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Implementation of Standardized Nutritional Care Processes for Children with Convulsive Epileptic Status + Slit Ventricle Syndrome Post VP Shunt ec Hydrocephalus + Comorbid Congenital Heart Disease

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ABSTRACT

Background: Status epilepticus is an early symptom that occurs in 75% of epilepsy patients. The incidence rate of SE in children varies between 10 and 73 cases per 100,000 children per year. **Objective:** To present the implementation of standardized nutritional care processes provided to pediatric patients with Convulsive Status Epilepticus + Slit Ventricle Syndrome Post VP Shunt + Hydrocephalus + Comorbid Congenital Heart Disease. **Method:** This study used an observational study design with a case study approach. The data used in this study included primary data obtained through interviews and secondary data from the patient's medical records. **Results:** Nutritional status assessment showed that the patient had good nutritional status; however, physical examination revealed inadequate contact, leading to limitations in food intake. The patient was given a stepwise epilepsy diet via a combination of enteral and parenteral routes. **Conclusion:** During the six-day monitoring period, nutritional intake reached optimal target requirements: energy intake 100%, protein 99%, fat 91%, and carbohydrates 103%. Laboratory test results showed a hemoglobin level of 11.7 g/dL (low).

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CASE REPORTS

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Key Messages:

- Status epilepticus is a neurological emergency characterized by seizures lasting more than 5 minutes or repeated seizures without full recovery of consciousness between episodes, resulting in limited food intake in patients.
- Convulsive status epilepticus places a significant burden on the body's metabolism and increases basal energy requirements due to continuous muscle contractions and systemic stress. If optimal nutritional therapy is not provided, this can lead to malnutrition in the patient.
- Case studies on the implementation of standardized nutritional care processes are crucial for evaluating the effectiveness of nutritional interventions in managing patients' nutritional status and aiding neurological function recovery.

INTRODUCTION

Status epilepticus (SE) is a neurological emergency that requires immediate treatment and can significantly affect the body's metabolism (1). In developing countries, the incidence of epilepsy is 61-124/100,000 children per year. The prevalence of epilepsy cases in Indonesia is 8.2 per 1,000 people, with an incidence rate of 50 per 100,000 people (2). The incidence of SE in children varies between 10 and 73 cases per 100,000 children per year, with the highest incidence occurring in children under 2 years of age, at approximately 135–156 cases per 100,000 children. The morbidity and mortality rates due to SE remain relatively high (3).

Malnutrition and epilepsy are two factors that influence each other. A study by Galuh Hardaningsih and Tjipta Bahtera (2016) found that 40% of children with malnutrition also experience SE. Seizure activity increases basal metabolism and muscle catabolism. Long-term use of antiepileptic therapy (such as valproate or phenytoin) carries a risk of causing certain micronutrient deficiencies, such as vitamin D and calcium, as well as carbohydrate and lipid metabolism disorders. In some patients with refractory epilepsy, a high-fat, very low-carbohydrate ketogenic diet is used as an adjunctive therapy, although it must be closely monitored by a clinical nutritionist and neurologist to avoid metabolic side effects. (4).

Slit Ventricle Syndrome (SVS) is one of the long-term complications that can occur in patients with a history of ventriculoperitoneal (VP) shunt placement due to hydrocephalus. SVS is characterized by extremely small cerebral ventricles (slit-like in shape), intermittent increased intracranial pressure, and clinical symptoms such as recurrent headaches, nausea, vomiting, and occasionally impaired consciousness. This condition poses a challenge in medical management as it can mimic shunt failure, but brain imaging results often show persistently small ventricles, making it difficult to distinguish without a comprehensive evaluation (5).

Patients with SVS, especially children, are prone to nutritional disorders due to a combination of increased metabolic needs, decreased intake due to neurological symptoms, and impaired nutrient absorption caused by long-term therapy, including the use of antiepileptic drugs. This imbalance can affect growth, immunity, and overall neurological recovery. (6).

