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Nutrition Care Process of Malnutrition in Patients with Bronchopneumonia and Atopic Dermatitis

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ABSTRACT

Bronchopneumonia and atopic dermatitis due to cow's milk allergy are common comorbidities in children with severe malnutrition. These conditions increase the risk of morbidity and mortality by impairing dietary intake and metabolism. The Nutrition Care Process (NCP) provides a structured approach to identify and address nutritional issues in such complex cases. This descriptive case study aimed to evaluate the effectiveness of NCP in improving nutrient intake and Clinical outcomes were reduced fever and shortness of breath. The study was conducted in the PICU of Dr. Tajuddin Chalid Hospital, Makassar, from April 8–12, 2025, involving a 1-year-old male patient. Nutritional assessment included anthropometric, biochemical, clinical, and dietary intake parameters. Intervention consisted of a high-energy, high-protein liquid diet administered via nasogastric tube in a staged manner. Results showed a weight gain of 200 grams and significant improvements in energy, protein, fat, carbohydrate, vitamin, and mineral intake. Clinical improvements were also observed, including reduced fever and shortness of breath. Although the nutritional status remained in the category of malnutrition, the integrated implementation of NCP proved effective in enhancing nutrient intake and stabilizing clinical condition. Personalized nutritional strategies and caregiver education on food allergy management are essential in treating pediatric patients with complex medical and nutritional needs.

ARTICLE INFO

CASE REPORTS

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Key Messages:

- This study highlights the importance of nutritional care in the treatment of malnourished patients, especially those hospitalized, which includes nutritional assessment, nutritional diagnosis, intervention, monitoring, and evaluation.
- A planned and systematic nutritional care process can increase nutrient intake and improve the weight of malnourished patients, although it does not yet change their nutritional status.

INTRODUCTION

Bronchopneumonia in children, especially those suffering from malnutrition, is a major challenge in the world of health. However, this emphases of implementing Nutrition Care Process for bronchopneumonia cases remain limited .Malnutrition can worsen respiratory tract infections such as bronchopneumonia, due to a weakened immune system and the body's limited capacity to fight infection (1). Case studies show that children with malnutrition have a higher risk of death from pneumonia, which increases with the severity of malnutrition. Therefore, appropriate nutritional intervention is crucial in supporting patient recovery (2).

Atopic dermatitis caused by cow's milk allergy adds complexity to this case. Cow's milk allergy is one of the most common food allergies in children with atopic dermatitis, and it can worsen skin conditions and affect children's nutritional status (3). Research indicates that half of children under 24 months of age with atopic dermatitis and cow's milk allergy can tolerate cow's milk by 67 months of age, with specific IgE levels to cow's milk in the first 24 months being the primary predictive factor. This highlights the importance of monitoring and managing food allergies in nutritional care (4)(5).

The Nutritional Care Process (NCP) is a systematic approach to addressing nutritional issues, encompassing assessment, diagnosis, intervention, monitoring, and evaluation. In cases of bronchopneumonia and malnutrition, NCP has proven effective in improving patients' nutritional intake and clinical condition. Studies show that providing a high-calorie, high-protein diet can increase patients' energy and protein intake, as well as gradually improve their physical and clinical condition. This emphasizes the importance of implementing NCP in managing similar cases (6).

In this context, an integrated NCP approach is crucial for addressing malnutrition complicated by bronchopneumonia and atopic dermatitis caused by cow's milk allergy. Selecting appropriate alternative protein sources, regularly monitoring nutritional status, and educating parents on food allergy management are integral components of nutritional intervention. With a comprehensive approach, it is hoped that optimal recovery can be supported and further complications prevented in the patient (7).

Based on this background, this case study aims to evaluate the effectiveness of the Standardized Nutritional Care Process in managing cases of children with bronchopneumonia, atopic dermatitis caused by cow's milk allergy, and malnutrition, and its impact on nutrient intake and nutritional status of patients.

