CASE REPORT

pISSN: 1907-3062 / eISSN: 2407-2230

Marasmus and stunting in 2-month-old boy with pneumatocele: a case report

Maya Susanti[1] and Aidah Juliaty[1*]

ABSTRACT

BACKGROUND

Nutrition is essential for humans and if inadequate may lead to undernutrition. Undernourished children are very susceptible to infections, such as pneumonia, one of its complications being pneumatocele, which is a more severe condition. Pulmonary pneumatoceles are thin-walled, air-filled cysts that develop within the lung parenchyma and have been found in 2.4 percent of 493 infants and children with pneumonia. However, in staphylococcal pneumonias, the frequency of pneumatocele can reach as high as 85 percent. Infants and young children are more likely to have pneumatoceles. It is critical to distinguish marasmus with pneumatocele from many other similar diagnoses. Failure to recognize can lead to incorrect diagnosis and treatment, causing more harm than good to patient care. This case highlights the importance of maintaining a high suspicion of pneumonia in neonates even with normal radiological findings and of searching for pneumatoceles.

CASE DESCRIPTION

We report a case of marasmus and stunting accompanied by pneumatocele in a 2-month-old boy. The diagnosis was made based on history, physical examination, anthropometric examination using the WHO child growth standards, laboratory tests, and radiological imaging. Management of the patient was according to a multidisciplinary system including antibiotics administration and wasting management.

CONCLUSION

Pneumatoceles are serious complications after pneumonia. Pneumonia is common in children with marasmus. Children with marasmus are caused by various underlying factors. The progression begins in the womb and continues through the first 1000 days of life.

Keywords: Stunting, pneumonia, pneumatocele, marasmus

[1]Department of Pediatrics, Faculty of Medicine, Hasanuddin University/ Wahidin Sudirohusodo Hospital, Makassar, Indonesia

Correspondence:
*Aidah Juliaty, MD, Ph.D
Department of Pediatrics, Faculty of Medicine, Hasanuddin University
Jl. Perintis Kemerdekaan km. 10, Tamalanrea 90245, Makassar-Indonesia
Email: juliatyaidah07@gmail.com
ORCID ID: 0000-0001-9927-1940

Date of first submission, February 22, 2020
Date of final revised submission, October 6, 2021
Date of acceptance, October 11, 2021

Cite this article as: Susanti M, Juliaty A. Marasmus and stunting in 2-month-old boy with pneumatocele: a case report. Univ Med 2021;40:263-9. doi: 10.18051/UnivMed.2021.v40.263-269

INTRODUCTION

Pulmonary pneumatoceles are thin-walled, air-filled cysts that develop within the lung parenchyma as a complication of pneumonia. They can also result from non-infectious etiologies such as trauma and positive pressure ventilation.[1] In most patients, pneumatoceles are asymptomatic and do not require surgical treatment. Hussain et al.[2] in the post surfactant era, including 1053 infants with a gestational age of d" 30 weeks and respiratory distress syndrome (RDS) requiring positive pressure ventilation, identified pneumatoceles in 19 infants, giving an incidence of 1.8% and a male to female ratio of 12:7. Pneumatocele is commonly seen in infants and young children as a complication of *Staphylococcus aureus* pneumonia,[3] its frequency can be as high as 85% and its predilection site depends on the susceptibility of the individual to infection. The high incidence was attributed to the high level of undernutrition in children.[4] Nutrition is essential and plays a role in the quality of life, because inadequate dietary intake will cause undernutrition, which then induces long-term effects on child physical and mental development and quality of life.[5,6]

Undernutrition occurs as a result of malabsorption or metabolic failure. Clinical signs of undernutrition are identified by indicators measuring body weight (BW), body length (BL), and upper arm circumference (UAC) that are significantly lower than the mean. Undernutrition can have long-term consequences for child physical and mental development and quality of life.[6]

The 2018 Global Nutrition Report stated that the case burden of severe wasting reached 7.5% or 50.5 million children under five in 2017.[7] Indonesia ranks second highest (12.1%) in prevalence of wasting among 17 countries in the Asian region. In South Sulawesi, the prevalence of wasting reaches 9.6%.[8] Stunting affected 159 million children younger than 5 years of age in 2014.[9]

Toddlers with undernutrition have a decreased immune system, thus they are prone to infections, such as pneumonia, which is one of the most common causes of death in children under five.[10] Pneumonia accounts for 15% of all deaths of children under 5 years old.[11] Pneumatocele is a complication of community-acquired pneumonia (CAP) and increases the risk of death in children under five years.[3] The purpose of this case is to highlight the importance of adequate treatment when neonatal pneumonia is highly suspected with normal radiological findings, to search for pneumatocele as a complication of marasmus and stunting and to rule out congenital malformations in case of pulmonary cyst.

