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Case Report

Acute diarrhoea with severe dehydration and complications in a 1-year-old child: a case report in a hospital with low resource setting

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ABSTRACT

Diarrhea remains a leading cause of child morbidity and mortality because can lead to complications such as hypovolemic shock, electrolyte disturbances and metabolic acidosis. In this case study, the author would like to demonstrate management of diarrhea in a hospital with limited resources. A 1-year-old boy presented with complaints of watery stools 6 times/day, vomiting 3 times/day and fever. Child appeared weak, refused to drink, experience rapid and heavy breathing, and a loss of consciousness. Physical examination revealed heart rate about 156 per min, peripheral pulse was not palpable, respiratory rate 44 per min, oxygen saturation 98% and temperature about 36.7°C. When crying, the face appeared haggard, the eyes sunken, and there were no tears, reduced bowel noise, longer skin turgor and the capillary refill time increases. Laboratory findings showed leucocytosis (23,600/µl), hyponatremia (127 mmol/l) and hypokalemia (2.66 mmol/l). He was treated with resuscitation fluid administration, Ringer lactate 20 cc/kg BW in 20 min continue with 30 ml/kg BW in 30 min and 70 ml/kg BW 2 hrs 30 min later. The patient was then administered with D5% 500 cc±28 cc sodium bicarbonate, 27 cc+KCL 7.4% within 24 hour. The patient was also given oxygen therapy, antibiotic, probiotics and zinc. The patient was discharged home on hospitalization day 5 with a significant improvement condition. Diarrhea can lead to complications that cause of death in diarrhea cases. This case report highlighted to recognize signs and symptoms and manage severe diarrhea in a hospital with limited resources.

Keywords: Diarrhea, Metabolic acidosis, Electrolyte imbalance, Infection, Rotavirus

INTRODUCTION

Diarrhea is a global health issue that according to the WHO affects 1.7 billion children under the age of five each year, with a fatality rate of roughly half a million. Indonesia is one of 15 nations that account for 70% of mortality in children under the age of five worldwide due to diarrhea and respiratory illnesses.[1]

In 2018, the Ministry of Health estimated that the prevalence of diarrhea in children under the age of five was 17%, or around 4 million cases. Diarrhea is also the biggest cause of death in children under the age of five, accounting for 10.7% of all deaths in 2019.[2] A study on the incidence of diarrhea in children under the age of five in Surabaya found that the majority of diarrhea cases (83.2%) occurred between the ages of 0 and 24 months.[3]

Diarrhea in children can lead to complications such as hypovolemic shock, electrolyte disturbances and metabolic acidosis. These complications are the main cause of death in diarrhea cases. The high mortality rate due to diarrhea is due to inadequate management. To correctly manage diarrhea situations, it is also vital to recognize the early signs and symptoms that will define subsequent treatment. Therefore, in this case study, the author would like to demonstrate how to recognize signs and symptoms and manage diarrhea in a hospital with limited resources.

CASE REPORT

A 1-year-old boy who was referred from primary health care, came to the emergency room with complaints of watery stools for 4 days. 6 times a day without mucus or blood present. The patient also has a complaint of non spraying vomiting three times a day and consists of food material and water. Complaints accompanied by a fluctuating fever for the last 2 days However, temperature was not measured and improved with febrile medication.

According to her mother, the patient appeared weak and had refused to drink since the previous night. The patient also began to experience shortness of breath, rapid and heavy breathing, and a loss of consciousness. Position had no effect on shortness of breath, and it was not followed by coughing. The patient had last voided 3 hours before admission, approximately 5-10 cc. Complaints of seizures and cyanosis when crying were denied.

The patient is the second child of two. The patient was born by Cesarean Section in the hospital on the indication of twin pregnancy with the risk of partus prematurus at 1.9 kg, body length is unknown. The patient immediately cried after birth and was treated in the NICU room for ten days. There was no history of hyperbilirubinemia or cyanosis. The patient has been breastfed since infancy and is currently eating regular family meals. There had been no history of food allergies or lactose intolerance.