Patients with hydrocephalus and VP shunts have a higher risk of seizures than the normal population due to changes in intracranial pressure and irritation of brain tissue (7). This condition is exacerbated in the presence of congenital heart disease due to impaired cerebral perfusion, which lowers the seizure threshold. Massive seizure activity during status epilepticus increases oxygen demand and cardiac workload, which in patients with aortic valve disease can lead to cardiac decompensation. (8).

Considering the complexity of these conditions, the implementation of standardized nutritional care processes, including assessment, diagnosis, intervention, monitoring, and nutritional evaluation, plays an important role in the comprehensive management of patients. Routine nutritional status evaluations are needed to identify the risk of malnutrition, optimize growth and development, and support the recovery of neurological and cardiovascular functions. Therefore, this case study is important to provide an overview of the role of standardized nutritional care processes in the management of pediatric patients with a diagnosis of Convulsive Status Epilepticus + Slit Ventricle Syndrome Post VP Shunt EC Hydrocephalus + Comorbid Congenital Heart Disease in the Violet Room of Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar.

CASE DESCRIPTION

Nutritional assessment: An. I.P.A.P.D, a 4-year-old boy, was admitted to the Violet Room of. The patient was admitted to the hospital on April 8, 2025, and was referred from Tabanan Regional General Hospital with the main complaint of seizures characterized by jerking of the hands and feet, and upward rolling of the eyes. After the seizure ceased, the patient experienced a decrease in consciousness, became drowsy, and could not be awakened by verbal or painful stimuli. The patient had a history of seizures and had been hospitalized for the last seizure in September 2024. The patient regularly took anti-seizure medication. Previous medical history included Post VP Shunt Keen (D) in 2020 at Prima Medika Hospital for hydrocephalus, and a history of congenital heart disease since 2020. On April 8, 2025, an aff VP shunt procedure was performed, and the medical diagnosis established was Status Epilepticus Type Convulsive + Slit Ventricle Syndrome Post VP Shunt due to Hydrocephalus + Comorbid Congenital Heart Disease.

Nutritional screening using the StrongKids instrument yielded a score of 3, indicating that the patient is at moderate risk of malnutrition. Anthropometric measurements yielded an upper arm circumference (UAC) of 18 cm, an estimated weight of 17.8 kg, and a height of 107 cm, with an ideal weight of 17.5 kg. Nutritional status assessment was conducted using the MUAC percentile anthropometric index, with a calculated result of 105.3%, indicating good nutrition compared to the normal category of 85% to 110%. Weight-for-height (+0.10 SD) is classified as good nutrition compared to the normal range of -2 SD to +1 SD, and height-for-age (-0.52 SD) is classified as normal compared to the normal range of -2 SD to +3 SD..

Initial laboratory test results showed a hemoglobin level of 11.5 g/dL (low), with normal values ranging from 12 to 16 g/dL, WBC 11.05 × 10^3/μL (normal), with normal values ranging from 6.0 to 14.0 × 10^3/μL, and PLT 240 × 10^3/μL (normal), with normal values ranging from 110 to 440 × 10^3/μL. Based on clinical examination, blood pressure at the start of observation on April 11, 2025, was 105/61 mmHg (normal) compared to the reference standard <120/80 mmHg, body temperature was 36.70°C (normal) compared to the reference standard range of 36.50°C to 37.50°C, pulse rate was 65 beats per minute (normal) compared to the reference standard range of 60 to 100 beats per minute, respiratory rate was 20 breaths per minute (normal) compared to the reference standard ranging from 60 to 100 breaths per minute, and oxygen saturation (SpO2) was 99% on room air (normal) with the reference standard ranging from 95 to 100%. The physical examination revealed a generally weak condition and inadequate contact with a somnolent level of consciousness.

