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Nutrition Management for Acute Stroke with Right-Sided Hemiparesis: A Case Study

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ABSTRACT

This case study aims to report on the nutrition management of acute stroke with right-sided hemiparesis using an approach of early enteral feeding intervention to prevent malnutrition. Mr. R, a 77-year-old Malay man was admitted to the hospital due to an acute stroke with right hemiparesis with underlying disease of Atrial Fibrillation (AF), hypertension, type 2 Diabetes Mellitus (DM), Chronic Kidney Disease (CKD) stage 3b, and significant Peripheral Artery Disease (PAD). His BMI was 24kg/m^2 with a weight of 67kg and height of 1.67m, and he was presented with abnormal blood results. All his vital signs were normal, and he appeared lethargic. The patient was on bolus Nasogastric (NG) feeding via Ryle's tube with polymeric formula. Inadequate enteral nutrition infusion related to infusion volume not yet reached, as evidenced by a 47% energy and 60% protein adequacy feeding history. The polymeric formula was changed to a diabetic-specific formula for better blood sugar control, and feeding was given according to the patient's needs. Mr. R required at least 70% of 1,675 kcal of energy and 53.6 g of protein (0.8 g/kg body weight) to prevent malnutrition. The patient was still on Ryle's tube feeding and already achieved the targeted energy and protein requirements. Before being discharged, the patient was allowed orally, and a sample menu was given as guidance to avoid weight loss and muscle wasting during long-term recovery. This case highlights the importance of early enteral feeding support in stroke recovery and the need to prioritize meeting nutritional needs in stroke patient care. Mr. R showed improvement in health and nutrition and concluded that early and focused enteral nutrition support can lead to improved results and better quality of life for stroke survivors.

Keywords: dysphagia, enteral nutrition, malnutrition, post-stroke nutrition, stroke

INTRODUCTION

Dysphagia is the patient's medical condition with swallowing difficulties (WHO 2019). Most patients with stroke commonly have a dysphagia problem, which usually leads to malnutrition if not appropriately addressed (Hien *et al.* 2022). In stroke patients, it may increase the risk of pulmonary complications and mortality (Grossmann *et al.* 2021). One of the ways to prevent malnutrition for patients with stroke and dysphagia is through early initiation of enteral nutrition (EN) (Sabbouh & Torbey 2018). Patients treated with EN within 72 hours of admission in the stroke unit have better nutrition test results at 21 days than those receiving family-managed food. Early EN improves neurological performance, aiding the recovery of neurological functions (Zheng *et al.* 2015). Early EN aims to meet the nutritional needs of patients who cannot eat or tolerate regular oral intake due to various medical conditions such as stroke, surgery, or trauma. By initiating EN early, healthcare providers aim to prevent malnutrition, preserve lean body mass, improve immune function, reduce the risk of infections, and promote better patient outcomes (Koontalay *et al.* 2021). Challenges in early EN are encountered in clinical settings, particularly among critically ill patients. One primary challenge lies in gastrointestinal tolerance, as some individuals may experience difficulties such as abdominal distension, diarrhea, or vomiting when initiating EN early, necessitating careful monitoring and adjustments. Furthermore, there

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is a risk of aspiration, particularly in patients with compromised swallowing abilities, which requires a delicate balance to ensure safe EN delivery (Wischmeyer 2021).