On physical examination, it was found that the patient appeared seriously ill, lethargic, with a body weight of 7 kg, body length of 71 cm, based on the WHO curve, weight for age curves shows value between -2 to -3; length for age curves shows value between -2 to -3 hence nutritional status was poor, heart rate about 156 times per min, peripheral pulse was not palpable, respiratory rate 44 times per min, oxygen saturation 98% and temperature about 36.7°C. When crying, the face appeared haggard, the eyes sunken, and there were no tears. The nose, ears, mouth, and lungs were all examined and found to be normal. The thorax is symmetrical, with no retraction, rhonchi, or wheezing. There are no murmurs or gallops in the heart sounds. The abdomen seems convex and pliable, with reduced bowel noises and longer skin turgor. Because the extremities are chilly, the capillary refill time increases (5 sec).

Initial laboratory results showed hemoglobin level 13.1 g/dl, leucocytes 23,600/µl, platelets 518,000/dl, and blood sugar 149 g/dl. Serum electrolyte results showed sodium 127 mmol/l, chloride 108 mmol/l, and potassium 2.66 mmol/l. After fluid resuscitation and rehydration of diarrhea with signs of severe dehydration, serum electrolytes were re-examined and the following results were obtained: sodium 132.5 mmol/l, chloride 114 mmol/l, and potassium 2.46 mmol/l.

The patient was treated with initial treatment in the form of resuscitation fluid administration, Ringer lactate 20 cc/kg BW in 20 min. After the administration of resuscitation therapy, clinical signs were reassessed, and it was found that the patient was still lethargic, with a heart rate of 146 beats per minute, breathing 42 beats per min, sunken eyes, but with a strong palpable peripheral pulse and improved capillary filling time, which was within 2 sec.Therapy was continued with the administration of ringer lactate fluid 30 ml/kg BW in 30 min and 70 ml/kg BW 2 hours 30 min later. Post rehydration, an evaluation was made, the patient began to appear more active, heart rate 136 beats per min, peripheral pulse was strong, respiratory rate 36 beats per min, skin turgor returned quickly, extremities were warm, capillary filling time is 2 seconds, and the patient had urinated, with diuresis 3.8 cc/kg BW/hr.

The patient was then administered with D5% 500 cc+28 cc sodium bicarbonate, 27 cc+KCL 7.4% within 24 hrs. Fluid administration was carried out with close observation of vital signs, diuresis, and fluid input and output. The patient was also given oxygen therapy with a non-rebreathing mask of 8 lpm, ceftriaxone 350 mg IV/12 hrs was administered as the antibiotic, and oral drugs were administered through nasogastric tube, including probiotics (1 sachet/24 hrs) and zinc (20 mg/24 hrs)

After 24 hrs of treatment in the ICU, the patient began to appear more active, reduced shortness of breath with a heart rate of 134 beats per min, strong palpable peripheral pulse, respiratory rate of 24 beats per min, oxygen saturation is 98% with nasal cannula oxygen of 2 l/min, and diuresis of 5.8 cc/kg BW/hr. Post correction serum electrolyte examination showed sodium 133.9 mmol/l; chloride 110.7 mmol/l; and potassium 2.52 mmol/l. The maintenance fluid therapy was then replaced with Kaen 3B 700 cc/24 hrs and corrected KCL 7.4% 4.2 cc/6 hours. The patient was then transferred to the high care unit.

On the third day of treatment, the NGT was removed and the patient was given a porridge diet of 900 kcal/24 hours, 3 times daily. The patient was discharged after 5 days of treatment, with oral therapy of probiotics, zinc, and vitamins.

DISCUSSION

In this case, the patient, a one-year-old kid, complained of watery diarrhea with no mucus or blood. The complaint was accompanied by non-spraying vomit and a two-day fever history. There was no history of food allergies, lactose intolerance, or diarrhea in the patient.

A review of Riskesdas reports in Indonesia found that the incidence of diarrhea in children under the age of five years has grown, with 82,666 cases in the 2013 report and 93,609 cases in the 2018 report. Diarrhea is most common between the ages of 0 and 24 months.[1] Diarrhea is classified as osmotic (due to lactose intolerance and toxin), secretory (due to cholera infection, E.coli, Shigella species), or inflammatory (due to enterotoxin).[3] The most