CASE REPORT

A two-month-old boy was transferred from the Jaury Jusuf Putera Academic Hospital, Makassar, South Sulawesi, to the emergency unit of our hospital with the main complaint of shortness of breath that had been noticed for 17 days and was getting worse a day before admission. There was no cyanosis and no cough but there was a history of cough two weeks before being admitted to the hospital. Oral intake was stopped in the last three days before the patient was transferred. He was treated for 11 days and received antibiotic therapy (cefotaxime and gentamicin). There were no abnormalities during delivery. The patient's birth weight was 3500 grams and his body length was 50 cm. His condition after birth was good. He only received hepatitis B immunization and had formula milk since birth. The mother never visited the health care center after being discharged after birth.

Physical examination revealed tachypnea, which had been present for 17 days prior to hospital admission and had worsened one day before admission. There was no fever and the oxygen saturation was 98% with nasal cannula. On examination of the head, the patient had an old man's face. Chest examination revealed intercostal and subcostal retraction and

Figure 1. Clinical examination on the 1st day of care: the patient appeared very wasted, with wasting on chest and extremities; on the 5th day, the patient began to regain weight

bronchovesicular breathing sounds with rales were heard in both lung fields. Wasting was found on the extremities. Skin examination showed no BCG scars. The examination of other regions was within normal limits (Figure 1).

Anthropometric examination showed that body weight (BW) was 3000 grams, body length (BL) 52 cm, head circumference (HC) 39 cm (normal 38-42 cm), and upper arm circumference (UAC) 8.5 cm. Weight-for-length was below -2