CASE DESCRIPTION

Clinical Physical Condition

A 1-year-old boy was admitted to the hospital complaining of not wanting to eat or drink since the day he was admitted, experiencing fever, and coughing with phlegm since the day before. He drank once per night. He experienced nausea and vomiting once, had loose stools once, and urinated normally. The child was reported to have experienced allergic symptoms since he was 4 months old, and was confirmed to have a milk allergy after consuming milk distributed by the community health center when he was around 7 months old. Medical diagnosis results showed that the child suffered from suspected bronchopneumonia (BP) + atopic dermatitis. Atopy (cow's milk allergy) has been present since the child was 6 months old. Laboratory test results before intervention showed elevated RDW SD, New CW, and neutrophil levels. Meanwhile, PDW, MPW, P-LCR, and lymphocyte levels were low.

Anthropometric Data

Anthropometric measurements showed the child's weight at 5.6 kg, height at 65.5 cm, and Mid-Upper Arm Circumference (MUAC) at 11 cm. The patient was born with a weight of 2 kg and a height of 56 cm at 9 months of gestation.

Dietary Assessment

The patient eats three times a day and has an allergy to cow's milk. The patient received exclusive breast milk from the mother's pumped breast milk from 0-6 months. Breastfeeding continued until the child was 8 months old. Starting at 6 months of age, the child was given instant carrot porridge. The child can now eat porridge 3 times a day mixed with vegetable water, but is occasionally still given instant porridge. Porridge is given 3 times a day, with 3 tablespoons per meal. The patient is also regularly given soy milk. The patient's diet consists of: soy formula milk 3-4 times/day, instant porridge (carrot flavor) 3 times/day @ 3 tablespoons, fish (catfish) 3 times/day @ 3 tablespoons, tofu/tempeh 3 times/week @ 1 medium piece, and vegetables (yellow squash) 3 times/week.

At the time of assessment, the patient was on a tube feeding regimen, but starting at 12:00 PM, hydrolyzed formula milk (anti-allergic) was administered twice via NGT, each time 10 ml per administration. Based on the recall results, the patient's intake data was as follows: energy 68.2 kcal (11.2%), protein 0.68 g (5.9%), fat 0.9 g (4.4%), and carbohydrates 14.8 g (15.5%).

Nutritional diagnosis

Child malnutrition related to disease associated with the pathophysiological issues of Bronchopneumonia and the patient's history of low birth weight, characterized by Z-scores for weight-for-age, height-for-age, weight-for-length, and length-for-age below -3 SD (NC 4.1.5).

Intervention Plan

The patient is provided with a High-Energy High-Protein Diet in liquid form administered via an NGT (Nasogastric Tube) during the stabilization phase and orally during the transition phase. Dietary intake is gradually increased to 50-70% of total requirements in each phase. On the first day, 45% of total energy requirements are provided, 81% on the second day, and 80% on the third day. The detailed implementation plan for meeting energy and nutrient intake during the intervention is as follows.

Data Collection and Analysis

Data collection is conducted before and during the intervention. The data collected includes clinical physical data, biochemistry, intake, and anthropometry. Monitoring of nutrient intake is conducted daily through observation of food residues and a 24-hour recall. Nutritional status data collection was conducted through weight measurements and upper arm circumference measurements at the beginning and end of the intervention. Data analysis was performed descriptively using univariate analysis based on mean values and percentage of measurement results. Changes in nutrient intake were compared with nutrient requirements. Changes in nutritional status were assessed based on children's weight gain.