prevalent cause of pediatric diarrhea is rotavirus infection, particularly in children aged 3-24 months. Vomiting, fever, and diarrhea are all symptoms of rotavirus infection. Rotavirus is the most common cause of infectious diarrhea in children, and it can lead to severe dehydration, electrolyte imbalance, metabolic acidosis, and death.[4] Another bacterial pathogens that may cause diarrhea include *Escheria coli* and non-thypoidal salmonella, followed by Shigella and *Vibrio parahaemolticus*. Bacterial and viral gastroenteritis cannot be definitively distinguished based on clinical appearance; however, bloody mucoid diarrhea and high fever are likely to be associated with bacterial pathogens. Infections by parasite such as giardiasis typically present with an acute watery diarrhoea, abdominal pain, abdominal distension and, if persistent, can result in weight loss or faltering growth. A stool test would help to confirm the diagnosis.[5] Diarrhoea may be a non-specific symptom of an acute abdomen such as in appendicitis, necrotising enterocolitis or intussusception, particularly in younger children. Non-infectious aetiologies in infants aged below six months include cow's milk or soy milk protein allergy and food protein-induced enterocolitis syndrome (FPIES). Patients may also present acutely to the primary care physician, especially if there has been a recent change in diet before onset of diarrhea. Elimination of cow's milk from a breastfeeding mother's diet or a trial of hydrolysed feed may be both diagnostic and therapeutic.[5]

Physical examination revealed that the child was weak with diminished consciousness, severe dehydration, hypovolemic shock, and indications of metabolic acidosis. According to WHO (2005), children with severe dehydration diarrhea will have fluid loss of more than 10% and may develop evidence of hypovolaemic shock, including: diminished consciousness, lack of urine output, cool moist extremities, a rapid and feeble pulse (the radial pulse may be undetectable), low or undetectable blood pressure, and peripheral cyanosis.[6] Meanwhile based on American Academy of Pediatrics (2016), the Clinical dehydration scale is used in the assessment of dehydration. This tools assest the general appearance, skin turgor, sunken eyes, capillary refill time and mucous membrane. Every characteristic has score from 0-2 and a score of 5-8 represents moderate/severe dehydration.[7]

Diarrhea in children has the potential to cause severe dehydration as well as complications such as shock, sepsis, electrolyte imbalance, acid-base imbalance ranging from acidosis to alkalosis, and AKI. Eni et al found that of 650 patients with diarrhea at Dr. Soetomo Surabaya Hospital between 2016 and 2018, 6.8% were dehydrated, 84.2% were mild to moderately dehydrated, and 9.1% were severely dehydrated. Furthermore, 29.6% of patients with acute diarrhea exhibited electrolyte imbalances. Hyponatremia (41%), hypokalemia (38.6%), hypernatremia (11.4%), and hyperkalemia (9%) were the most prevalent electrolyte abnormalities.[3]

A study in India by Takia et al showed the incidence of metabolic acidosis in acute diarrhea with severe dehydration was 13% of the total 929 cases.[8] While another study by Zain et al in 2020 in 280 cases, found the incidence of metabolic acidosis was 29.5% of the total cases.[9] The degree of metabolic acidosis is divided into 3 levels based on arterial blood pH levels: mild (pH 7.30-7.36), moderate (pH 7.20-7.29), and severe (pH<7.20). Symptoms depend on the underlying illness, and in severe metabolic acidosis, breathing compensation, namely rapid and deep breathing (kussmaul), might be found. Other laboratory tests required in addition to blood gas analysis include serum electrolytes, blood sugar, renal function, serum lactic acid, and urine.[10] When laboratory tests are not available, metabolic acidosis might be treated based on symptoms.[11]

Patients who have experienced severe diarrheal dehydration will lose bicarbonate ions through their digestive tract. Diabetic ketoacidosis (DKA) is a differential diagnosis for the condition. Clinically, DKA is characterized by dehydration, tachypnoea and Kussmaul breathing, smell of ketones in the breath, nausea, vomiting, abdominal pain, drowsiness, confusion, reduced level of consciousness and coma, which are precipitated by a variably long period of polyuria, polydipsia, and weight loss. Weight loss and gradually worsening fatigue, which are caused by insulin deficiency and the increase in counter-regulatory hormones that result in lipolysis and muscle lysis in the effort to compensate for intracellular glucopenia. Once ketosis and acidosis begin to develop, gastrointestinal symptoms are added, including nausea, vomiting and abdominal pain, in more than 60% of patients. Clinical examination may reveal severe dehydration and circulatory volume depletion presenting as dry mucous membranes, delayed capillary refill time, and tachycardia. Kussmaul breathing pattern is observed as a compensatory mechanism for hyperketonaemia and metabolic acidosis, characterized by tachypnoea, deep and laboured breathing. Finally, if DKA remains undiagnosed, mental status is impaired due to deteriorating dehydration and acidosis, resulting in lethargy or even coma.[11]