The patient's dietary history prior to admission to the hospital consisted of three main meals per day and two snacks per day, with white rice as the staple food, animal-based side dishes such as eggs, chicken, and seafood, bananas, and regular consumption of UHT milk and formula milk, but the patient did not like to consume vegetables. Nutritional support in the hospital is administered via a combination of enteral and parenteral routes. Currently, an enteral nutrition access (NGT) is in place, and there is no residual. The results of the initial nutritional intake recall at the hospital showed an energy intake of 710.4 kcal with a total energy requirement of 1,575 kcal, or only 45.1% of the requirement (insufficient). Protein intake was 14.4 g with a total requirement of 43.75 g, or only 32.9% of the requirement (insufficient). Fat intake was 14.4 g with a total requirement of 47.5 g, or only 30.3% of the requirement (insufficient). Carbohydrate intake was 129.6 g with a total requirement of 243.13 g, or only 53.3% of the requirement (insufficient).

Nutritional diagnosis: NI.2.3. Inadequate enteral infusion related to gradual nutrition administration at the onset of care, characterized by nutritional intake recall results of only 45.1% of energy requirements (inadequate), 32.9% of protein requirements (inadequate), 30.3% of fat requirements (inadequate), and 53.3% of carbohydrate requirements (inadequate). NC.1.1. Difficulty swallowing related to inadequate contact (somnolent consciousness) characterized by nutritional administration via enteral access (NGT) and parenteral.

DISCUSSION

Nutritional Intervention: The goal of the diet given to patients is to optimize nutritional intake to reach >80% of requirements within 6 days and to provide easily digestible food according to clinical conditions through enteral and parenteral feeding routes. Energy requirements are calculated using RDA standards based on age and height, which is 90 kcal multiplied by ideal body weight, resulting in 1,575 kcal/day. Protein is provided at 2.5 g multiplied by ideal body weight, resulting in 43.75 g/day. Fat is set at 30% of total energy requirements, amounting to 47.5 g/day. Carbohydrates are provided as the remainder of total energy requirements minus protein and fat requirements, resulting in 243.13 g/day. Vitamins and minerals are provided in sufficient amounts according to the 2019 Recommended Dietary Allowances for a 4-year-old child. Fluids are provided in sufficient amounts according to the Holiday Segar method, which is 1,390 ml/day.

The nutritional therapy provided to patients is a high-fat epilepsy diet. Nutrition is administered gradually over a period of 6 days until the target requirement is reached. The form of food provided is liquid, administered enterally via an NGT tube at a frequency of 8 times daily or every 3 hours. Additionally, nutritional administration is combined through parenteral access. The selection of the standard formula provided to the patient is tailored to the principles of the diet and the patient's age.

Monitoring and evaluation: Interventions and observations were conducted over a period of 6 days, from April 11 to 16, 2025. Anthropometric measurements were taken by directly measuring the patients. The anthropometric indicator used in this case study was upper arm circumference (UAC) due to inadequate patient contact, making weight measurement impossible. The following are the results of the patients' anthropometric observations (Table 1):

Table 1. Anthropometric Assessment Results

Intervention Time	LiLA	%LiLA	Nutritional Status Category
Day I	18 cm	105,3%	Good Nutrition
Day II	18 cm	105,3%	Good Nutrition
Day III	18 cm	105,3%	Good Nutrition
Day IV	18 cm	105,3%	Good Nutrition
Day V	18 cm	105,3%	Good Nutrition
Day VI	18 cm	105,3%	Good Nutrition

Anthropometric assessment in children aged 4 years and 11 months uses the BB/TB anthropometric index and LiLA percentile. The weight-for-height (WHZ) anthropometric index is a nutritional status indicator used to assess the relative comparison of a child's weight aged 0-60 months to their height growth. This index is not influenced by age and provides the proportion of a child's weight to their height (9). In this case, nutritional status assessment can also use the LiLA percentile. Upper arm circumference (LiLA) can serve as an alternative measurement or screening tool for nutritional status when calculating BMI from weight and height measurements is difficult. Table 1 shows patients with a LiLA of 18 cm before intervention and a LiLA percentage of 105.3%, indicating that the patients were in good nutritional status. At the end of the intervention, there was no change in the patient's LiLA, which remained at 18 cm, with the %LiLA remaining at 105.3%, and the patient's nutritional status still falling within the good nutritional category. This occurred because changes in LiLA require a long time, so LiLA can indicate changes in long-term nutritional status. (10). Biochemical monitoring and evaluation: Biochemical assessment was performed by reviewing the patient's laboratory test results obtained from medical records. During the patient's treatment period, initial laboratory tests were conducted on April 8, 2025, and one follow-up test was conducted on April 15, 2025. The following are the patient's biochemical observation results (Table 2)