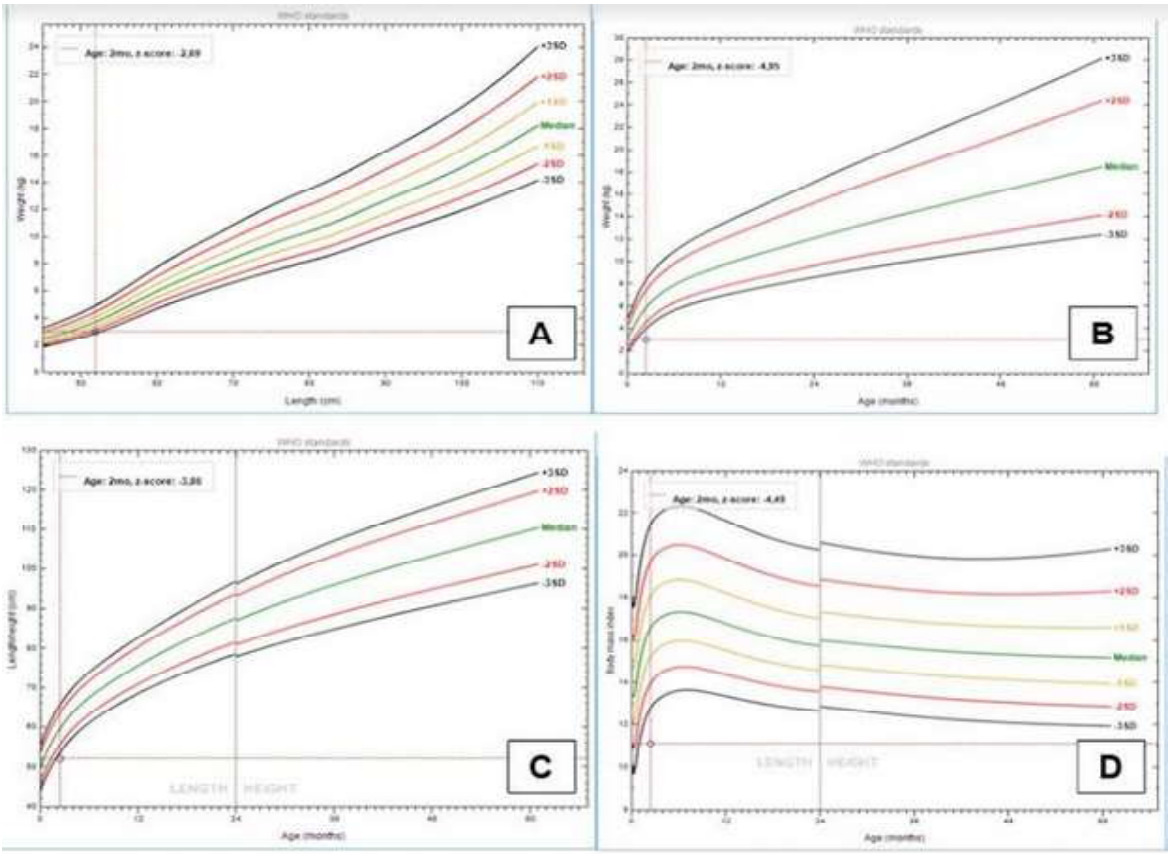

Figure 2. Child growth: weight-for-length was below -2 SD (A), weight-for-age was below -3 SD (B), length-for-age was below -3 SD (C), body mass index (BMI)-for-age was below-3 SD (D), using WHO child growth standards

Figure 3a. Thoracic MSCT (without contrast) July, 23 2020 showed bilateral pneumonia accompanied by multiple left pulmonary cavities suspected of being pneumatocele and bilateral pleural effusion

SD (wasting), weight-for-age was below -3 SD (severely underweight), and length-for-age was below -3 SD (severely stunted), all based on the WHO child growth standards (Figure 2). Based on the patient's anthropometric and clinical status, it was concluded that the child had nutritional marasmus.

Laboratory examination from Jaury Academic Hospital showed Hb 10.9 g/dL, Ht 34.8%, leukocytes 23,560/uL, platelets 353,000/uL. Laboratory examination from our hospital showed Hb 8.2g/dL, MCV 91 fL (femtoliter), MCH 30 pg, Ht 25%, leukocytes 6,300/uL, platelets 251,000/uL, lymphocytes 29.9%, neutrophils 55.7%, monocytes 8.5%, glucose 174 mg/dL, sodium 133 mmol/L, potassium 4.3 mmol/Ll, ureum 8 mg/dL, creatinine 0.31 mg/dL, SGOT 132 U/L, SGPT 71 U/L, albumin 2.8 g/dL, CRP 2.0 mg/L, procalcitonin 2.03 ng/mL, ferritin 1018.22 ng/mL. Blood and urine cultures show no growth of aerobic bacteria. Radiological examination (multi slice computed tomography/MSCT of thorax without contrast) showed bilateral pneumonia accompanied by multiple left pulmonary cavities suspected as pneumatoceles and bilateral pleural effusions (Figure 3a).

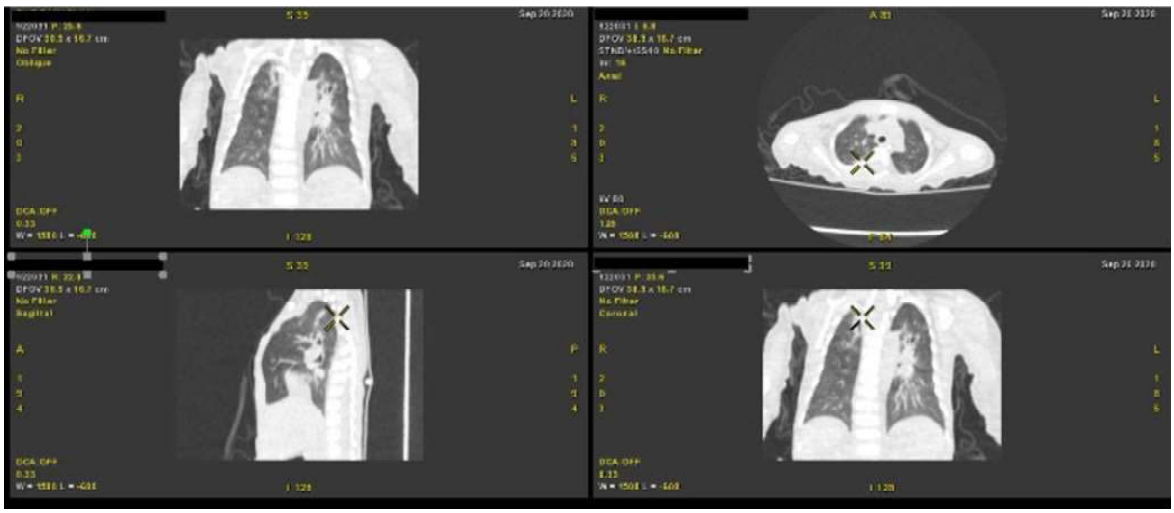

Figure 3b. Thoracic MSCT (without contrast) after 2 months of observation, September 20, 2020 showed bilateral pneumonia and no multiple pulmonary cavities