Table 1. Implementation Plan for Meeting Patients' Nutritional Intake During Intervention

Nutrients	Nutritional requirements		Implementation Plan		
	Stabilization phase	Transition phese	Day 1	Day 2	Day 3
Energy (kcal)	608	912	276 (45%)	493 (81%)	730 (80%)
Protein (g)	11.4	22.8	8 (70%)	17 (149%)	21 (92%)
Fat (g)	20.3	32	9 (44%)	18 (89%)	26 (81%)
Carbohydrates (g)	95	137	35 (37%)	57 (60%)	81 (85%)

RESULTS

Clinical Physical Data

Clinical physical examinations focused on nutrition were monitored daily from before the intervention until the final observation. Before the nutritional care process, the patient experienced shortness of breath, fever, irritability, and was very thin. Heart rate 156 beats/minute, respiratory rate (RR) 80 breaths/minute, body temperature 37.3°C, SPO2 93%. At the end of the intervention, the patient was no longer irritable, shortness of breath had decreased, and was no longer irritable. Similarly, the pulse rate decreased to 120 beats per minute, body temperature was normal (36.8°C), and SPO2 was 100%.

Biochemical Data

Based on laboratory test results on Feb 11, 2025, RDW SD, New CW, and neutrophil levels were elevated. Meanwhile, the PDW, MPW, P-LCR, and lymphocyte parameters showed low values. Laboratory tests were only conducted at the beginning of the intervention; no further tests were performed. There were no specific laboratory parameters related to allergies, such as total IgE and specific IgE. The levels of physical/clinical nutrition-focused assessments were monitored daily, starting before the intervention until the final observation. Before the nutrition care process, the patient experienced shortness of breath, fever, irritability, and was severely underweight. The heart rate was 156 beats per minute, respiratory rate (RR) was 80 breaths per minute, body temperature was 37.3°C, and SPO2 was 93%. At the end of the intervention, the patient was no longer irritable, the shortness of breath had decreased, and the irritability subsided. The heart rate decreased to 120 beats per minute, body temperature returned to normal (36.8°C), and SPO2 reached 100%.

Nutrient Intake Data

Table 2. Nutrient Intake of Patients During Intervention

Nutrients	Nutritional requirements		Time of intervention			
	Stabilization phase	**Transition phase**	**Day-1**	**Day 1**	**Day 2**	**Day 3**
Energy (kcal)	608	912	68	270	492	720
Protein (g)	11.4	22.8	0.7	8	16	25
Fat(g)	20.3	32	0.9	10.8	22	32
Carbohydrates (g)	95	137	14.8	38.9	65	94
Vitamin A (mcg)	400	400	18.6	225.1	450	675.4
Vitamin D3 (mcg)	15	15	0.3	3.6	7	10.7
Vitamin B1 (mg)	0.5	0.5	0.021	0.26	0.5	0.77
Vitamin B2 (mg)	0.5	0.5	0.043	0.52	0.1	1.55
Folic acid (mcg)	160	160	0.003	0.384	0.08	115.2
Vitamin C (mg)	40	40	0.02	24.2	48	72.7
Sodium (mg)	800	800	1071	860	647	580.3
Potassium (mg)	2600	2600	360	490	635	828
Iron (mg)	10	10	0.28	3.4	6.72	10.1
Zink (mg)	5	5	0.18	2.4	4.32	6.48

Table 2 shows an increase in patients' nutrient intake during the intervention, including energy, protein, fat, and carbohydrates. A significant increase in nutrient intake occurred on the third day of the intervention.