Pathophysiology

A stroke, also known as a Cerebrovascular Accident (CVA), is a medical condition that occurs when blood flow to the brain is suddenly disrupted, leading to brain cell damage or death. This disruption can happen due to a blockage of a blood vessel, classified as ischemic stroke, or the rupture of a blood vessel, causing bleeding into the brain and is classified as hemorrhagic stroke (Kuriakose & Xiao 2020). When a stroke occurs, the affected part of the brain is deprived of oxygen and nutrients, resulting in various neurological deficits depending on the location and extent of the brain injury. These deficits may include weakness or paralysis on one side of the body (hemiparesis), speech difficulties (aphasia), vision problems, coordination issues, and other cognitive or sensory impairments (Musuka *et al.* 2015). Risk factors for stroke include non-modifiable factors such as age, race, and ethnicity, and modifiable factors such as a smoking habit, lack of physical activity, and medical conditions such as hypertension, Atrial Fibrillation (AF), diabetes, and cardiovascular disease. Stroke treatment is highly individualized, and the specific approach may vary based on the patient's age, overall health, time since symptom onset, and other factors. Early recognition of stroke symptoms and seeking immediate medical attention can improve the chances of successful treatment and recovery. Stroke can have significant nutrition implications in terms of prevention and post-stroke care. Primarily, dietary choices are a key factor in stroke prevention. A diet high in saturated fats, trans fats, and sodium, and low in fruits, vegetables, and whole grains can elevate stroke risk, emphasizing the importance of promoting a diet rich in healthier options. The Dietary Approaches to Stop Hypertension (DASH) diet was recommended by promoting the consumption of fruits, vegetables, and low-fat dairy products while advocating for reduced intake of saturated fat, overall fat, and cholesterol. It encouraged the inclusion of whole grains, poultry, fish, and nuts while discouraging the consumption of red meat, sweets, and sugar-containing beverages (Spence 2018). Alcohol consumption, substance abuse, and smoking have varying impacts on stroke risk, depending on the type of stroke. For ischemic stroke, research suggests a J-shaped relationship with alcohol consumption. Light to moderate drinking, defined as up to 2 drinks daily for men and up to one drink daily for women, appears to provide some protection against stroke. In contrast, heavy alcohol consumption is linked to a heightened risk of ischemic stroke (Boehme *et al.* 2017). Nutritional deficiencies are a common concern for individuals who have experienced a stroke, often resulting in malnutrition, which is linked to reduced daily functioning and quality of life (Lee & Chiu 2021). Various stroke-related factors, such as dysphagia, limited upper limb mobility, visuospatial difficulties, increased catabolism, gastrointestinal issues, and depression, can contribute to malnutrition (Shiraishi *et al.* 2018). There is a close association between sarcopenia and inadequate dietary intake. Malnutrition or a lack of essential calories and nutrients can lead to muscle decline and potentially worsen post-stroke sarcopenia (Scherbakov *et al.* 2013). Therefore, assessing the nutritional status early and, if necessary, implementing nutritional interventions to enhance outcomes for individuals with sarcopenia following a stroke is crucial.

Patient profile

Mr. R, a 77-year-old Malay Man, government pensioner, used to work as a plan designer. He is married and blessed with six children. Before admission, the patient could do basic Activities of Daily Living (ADL) independently. His primary carer is his sixth daughter and grandson. He has underlying disease of Atrial Fibrillation (AF), hypertension, type 2 Diabetes Mellitus (DM), Chronic Kidney Disease (CKD) stage 3b, and significant Peripheral Artery Disease (PAD). The patient was admitted to the medical ward via the emergency unit due to sudden numbness in the face and arm and slurred speech. He was diagnosed with acute stroke with right-sided hemiparesis due to thromboembolic, uncontrolled DM, and Acute Kidney Injury (AKI) on CKD. He currently receives medications for treating his medical condition, which are T. Atorvastatin 40 mg ON, S/C Actrapid 6u PRN, T. Glyprin 100 mg OD, T. Omeprazole 20 mg OD, T. Bisoprolol 10 mg OD, and T. Metformin HCL XR 2 g OD. The patient was referred to a dietitian on his third day of admission for nutrition optimization of enteral feeding.

NUTRITION ASSESSMENT

Anthropometry data

The patient's weight is 67 kg with a height of 1.67m, and the calculated Body Mass Index (BMI) is 24 kg/m^2, categorized as normal BMI for older adults (Winter *et al.* 2014). According to the patient's daughter, the patient does not show any recent signs of weight loss, as the patient was well before admission to the ward.

Biomedical data, medical tests, and procedures

Based on Table 1, his biochemical profile shows an elevated level of urea (13.1 mmol/L) and creatinine (123 µmol/L) due to his condition of AKI on CKD and high level of blood sugar (13.8 mmol/L) as the patient diagnosed with uncontrolled DM and a low level of red blood cell (3.9x10^12/L) and hemoglobin (11.8 g/dL) in blood. Besides, the patient has a normal reading of lipid profile and a slightly high level of c-reactive protein (5.6 mg/dL).

Nutrition-focused physical findings

All his vital signs are normal, and his Glasgow Coma Scale (GCS) score of 11/15 describes the patient as alert and conscious with incomprehensible sounds.

Food nutrition-related history

A Ryle's tube was inserted for nasogastric feeding initiation due to dysphagia and the patient received EN through bolus nasogastric tube feeding. The feeding was initiated by the ward nurse, and he currently receives a standard polymeric formula with a dilution of 3 scoops in 150 mL water, given every four hours and six times feeding daily providing 787 kcal, 32.4 g protein, 102.6 g carbohydrate, and 25.2 g fat. Based on Table 2, his energy intake is inadequate, and he only received 47% of his energy requirements.