Another differential diagnosis is sepsis and early sepsis can present with temperature changes, tachycardia, and local signs of infection. If, in addition, the child shows signs of systemic infection, such as tachypnea and mental state changes, or looks generally 'unwell', the diagnosis of sepsis should be considered. Meanwhile septic shock implies cardiovascular dysfunction as evidenced by signs of inadequate tissue perfusion, such as prolonged capillary refill (>3 sec), mottled and cool extremities, altered mental status, oliguria, and/or hypotension.[13] Uremia and impaired renal excretion are indicated by elevated BUN and serum creatinine. Sepsis, heart conditions, and severe hypoxia can all present with signs of shock that are accompanied by a rise in lactic acid. Hypotonia, delayed development, and a history of apneu throughout infancy are just a few neurological symptoms and indicators that may point to a congenital metabolic condition. Other

causes of metabolic acidosis include drug intoxication.[10] Ketoacidosis, sepsis, neurological dysfunction, and renal impairment can all be ruled out in this situation.

Although blood gas analysis cannot be performed, metabolic acidosis can be diagnose based on the patient's clinical condition. In this case, apart from metabolic acidosis, the patient also had hypokalemia (K=2.46 mmol/l) with hyponatremia (Na: 132.5 mmol/l). The patient suffered from isonatremic dehydration (Na: 130 to 150 mmol/l), which is the most common type of dehydration in children, and has the best prognosis.[11]

Hypovolemic shock therapy involves the administration of isotonic fluids 10-20 cc/kg BW bolus within 15-20 min, with a maximum of 40-60 cc/kg BW within the first hour.[12,13] Rehydration fluid administration is the main therapy for diarrhea. There are three treatment plan that corresponds with the child's degree of dehydration based on WHO. Treatment plan A is used if there is no signs of dehydration, treatment plan B for some dehydration and plan C for severe dehydration. Start intravenous fluids immediately in severe dehydration, by give 100 cc per body weight, within 3 hours for children over 1 year and 6 hours for children under 1 year.and then reassess the patient every 1-2 hrs.[6]

Following resuscitation and rehydration therapy, maintenance fluid is administered together with electrolyte correction in the amount that is required per kilogram of body weight over the course of 24 hours. A solution of 5% dextrose (D5), 1/3 NS, and 40 meq/l (40 mmol/l) KCl was used. The hospital does not have D5 1/3 NS as standard fluid, hence the guideline suggests using 5% dextrose instead.[8,11]

In this case, the patient weighed 7 kg, and the patient was isonatremic, therefore a total maintenance fluid of 700 cc/24 hours was administered, consisting of 5% dextrose, 27 meq KCL fluid for correction, and 28 meq sodium bicarbonate. After estimating the amount of sodium required, sodium bicarbonate can be added to intravenous fluids as a substitute for the chloride already present in the fluid.

Since viruses are the primary cause of severe diarrhea, antibiotics are rarely prescribed. Cephalosporins, the penicillin group, or a combination of the penicillin and aminoglycoside groups, such as ampicillin and gentamicin, can all be used as antibiotics.[16]

Zinc supplementation can reduce the risk of recurrence, duration and frequency by up to 30%.[16] Probiotics are beneficial microbes that, when taken by the body, can enhance the microflora balance in the digestive tract. Probiotics are frequently used in situations of acute diarrhea, however they are not mandated by the WHO.[3] Probiotics can reduce the duration of diarrhea and length of stay by up to 1 day especially when given as soon as possible at the onset of symptoms.[17]

CONCLUSION

Diarrhea is a widespread health issue that has a high mortality rate, particularly in poorer nations with inadequate sanitation. Dehydration can range from mild to severe in children who have diarrhea. This makes it crucial to recognize the symptoms and signs of diarrhea in children while making medical decisions. If diarrhea is not treated right away, it can result in complications such metabolic acidosis, hypovolemic shock, and electrolyte imbalances. Treatments for diarrhea cases in healthcare institutions with limited resources include fluid rehydration therapy, electrolyte and metabolic acidosis correction, probiotics, and antibiotics when indicated.

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