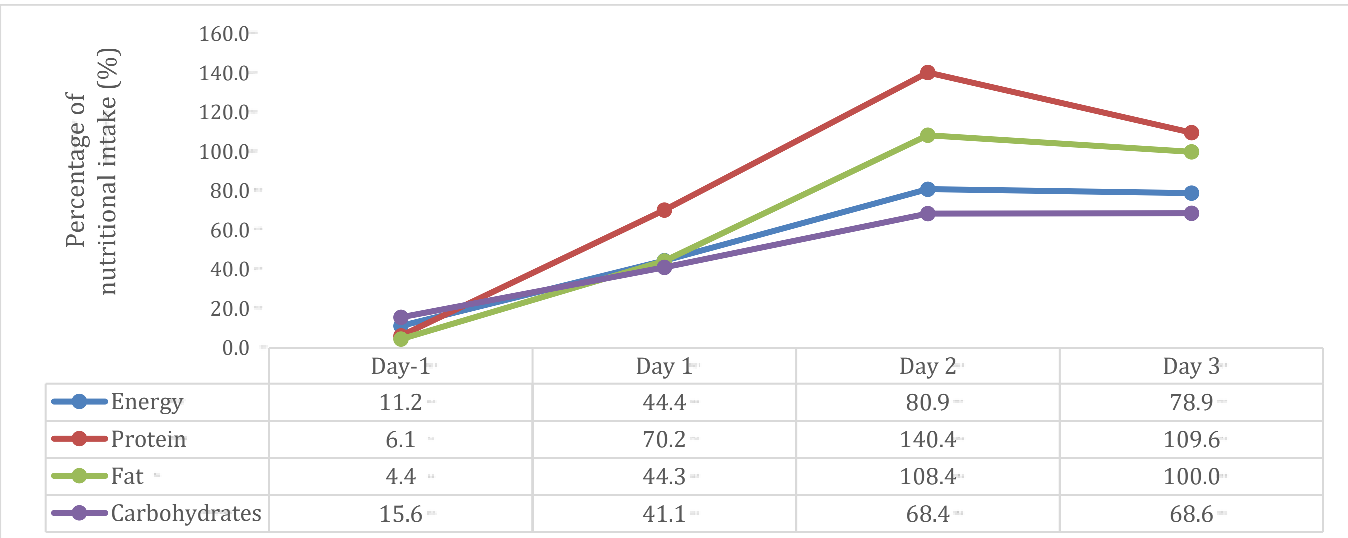
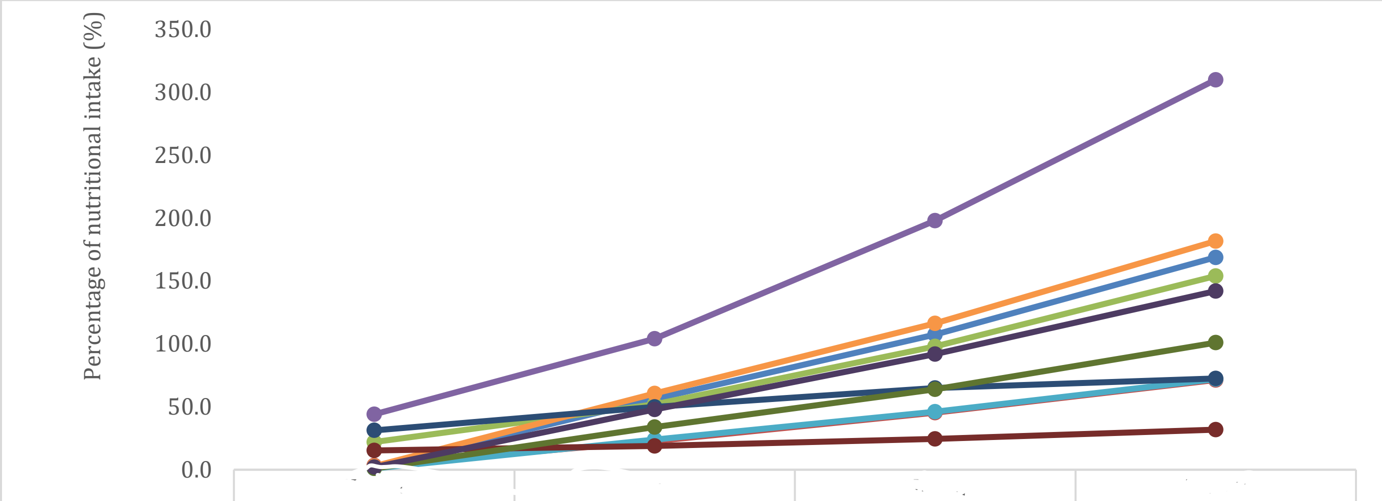


Figure 1. Percentage of Nutrient Intake from Total Patient Requirements

Figure 1 shows that the percentage of energy, protein, and fat nutrient intake can meet patient nutrient requirements during the intervention, both in the stabilization phase and on the first day of the transition phase. Meanwhile, the percentage of carbohydrate intake increased during the intervention but did not meet requirements.