The patient was diagnosed as having nutritional marasmus, with an additional diagnosis of inadequate intake, stunting, *community-acquired pneumonia, pneumatocele,* bilateral pleural effusions, anemia of chronic disease, hypoalbuminemia, elevated transaminases, and delayed immunization. The patient was treated with nasal oxygen and antibiotics (ceftazidime and amikacin). We also performed gastric decompression and gave the nutrition via parenteral route. The patient was planned for tuberculosis work-up. The stabilization phase of wasting management was temporarily postponed. The patient's fluid requirement on the first day after the restriction was 240 mL/day with an energy requirement (Schofield) of 257.85 kcal/day. After treatment, laboratory examination showed Hb 9.9 g/dL, MCV 84 fL, MCH 29 pg, Ht 22%, Leukocytes 9,600/uL, platelets 312,000/uL,%, glucose 155 mg/dL, sodium 130 mmol/l, potassium 4.3 mmol/L, ureum 12 mg/dL, creatinine 0.26 mg/dL, SGOT 23 U/L , SGPT 14 U/L, albumin 3.3 g/dL, CRP 0.0 mg/L, procalcitonin 0.25 ng/mL, and IT ratio 10%.

On the third day, the child was given enteral priming at 10 mL/kg/day through a nasogastric tube while still being given parenteral nutrition. On the 4th and 5th days, enteral priming was increased gradually to 30 mL/kg/day. On the 6th day, the child's condition improved, dyspnea had decreased, enteral administration via the nasogastric tube was given to 50% of energy requirement with high-calorie formula milk, and the remaining 50% with parenteral nutrition. On the 8th day of treatment, the patient was started on the stabilization phase of wasting treatment on day one using high-calorie formula milk at 12 x 25 mL (240 kcal) through the nasogastric tube, with supplementation. On the 9th, 10th, and 11th days, the treatment was followed by the transition and rehabilitation phase of wasting management. After 2 months of observation, radiological examination (MSCT thorax without contrast) showed bilateral pneumonia with no evidence of multiple pulmonary cavities (Figure 3b). Written informed consent was obtained from the patient's parents for publication of this case report and accompanying images.

DISCUSSION

The nutritional status of undernutrition children under the age of five influences the risk of pneumonia in these children. Undernourished children under the age of five have a weakened immune system, making them vulnerable to infectious diseases. Wasting is a nutritional disorder that can have a negative impact on the health of children under the age of five and will stifle their growth if not handled properly.[12] Our case report is consistent with the findings of a case of pulmonary pneumatocele in post-pneumonic empyema in a 4-year-old female.[13] Following pneumonia, inflammation and narrowing of the bronchi cause the formation of an endobronchial ball valve mechanism, resulting in distal dilatation of the bronchi and alveoli. The obstruction is believed to be caused by inflammatory exudates within the airway lumen or wall, allowing air to enter but not to leave the cystic space. There is little information available about infective pulmonary cysts in infants. The high incidence is attributed to undernutrition in children. It is hypothesized that undernutrition would delay the development of Kohn's pores, resulting in undernourished children having lungs similar to newborns. When there is a valvular obstruction, air continues to enter with no way out due to the absence of Kohn's pores, resulting in pneumatocele.[4] The majority of children with severe pneumonia are malnourished and unhealthy. The decrease in immunity is caused by a decrease in the activity of leukocytes to phagocytize and kill germs. According to a study, there is a link between infant pneumonia and nutritional status. The toddlers do not have appetite, which leads to undernutrition.[6]