Table 1. Mr. R's nutrition assessment data during the first dietitian visit on day 3 of admission

Nutrition assessment	Criteria	Normal range	Result	Interpretation
Anthropometry	BMI	18.5–24.9 kg/m^2	24 kg/m^2	Normal
Biochemical data, medical tests, and procedures	Urea	2.78–8.07 mmol/L	13.1	Above normal range
	Sodium	135–145 mmol/L	137	Normal
	Creatinine	44–80 µmol/L	123	Above normal range
	eGFR	>60 mg/mmol	48.0	Below normal range
	Red blood cell	4.5–5.5 x 10^12/L	3.9	Below normal range
	Hemoglobin	12.0–15.0 g/dL	11.8	Below normal range
	Fasting blood sugar	4.0–6.0 mmol/L	8.3	Above normal range
	Random blood sugar	4.0–7.8 mmol/L	13.8	Above normal range
	Total cholesterol	<5.2 mmol/L	4.1	Normal
	Triglyceride	<1.7 mmol/L	1.3	Normal
	LDL cholesterol	<3.0 mmol/L	2.2	Normal
	HDL cholesterol	>=1.3 mmol/L	1.3	Normal
	C-Reactive protein	<5 mg/dL	5.6	Above normal range
Nutrition-focused physical findings	Blood pressure	<140/90 mmHg	119/79 mmHg	Normal
	Pulse rate	60–100 bpm	79 bpm	Normal
	Temperature	<37.5^{o}C	36.3^{o}C	Normal
	GCS	E4V6M5	E4V2M5	Alert and conscious with incomprehensible sound

BMI: Body Mass Index; eGFR: Estimated Glomerular Filtration Rate; GCS: Glasgow Coma Scale
HDL: High-Density Lipoprotein; LDL: Low-Density Lipoprotein

All macronutrients are also inadequate, achieving 60% of protein requirements, 47% of carbohydrate requirements, and 39% of fat requirements.

NUTRITION DIAGNOSIS

Inadequate enteral nutrition infusion related to infusion volume not yet reached, as evidenced by feeding history, which only received 47% of energy and 60% of protein requirements, 0.5 g/kg body weight.

NUTRITION INTERVENTION

The short-term goal for Mr. R is to provide adequate energy and protein to prevent malnutrition by achieving at least 70% of the requirements (Arsava *et al.* 2018) and controlling the patient's blood sugar profile. His energy requirement is 1,675 kcal per day, which is calculated by multiplying with a factor of 25 kcal per kg body weight based on nutrition requirements for elderly stroke patients (Yuan *et al.* 2019), and his protein requirement is 53.6 g per day which is calculated by 0.8 grams per kg body weight. Protein was not given too high due to his condition of AKI on CKD (Ikizler *et al.* 2020). To achieve the goal, the standard polymeric formula was changed to a diabetic-specific formula for better blood sugar control, and feeding was prescribed with 4.5 scoops in 200 mL water, given every four hours with six times daily feedings. This feeding regime provides 1,231 kcal per day and 54 g per day of protein, indicating 74% and 100% of his energy and protein requirements, respectively. He was only able to achieve 74% of the energy requirements due to the restriction of protein because of his kidney condition which is considered adequate as the patient’s goal is to achieve at least 70% of the calculated energy requirement.

NUTRITION MONITORING & EVALUATION

The patient was monitored by assessing his biochemical data changes and nutrition-focused physical findings, including vital signs as mentioned in Table 3. There were no changes in BMI during the follow-up visit, seven days after the first visit by the dietitian. The renal profile shows improvements with decreasing trend of urea and creatinine levels with readings of 10.4 mmol/L and 95 µmol/L respectively, but sodium levels dropped to below range with readings of 132 mmol/L. Red blood cell values show improvement even though not yet reached the normal range with a value of 4.2x10^12/L, and hemoglobin level shows improvement and achieved the normal range with a value of 12.5 g/dL. Both fasting blood sugar and random blood sugar showed improvement and achieved normal range values with readings of 5.9 mmol/L and 7.0 mmol/L respectively. All his vital signs were maintained in the normal range but with a slight drop in GCS to 9/15, indicating decreased alertness with incomprehensible sounds.