Vitamin A	2.4	56.3	107.4	168.9
Vitamin D3	3.3	22.7	45.3	71.3
Vitamin B1	22.0	52.0	98.0	154.0
Vitamin B2	44.0	104.0	198.0	310.0
Folat acid	1.0	24.0	46.1	72.0
Vitamin C	2.8	60.5	116.3	181.8
Sodium	31.3	50.0	65.0	72.5
Potasium	15.3	18.8	24.4	31.8
Iron	1.0	34.0	64.0	101.0
Zink	2.0	48.0	92.0	142.0

Figure 2. Vitamin and Mineral Intake Levels of Patients

Figure 2 shows that there was an increase in the vitamin and mineral intake levels of patients during the intervention. The highest increase in nutrient intake occurred on the third day of the intervention, particularly for vitamin B2, vitamin A, zinc, and vitamin C.

Anthropometric Data

Anthropometric measurements were taken during the initial assessment, before the intervention, by measuring weight, height, and MUAC. The following are the results of the patients' anthropometric measurements before and after the intervention.

Table 3. Changes in Anthropometric Data During Intervention

Parameter	Before	After
Body length (cm)	65.6	65.6
Weight (kg)	5.6	5,8
MUAC (Mid Upper Arm Circumference) (cm)	11.0	11.0
WHZ (weigh for heigh z score)	-3.07 (malnutrition)	-3.07 (malnutrition)
WAZ (weight for age z score)	-4.72 (severe underweight)	-4.75 (severe underweight)
HAZ (Heugh for age score)	-4.59 (severe stunting)	-4.64 (severe stunting)
BAZ (BMI-for-Age Z-score):	-3.68 (malnutrition)	-3.68 (malnutrition)

Table 3 above shows that there was an increase in patient weight of 200 grams during the intervention. Meanwhile, other anthropometric parameters of children, namely height and MUAC, did not change during the intervention. Similarly, the nutritional status of patients did not change for all nutritional status indices, including height for age, weight for age, weight for height, and MUAC for age.

DISCUSSION

Anthropometric Data

A one-year-old patient with suspected bronchopneumonia and atopic dermatitis showed poor nutritional status based on weight-for-height, weight-for-age, height-for-age, and MUAC, exacerbated by a history of low birth weight. This condition reflects a high risk of growth and immune system disorders, as infants with LBW tend to experience developmental delays and have minimal nutrient reserves (8)(9)(10).The primary nutritional intervention was the cessation of all intake except formula milk and the administration of extensively hydrolyzed formula milk. This formula is used to prevent allergic reactions to cow's milk protein, improve intestinal mucosal integrity, and support nutrient absorption (11)(12). Anthropometric data showed an increase in weight from 5.6 kg to 5.8 kg over three days, which, although small in absolute terms, is clinically significant for patients with malnutrition, indicating an initial positive response to the intervention (13).

Body length and MUAC remained unchanged during the intervention, at 65.6 cm and 11.0 cm, respectively. This is understandable as linear changes and muscle mass require more time to become apparent, especially in children with acute malnutrition. The Z-scores for weight-for-age (-4.72 to -4.75) and length-for-age (-4.59 to -4.64) remained in the very low category, indicating that the intervention duration was still too short to show significant improvements in nutritional status (13).

The administration of hydrolyzed formula has been shown to reduce inflammatory responses, improve intestinal tolerance, and support immune homeostasis in children with cow's milk allergy and atopic dermatitis (14)(3). The selection of formula type is a critical step, as improper protein intake can exacerbate inflammation and impair nutrient absorption.

Persistently low MUAC (<11.5 cm) indicates acute malnutrition and a high risk of systemic complications. Therefore, continuous monitoring of daily intake and multidimensional assessment of nutritional status is necessary, such as using the Pediatric Subjective Global Assessment (SGA) (9)(13).