In the present case, the patient had a weight-for-height value below -2 SD. He had clinical symptoms of marasmus. We also found that the patient's length-for-age was below -3 SD with the growth rate in these patients for ages 0-12

months being 23-27 cm/year or 1.9-2.2 cm/month. The patient met the diagnostic criteria for stunting. According to epidemiological studies, an estimated 155 million children under the age of five were stunted in 2016, with 52 million suffering from wasting and 17 million suffering from severe wasting. Marasmus is equally distributed between the sexes; however, due to cultural differences in some parts of the world, women may be at greater risk of developing marasmus. Meanwhile, the causes of stunting are classified as direct and indirect. Food intake and infectious diseases have a direct impact on stunting, while the indirect causes are food accessibility, parenting, drinking water availability, sanitation, and health services.[14]

Inadequate total caloric intake is the main cause of marasmus. However, it is critical to understand what causes the decrease in calorie intake in a marasmic patient. Severe caloric restriction increases susceptibility to infection, which occurs as a result of secondary immune deficiency. Prolonged caloric restriction is associated with impaired mucosal barrier integrity in the respiratory and gastrointestinal systems. Inflammatory cytokines such as interleukin 1 (IL-1), IL-6, and IL-12 disrupt growth hormone function, contributing to short stature. As a result of T cell dysfunction and decreased neutrophil microbicidal activity, there is an increased susceptibility to infection.[14,15] Infection with Gram-negative organisms, in particular, has been linked to marasmus. In addition, marasmus is linked to urinary, gastrointestinal, and respiratory tract infections.[10]

Pneumatocele is one of the complications of pneumonia that are found in children under five. It occurs due to inflammation and narrowing of the bronchi causing the formation of endobronchial ball valves which initiate dilatation of the distal part of the bronchi and alveoli. The obstruction is believed to be caused by inflammatory exudate within the lumen or airway walls, allowing air to enter the cystic space but not to escape. Subsequent enlargement of the pneumatocele occurs either due to pressure from the adjacent pneumatocele or intraluminal inflammatory exudate.[5]

In our case, the patient complained of dyspnea, and a radiological examination revealed that the patient had pneumonia with pneumatocele. As described in the theory above, this patient has several risk factors, including: low socioeconomic status, residence in a densely populated area, non-exclusive breastfeeding, and malnutrition. Due to the high incidence of infection in malnourished children and to the patient's complaints, we also performed radiological examinations to determine the patient's source of infection. The chest CT scan results revealed bilateral pneumonia with multiple left pulmonary cavities suspected of being a pneumatocele. Pneumatoceles can be treated using a variety of methods, including: i) observation; 90% of pneumatoceles resolve spontaneously within a few weeks up to 6 to 12 months without intervention. However, antimicrobials were still administered during the observation period; ii) utilization of unilateral ventilation with high-frequency oscillation (HFO); iii) percutaneous drainage in the decubitus position with the affected side down, followed by selective intubation of the unaffected side; iv) surgical resection; including video-assisted thoracoscopic surgery (VATS), lobectomy, pneumatocele consideration/deroofing, and pneumonectomy.[16] In this case, we planned to perform observation by giving antibiotics and to do thoracic MSCT 3 months later to observe the progress.

One of the contraindications for enteral nutrition is severe respiratory distress. Therefore, we used parenteral nutrition (PN). When the condition is stable, children with PN may possibly be given enteral or oral nutrition. In this transition period, PN was given cyclically to prevent hyperinsulinism and hypoglycemia. Therefore, even though we had enteral priming on the second day, PN was continued and decreased slowly.[17] Parenteral nutrition should be stopped gradually and malnutrition management should be initiated. The stabilization phase should be started when the children receive full enteral nutrition.[17]

Patients with good oro-motor function should have oral nutrition directly. The patient was discharged on the eleventh day to continue outpatient care with the consideration of improved clinical condition, being conscious, without medical problems or edema, the baby getting adequate intake, and the weight gain being sufficient (>5 g/kg/day) for three consecutive days.[17] However, adequate nutrition for children is essential for growth, development, and defense of the body, ensuring that they are not susceptible to infection.

CONCLUSION

This case highlights the importance of maintaining a high suspicion of pneumonia in marasmic and stunted infants with multiple left pulmonary cavities suspected of being pneumatoceles and bilateral pleural effusions in radiological findings with a focus on the diagnostic value and sputum cultures and viral testing to complete the investigation on infectious etiology. Clinicians should search for pneumatoceles and other complications when pneumonia is diagnosed, especially in cases accompanied by malnutrition.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

CONTRIBUTORS

All authors critically reviewed the manuscript and approved the final version submitted for publication.

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