Table 2. Laboratory examination results

Laboratory Data	Test Results		Normal Values	Units	Categories
	8 April 2025	16 April 2025			
Hemoglobin	11,5	11,7	12-16	g/dL	Low
Trombosit	240	244	110-440	10^3µL	Normal
WBC	11,05	6,85	6,0- 14,0	10^3µL	Normal

Hemoglobin levels remain low (11.7 g/dL), indicating that the patient has mild anemia. Anemia is caused by multiple factors, one of which is a lack of iron-rich nutrients (11). The incidence of anemia in children in Indonesia remains quite high. The prevalence of anemia in children over 5 years of age in Indonesia is 38.5% (12). This aligns with the research by Muhamad Helmi H and Alifiani Hikmah Putranti (2014), which showed that seizures occur more frequently in anemic children (13). This finding is also supported by Abdul Khanis's (2010) study, which states that iron deficiency is a significant risk factor for seizures. This condition arises due to the role of iron in the central nervous system, leading to neurological dysfunction caused by iron deficiency. The production of dopamine, GABA, and serotonin is influenced by iron, which functions as a cofactor for brain nerve cells. GABA activity increases, while some neurotransmitters, including monoamines and aldehyde oxidase, decrease. The DNA replication process and myelogenesis in oligodendrocytes are also disrupted. This condition can make seizures more likely to occur (14,15).

Monitoring and clinical physical evaluation of nutritional status: The patient's clinical physical data is obtained from the patient's medical records. Clinical physical examinations are conducted from the initial observation until the last day of monitoring. The following are the results of the patient's clinical physical examination (Table 3):

Table 3. Results of Clinical Physical Assessment Focusing on Nutrition

Parameter	Result						Normal Values	Units
	Day I	Day II	Day III	Day IV	Day V	Day VI		
Blood Pressure	105/61	102/67	101/63	101/62	106/65	105/68	<120/80	mmHg
Temperature	36,7	36,7	36,8	36,8	36,7	36,4	36,5-37,5	°C
Pulse	65	77	86	86	75	78	60-100	times/minute
Respirtion	22	22	23	22	22	23	20-30	times/minute
Saturation	99	99	98	99	99	99	95-100	%
Consciousness	Somnolen	Somnolen	Somnolen	Somnolen	Somnolen	Somnolen	Composmentis	-

Clinical physical assessment focusing on nutrition is conducted by observing the patient's general condition, level of consciousness, and vital signs such as blood pressure, body temperature, pulse, respiratory rate, and oxygen saturation. In general, there have been no significant changes in the patient's clinical physical condition, particularly in terms of consciousness, which has not improved, and blood pressure, which remains low. Research by Suryani Gunadharma et al. (2022) indicates that decreased consciousness is caused by metabolic disorders. Metabolic disorders that can lead to decreased consciousness include electrolyte imbalance, hypoglycemia, hypoxia, non-ketotic hyperglycemia, and hyperuricemia. The brain relies heavily on stable internal conditions to function properly. Changes in energy metabolism, electrolyte levels, osmolarity, acid-base status, and endogenous toxin production can affect normal brain function and lead to seizures. The brain requires a significant amount of energy and is highly dependent on glucose for energy, with very limited energy reserves. This depends on aerobic metabolism, so a constant supply of oxygen is also necessary. The high energy demand is aimed at maintaining the resting membrane potential, which constantly expels sodium from the cell. Therefore, any metabolic disturbances that disrupt energy metabolism can lead to seizures (16). The patient's low blood pressure may be associated with a comorbidity of congenital heart disease with a diagnosis of moderate neo-aortic regurgitation, commonly abbreviated as AR. AR, especially when severe, can cause a decrease in diastolic blood pressure because blood returns to the left ventricle during diastole, thereby reducing pressure in the aorta (17).