Food-nutrition-related history shows the patient tolerates enteral feeding because there is no gastric residual volume, diarrhea, vomiting, or gastrointestinal bleeding. Based on Table 4, the patient achieved the target goal of energy with at least 70% of the requirement, 1,231 kcal as prescribed. For macronutrients, the patient was able to achieve 100% protein requirement with 54 g/day and 0.8 g/kg body weight. Carbohydrates only reached 64% of the calculated requirement, 140.4 g/day out of the goal due to the use of a diabetic-specific formula with lower carbohydrate content. Fat can meet over 70% of the daily requirement with 45.9g/day, which is 71% of the requirement.

Table 2. Comparison of current intake and requirement for Mr. R's food nutrition-related history during the first dietitian visit on day 3 of admission

Nutrition assessment	Criteria	Current intake	Requirement	Interpretation
Food nutrition-related history	Energy	787 kcal	1,675 kcal	Inadequate intake
	Protein	32.4 g	53.6 g	Inadequate protein
	Carbohydrate	102.6 g	217.8 g	Inadequate carbohydrate
	Fat	25.2 g	65.1 g	Inadequate fat

Table 3. A comparison of the nutrition assessment data of Mr. R during the first visit (day 3) and follow-up visit (day 10) by the dietitian

Nutrition assessment	Criteria	Normal range	First visit (Day 3)	Follow-up visit (Day 10)	Interpretation
Anthropometry	BMI	18.5–24.9 kg/m^2	24 kg/m^2	24 kg/m^2	No changes
Biochemical data, medical tests, and procedures	Urea	2.78–8.07 mmol/L	13.1	10.4	Decreased
	Sodium	135–145 mmol/L	137	132	Decreased
	Creatinine	44–80 µmol/L	123	95	Decreased
	eGFR	>60 mg/mmol	48.0	66	Increased
	Red blood cell	4.5–5.5 x 10^12/L	3.9	4.2	Increased
	Hemoglobin	12.0–15.0 g/dL	11.8	12.5	Increased
	Fasting blood sugar	4.0–6.0 mmol/L	8.3	5.9	Decreased
	Random blood sugar	4.0–7.8 mmol/L	13.8	7.0	Decreased
	Total cholesterol	<5.2 mmol/L	4.1	No data	Normal
	Triglyceride	<1.7 mmol/L	1.3	No data	Normal
	LDL cholesterol	<3.0 mmol/L	2.2	No data	Normal
	HDL cholesterol	>=1.3 mmol/L	1.3	No data	Normal
	C-Reactive protein	<5 mg/dL	5.6	4.0	Decreased
Nutrition-focused physical findings	Blood pressure	<140/90 mmHg	119/79 mmHg	121/80 mmHg	Normal
	GCS	E4V6M5	E4V2M5	E2V2M5	Decreased alertness with incomprehensible sound

BMI: Body Mass Index; eGFR: Estimated Glomerular Filtration Rate; GCS: Glasgow Coma Scale
HDL: High-Density Lipoprotein; LDL: Low-Density Lipoprotein

Table 4. A comparison of the food-nutrition-related history of Mr. R during the first visit (day 3) and follow-up visit (day 10) by the dietitian

Nutrition assessment	Criteria	Requirement	Intake first visit (Day 3)	Intake follow-up visit (Day 10)	Interpretation
Food nutrition-related history	Energy	1,675 kcal	787 kcal	1,231 kcal	74% (Achieved goal >70%)
	Protein	53.6 g	32.4 g	54 g	100% (Achieved goal)
	Carbohydrate	217.8 g	102.6 g	140.4 g	65% (Inadequate carbohydrate)
	Fat	65.1 g	25.2 g	45.9 g	71% (Achieved >70%)

The patient was allowed discharge after 11 days of admission. Before discharge, the patient was reviewed by the speech-language therapist to assess his swallowing ability. Based on the assessment, the patient could tolerate mixed porridge and thin liquid consistency; thus, Ryle's tube was removed. The patient was given a discharge plan which included a 1,600 kcal menu with mixed porridge and thin liquid consistency suitable for his diabetic and post-stroke condition. A sample of the menu is provided in Table 5.