Nutrient Intake

The development of macronutrient intake during the intervention showed a significant increase, reflecting the success of the intervention based on the Standardized Nutrition Care Process (NCP). Before the intervention (Day -1), the patients' energy intake was very low, only 2.2% of their requirements (20 kcal out of 608 kcal), indicating a serious risk of metabolic disorders, particularly in children with poor nutritional status and a history of low birth weight (LBW), who have high energy requirements and limited reserves. Through the administration of extensively hydrolyzed formula milk, energy intake increased to 44.4% (270 kcal) on Day 1, 81.1% (493 kcal) on Day 2, and 79% (720 kcal) on Day 3. This increase in energy was accompanied by an increase in protein intake from 61.4% (7 g) to 70.2% (17 g) on Day 2, and reached 109.6% (25 g) on Day 3. Protein plays a crucial role in lung tissue repair and the synthesis of immunoglobulins needed to combat bronchopulmonary infections (15).

In children with atopic dermatitis caused by cow's milk allergy, extensive hydrolyzed formula helps avoid allergen exposure, reduce the risk of skin flare-ups, and support immune system recovery and skin integrity (16). The combination of increased energy and adequate protein also accelerates recovery from wasting, a common condition in malnourished children. Overall, a structured nutritional approach through NCP has proven effective in supporting infection resolution, reducing inflammation, and improving nutritional status in children with complex conditions. WHO and ESPGHAN recommendations also emphasize the importance of individualized nutritional intervention in children with severe infectious diseases and malnutrition (17)(15).

Additionally, the significant increase in fat and carbohydrate intake supports increased total energy and improves body energy reserves. Fat, which increased from 44.3% to 88.7% of requirements, not only serves as a dense energy source but also supports the absorption of fat-soluble vitamins and provides anti-inflammatory effects through essential fatty acids. Carbohydrates, increased from 36.8% to 59.1%, are the primary energy source for immune cells and body tissues and are essential for supporting metabolism during the healing process (18).

The development of micronutrient intake in pediatric patients with suspected bronchopneumonia and atopic dermatitis showed a significant increase over three days of intervention, particularly for vitamin A, D_3, iron (Fe), zinc (Zn), and calcium (Ca). This increase is important because micronutrients play a vital role in the healing process of respiratory infections, strengthening the immune system, and improving nutritional status.

Vitamin A intake increased from 2.4% to 168.9% of the Recommended Daily Allowance (RDA) by day 3. Vitamin A supports epithelial cell regeneration, macrophage and lymphocyte function, and strengthens the respiratory tract mucosal barrier. Its deficiency has been shown to worsen the prognosis of lower respiratory tract infections in children. Vitamin D_3 increased from 3.3% to 71.3%. This vitamin acts as an immunomodulator, suppressing pro-inflammatory cytokines, and increasing the production of antimicrobial peptides such as cathelicidin, which are important for combating lung infections. In atopic dermatitis, vitamin D also strengthens the skin barrier and suppresses inflammation. Iron (Fe) intake increased from 1.0% to 101%. Iron is essential for hemoglobin synthesis and immune enzymes, and prevents anemia, which can worsen hypoxia caused by broncho-pneumonia. Zinc, which was only 2.0% on the day before the intervention, increased to 142.0% on the third day. Zinc plays a crucial role in growth, wound healing, and antibacterial and antiviral activity. In respiratory tract infections, zinc supplementation has been shown to shorten the duration of illness and reduce the severity of symptoms (18)(19).

CONCLUSION

The patient's weight increased by 200 grams during the intervention, but the patient's nutritional status was still classified as severe malnutrition (poor nutrition, very thin, and very short) at the end of the intervention. The diet given to the patient was a poor nutrition diet (high energy, high protein) which was given gradually according to the patient's medical condition, in liquid form through an NGT tube. The patient's intake showed a significant increase during the intervention, including energy, protein, fat, carbohydrates, vitamins, and minerals.

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