Table 4. Assessment of Nutritional Intake (Energy and Macro Nutrients)

Intervention Time	Energy and Macronutrients	RDA	Actual Intake	Percentage of RDA	Category
Day I	Energy (kkal)	1.575	710,4	45%	Low
	Protein (g)	43,75	14,4	33%	Low
	Fat (g)	47,5	14,4	30%	Low
	Carbohydrate (g)	243,13	129,6	53%	Low
Day II	Energy (kkal)	1.575	1070,4	68%	Low
	Protein (g)	43,75	26,4	60%	Low
	Fat (g)	47,5	26,4	56%	Low
	Carbohydrate (g)	243,13	179,6	74%	Low
Day III	Energy (kkal)	1.575	1358,4	86%	Good
	Protein (g)	43,75	36	82%	Good
	Fat (g)	47,5	36	76%	Low
	Carbohydrate (g)	243,13	219,6	90%	Good
Day IV	Energy (kkal)	1.575	1358,4	86%	Good
	Protein (g)	43,75	36	82%	Good
	Fat (g)	47,5	36	76%	Low
	Carbohydrate (g)	243,13	219,6	90%	Good
Day V	Energy (kkal)	1.575	1.575	100%	Good
	Protein (g)	43,75	43,2	99%	Good
	Fat (g)	47,5	43,3	91%	Good
	Carbohydrate (g)	243,13	249,6	103%	Good
Day VI	Energy (kkal)	1.575	1.575	100%	Good

Protein (g)	43,75	43,2	99%	Good
Fat (g)	47,5	43,3	91%	Good
Carbohydrate (g)	243,13	249,6	103%	Good

The following is an image of the results of nutritional intake monitoring:

Nutritional intake monitoring and evaluation: Nutritional supplementation was administered gradually, starting from the first day of intervention on April 11, 2025, until the target nutritional requirements were achieved by the sixth day of intervention on April 16, 2025. On the first day of the intervention (April 11, 2025), enteral nutrition was administered 8 times at 60 ml each. On the second day, it was increased to 8 times at 110 ml each. On the third and fourth days, it was further increased to 8 times at 150 ml each. On days 5 to 6, it was increased to 8 times 180 ml. Additionally, during the 6-day intervention period, the patient was also administered parenteral nutrition with D5 ¼ NS at 58 ml per hour. The complete assessment of the patient's nutritional intake is as follows (Table 4):

