the peak incidence of diarrhea of infants aged 6-11 months was when the food consumed increased in number and variety, also increasing the possibility of microbial contamination.[11] Giving additional food before infants are aged 6 months could interfere with digestion due to immaturity of digestive enzymes thus increasing the risk of diarrhea and reducing the protection that exclusive breastfeeding could provide. Digestion of infants developed well from the age of 6 months so complementary feeding had to be given gradually adjusting the ability of the infant.[12]

Most of the nutritional status was found in children with acute diarrhea was malnutrition as many as 72 patients (48%) with the longest of > 72 hours, 107 patients (71.3%) (table 1). However, a study conducted in RSUD Ulin Banjarmasin and Desi Primayani (2009) also showed no correlation between nutritional status and the length of hospitalization of patients.[13,14] Malnutrition caused structural changes such as mucosal villi atrophy, disruption of enzyme disaccharide activities, the disorder of monosaccharide absorption, abnormal intestinal motility, and changing the intestinal flora. Malnutrition involved several mechanisms including; suppression of immune factors, changing the structure of the intestinal mucosa, and micronutrient deficiencies of zinc and vitamin A.[15] Good nutritional conditions would enhance the ability of children to fight and reduce the negative effects of infection.[11]

The majority of children with acute diarrhea patients had a history of exclusive breastfeeding, which was 81 people (54%) (table 1). This was in contrast with some theories that stated there was a relationship between exclusive breastfeeding with the incidence of diarrhea. Exclusive breastfeeding was associated with a lower relative risk of diarrhea compared with nonexclusive breastfeeding. It provided a protective effect through several mechanisms, including immunological substances, preventing contamination that could be sourced from infant formula or baby bottles, and as a general source of nutrition for infants. Breast milk contains many antimicrobial and anti-inflammation factors, hormones, digestive enzymes, and growth modulators that helped to fight infection.[16]

In a small number of patients, we found bloody diarrhea which is often associated with the presence of blood and mucus that was seen in the stool. Usually, it is a sign of invasive enteric infection by pathogens that invaded the digestive mucosa and indicated of inflammation and the tissue damage.[12] These manifestations are more common in the colon, where diarrhea happens more often but regularly and on a small volume and are often due to aggressive bowel movements that cause pain. Erythrocytes and inflammatory cells were always found in the stool examination. While in the small intestine infection process would cause watery diarrhea with large volume, abdominal cramps, bloating, and gas.[17] Bloody stools provided the possibility of invasive pathogens that releases cytotoxins such as infection by EHEC (*Enterohemorrhagic Escherichia coli*) if there were no leukocytes in the stool. The presence of occult blood and leukocytes in the stool could support the diagnosis due to bacterial infection.[18] In general, the parasites that caused diarrhea did not produce leukocytes in large quantities. Protozoa usually would cause the stool to become liquid and without mucus or blood. Meanwhile, intestinal parasites such as *E. histolytica*, *B. coli* and *T. trichiura* cause symptoms of stools containing blood or mucus. Usually, when blood is present, it would blend in the stool, except *E. histolytica* infection where there was fresh blood on the surface stool and an infection by EHEC that's marked by a line of blood in the stool.[6]

Infection by invasive pathogens was also often associated with fever. That became important because the diagnostic findings of fever could indicate the presence of invasive bacteria such as *Salmonella*, *Shigella*, and *Campylobacter*, some enteric viruses, or cytotoxic pathogens such as *C. difficile* and *E. histolytica*. Most of the pathogens causing inflammatory diarrhea producing mucosal damage as well by stimulating intestinal secretion. The organisms elaborate enterotoxins which stimulate intestinal secretion. In addition, the products of the inflammatory reaction and the local synthesis of inflammatory mediators including cytokines and prostaglandins contribute both to mucosal damage and to intestinal secretion. The presence of co-existing symptoms gives a clue to the etiology that inflammatory diarrhea is typically small volume with frequent bowel movements associated with tenesmus, abdominal cramps or pain and frequently with fever.[19]

Vomiting might aggravate the degree of dehydration caused by diarrhea. So although rehydration with oral rehydration salts was done, due to the vomiting symptom being more dominant the children could still become dehydrated.[5] The presence of symptoms of fever also increased fluid needs, so that children tended to be dehydrated (4.5% without dehydration, compared to 27.0% mild-moderate dehydration, and 68.5% with severe dehydration). If the status was associated with dehydration, patients with seizures and dehydration of only 7.7% compared with mild-moderate dehydration (46.2%) and severe dehydration (46.2%) (table 3). Both dehydration and fever could trigger seizures and the higher the degree of dehydration the higher the risk of seizures. From the laboratory, results showed no evidence of the hemoconcentration process, this could be caused by several things, among them was the possibility of blood sampling performed after or during rehydration and hematocrit value that varies based on the child's age level. If dehydration occurred due to diarrhea, then there was a homeostatic mechanism that will maintain the body's fluid NaCl, so that normal sodium concentration is maintained.[20] However, it

was not easy to identify the specific cause of diarrhea only based on the clinical representation because some pathogens could show the same clinical representation.[18] Identifying the cause of the diarrhea also required additional data on the incubation period, a history of previous trips, history of eating certain foods, occupational risk, the use of antibiotics in the last 2 months, maintenance history, residency, pets, hobbies, as well as the risk of HIV infection.[7, 21]

Conclusion

The etiology of acute diarrhea is mostly caused by viruses and symptoms dominated by a combination of vomiting, fever, and diarrhea without blood caused by villi damage. Further research was needed to determine the incidence of acute diarrhea that are more specific to the causing agents.

Conflict of Interest

The author stated there is no conflict of interest

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