Table 5. Sample menu of 1,600 kcal with mixed porridge and thin liquid consistency

Meals	Food	Portion
Breakfast 6.00–8.00 am	Mixed vegetables and tofu porridge	2 cups
	- Brown rice porridge	2 cups
	- Mixed vegetables	½ cup
	- Firm tofu, diced	½ cup
	- Oil	2 teaspoons
	Tea 'o' without sugar	1 cup
Morning tea 10.00 am	Papaya and chia seed porridge	1 cup
	- Papaya, diced	½ cup
	- Chia seeds	2 tablespoons
	- Skimmed/low-fat milk	2 tablespoons / ½ glass (60 mL)
Lunch 1.00–2.00 pm	Chicken and spinach porridge	2 cups
	- Rice porridge	2 cups
	- Chicken breast, diced	1 medium size (120 g)
	- Spinach	1 cup
	- Oil	2 teaspoons
	Plain water	1 glass
Afternoon tea 4.00 pm	Rolled oat porridge with mixed nuts	1 cup
	- Rolled oat	3 tablespoons
	- Mixed nuts, chopped	2 tablespoons
	- Skimmed/low-fat milk	2 tablespoons / ½ glass (60 mL)
Dinner 7.00–8.00 pm	Fish and asparagus porridge	2 cups
	- Rice porridge	2 cups
	- Fish fillet	1 fillet (120 g)
	- Asparagus, chopped	½ cup
	- Oil	2 teaspoons
	Plain water	1 glass
Supper 10.00 pm	Greek yogurt	½ cup
	+ mixed berries	½ cup

DISCUSSION

The comparison of first and follow-up visits shows an improvement in biochemical data analysis, vital signs, and food-nutrition-related history. Positive improvement in red blood cell value and hemoglobin level might indicate the patient received adequate energy and protein. Blood sugar profile also showed an improvement because of changing to a diabetic-specific formula. Food-nutrition-related history shows the patient achieving the target goal with at least 70% of the nutrient requirement. This patient received 74% of the energy requirements and 100% of the protein requirements on day 3, after 72 hours of admission after being seen by a dietitian for the first visit. There is a limitation for achieving 100% of the intended calories due to the restriction of protein because of the patient's underlying disease of CKD. For adequate enteral feeding, it is recommended to administer at least 70% of the intended calorie and protein amounts within the initial 48 to 72 hours of admission (Arsava *et al.* 2018). EN support is a valuable approach to meeting the nutritional needs of individuals with dysphagia after an acute stroke (Ojo & Brooke 2016). The European Society of Intensive Care Medicine (ESCIM) advocates for the utilization of early EN to improve results and decrease mortality rates in critically ill patients, even those who have experienced ischemic and hemorrhagic strokes (Reintam Blaser *et al.* 2017).

This case study of Mr. R provides several critical learning points. It emphasizes the importance of assessing a patient's nutritional status through measures such as BMI, biochemical profiles, and food-nutrition-related history. Mr. R's normal BMI and the absence of recent weight loss suggested that his nutritional issues were primarily linked to his medical condition rather than chronic malnutrition. Mr. R's specific medical conditions, including uncontrolled diabetes and acute kidney injury on chronic kidney disease, necessitated adjustments in his enteral feeding regime. Switching to a diabetic-specific formula helped in better blood sugar control while considering his kidney function by giving protein of 0.8 g/kg body weight. The importance of setting short-term goals tailored to the patient's overall health objectives is another key learning point. In this case, the short-term goal was to provide adequate energy and protein to prevent malnutrition while controlling blood sugar levels. Achieving at least 70% of calculated energy requirements was considered sufficient, considering the constraints imposed by the patient's kidney condition. Continuous monitoring of the patient's progress, both biochemically and through physical findings, was crucial. The improvements seen in Mr. R's renal profile, red blood cell values, hemoglobin levels, and blood sugar levels demonstrated the effectiveness of the nutritional interventions. However, it's essential to remain vigilant for any changes in vital signs, as a drop in the Glasgow Coma Scale (GCS) indicated decreased alertness in this case. In future cases like this one, it's important to optimize the patient's nutritional intake, closely monitor their biochemical markers, and adjust the nutrition plan as needed to achieve optimal outcomes. Additionally, effective communication among the healthcare team and promptly addressing any changes in the patient's condition will be essential for providing comprehensive care.

CONCLUSION

Mr. R's health and nutrition have improved since the first assessment. He has made progress in his condition, showing positive outcomes in blood tests, vital signs, and dietary patterns. The patient was able to receive more than 70% of the essential nutrients required and his blood sugar improved. Mr. R's case highlights the significance of tailored nutritional interventions in stroke survivors' recovery. Early and focused enteral nutrition support can lead to improved results and a better quality of life during the critical phase of stroke rehabilitation.

CONSENT

Verbal consent has been obtained from the patient.

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DECLARATION OF CONFLICT OF INTERESTS

The authors declared no potential conflicts of interest concerning the preparation and publication of this article.

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