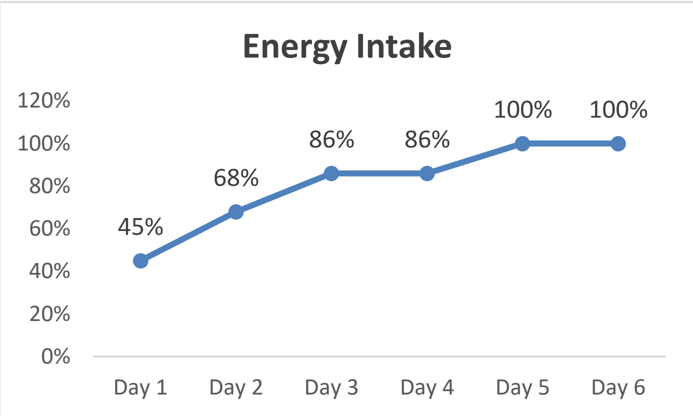

Figure 1. Results of Energy Intake Monitoring

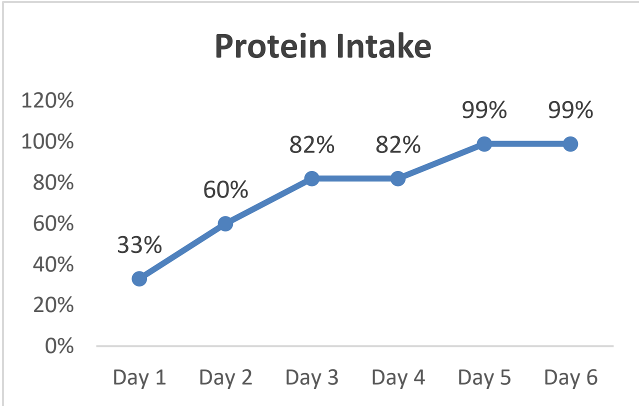

Figure 2. Results of Protein Intake Monitoring

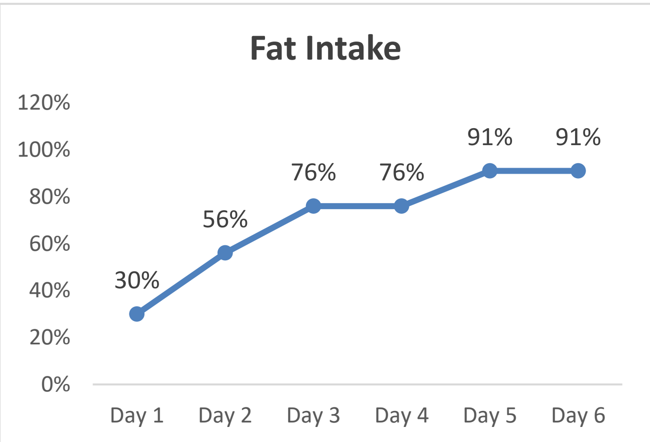

Figure 3. Results of Fat Intake Monitoring

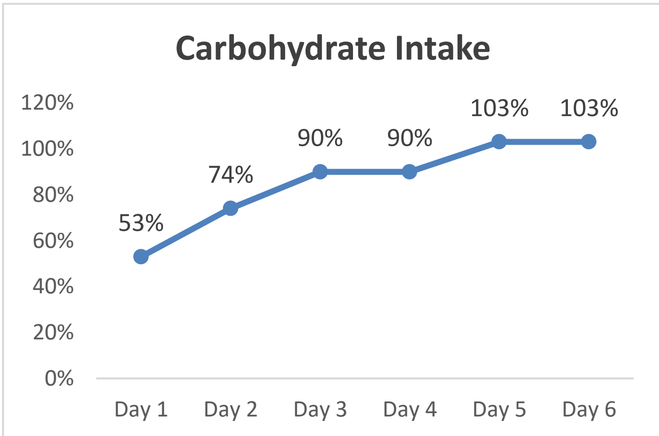

Figure 4. Results of Carbohydrate Intake Monitoring

Energy and macronutrient intake increased during the intervention. Nutrition was administered gradually. Food was given to patients gradually to prevent refeeding syndrome. Refeeding syndrome (RFS) is a metabolic disorder caused by sudden and rapid nutritional intake in severely malnourished patients. Symptoms typically begin 24–48 hours after consuming a large amount of energy and can manifest in various ways, such as shortness of breath, tachycardia, increased venous blood pressure, hepatomegaly, diarrhea, seizures, and even death (18). Nutrition is initiated at 45% of the recommended dietary allowance (RDA) and gradually increased to 100% of the RDA over a 6-day intervention period. During the intervention, the patient tolerated the formula well, with all formula administered via NGT without complaints of vomiting or residual formula in the NGT.

Energy is a nutrient that plays a role in providing energy for the body to support various physiological activities, including metabolism, growth, and maintenance of organ function. The main sources of energy nutrients come from macronutrients, namely carbohydrates, fats, and proteins. The metabolism of nutrients in food produces the energy required by the body to perform activities, for the functioning of bodily organs such as blood circulation and respiration, to restore stamina, and to maintain the patient's nutritional status (19). According to calculations of nutrient requirements based on the Recommended Dietary Allowance (RDA), the energy required by the patient is 1,575 kcal. Based on the patient's recall during the intervention, the patient's energy intake from day 1 of the intervention up to day 6 of the intervention has reached 100% of the total requirement (RDA).

Protein is a complex and essential organic macromolecule composed of long chains of amino acids linked together by peptide bonds. These molecules play a crucial role in nearly all biological processes within the bodies of living organisms, including humans. According to nutritional requirement calculations, the patient's required protein intake is 43.75 g. The patient's protein intake recall from the start of the intervention on day 1 to day 6 has already reached 99% of the total requirement. Children with epilepsy require adequate protein for healthy growth and development, just like children without epilepsy. Protein requirements vary depending on age, body weight, and activity level. (20).

Fats are a group of hydrophobic or water-insoluble organic compounds that are essential for life. Chemically, fats are mostly composed of carbon, hydrogen, and oxygen atoms, but with a much lower proportion of oxygen compared to carbohydrates. Fats play a crucial and central role in the ketogenic diet for children with epilepsy by inducing and maintaining ketosis, which can reduce seizure frequency (20). According to nutritional requirement calculations, the patient requires 47.5 g of fat. The results of fat intake recall from day 1 to day 6 of the intervention already reached 91% of the total requirement.

Carbohydrates are a group of organic compounds that serve as the primary energy source for the body. According to nutritional requirement calculations, the patient's required carbohydrate intake is 243.13 g. The patient's carbohydrate intake recall results from the first to the sixth day of intervention have already reached 103% of the total requirement. Epilepsy patients require a lower carbohydrate intake, forcing the body to shift from using glucose (derived from carbohydrates) to using fat for energy. This metabolic shift leads to the production of ketone bodies. Ketones can cross the blood-brain barrier and are believed to have anticonvulsant effects. By inducing ketosis, a low-carbohydrate diet can help reduce the frequency and severity of seizures (20).

The results of this case study underscore the critical importance of implementing a structured and individualized nutrition care process (NCP) in pediatric patients with complex comorbidities. The successful application of NCP in a child with convulsive epileptic status, slit ventricle syndrome post-VP shunt, hydrocephalus, and congenital heart disease demonstrates that tailored nutritional interventions can lead to measurable improvements in intake and clinical stability, even in high-risk cases. Although MUAC remained stable and anemia persisted, the overall nutritional intake improved, indicating that targeted nutrition support can positively influence recovery trajectories.

This study reinforces the feasibility of integrating nutrition care into multidisciplinary treatment plans in pediatric intensive care settings. It highlights the need for clinical dietitians to be actively involved in managing children with neurological and cardiac conditions, ensuring that nutrition is not overlooked amid complex medical interventions. Moreover, the findings advocate for the inclusion of standardized nutrition protocols in hospital guidelines, particularly for children with chronic and overlapping diagnoses.

In practice, this case encourages healthcare providers to adopt a proactive and evidence-based approach to nutrition care, emphasizing continuous monitoring, individualized planning, and collaboration across specialties. It also calls for further research involving larger samples to validate and expand the applicability of NCP in similar clinical contexts.

CONCLUSION

Based on the results of this case study, the implementation of a standardized nutritional care process provides a systematic framework for providing effective nutritional care to pediatric patients at risk of malnutrition. Nutritional assessment results are used as the main basis for establishing a nutritional diagnosis, and based on the nutritional diagnosis, appropriate nutritional interventions can be planned to address nutritional problems. Nutritional interventions are carried out in stages according to the patient's condition and tolerance. The results of the interventions are then monitored and evaluated for effectiveness. In this case, nutritional intake has been achieved at 100% for energy, 99% for protein, 91% for fat, and 103% for carbohydrates; however, the hemoglobin level remains in the low category (11.7 g/dL).

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Conflicts of Interes: The authors declare no conflict of interest

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