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PATIENT PROGRESS FOLLOWING NUTRITIONAL CARE FOR SUPERFICIAL DERMAL TO FULL THICKNESS BURNS

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Abstract
Background: Burns are a type of injury that require serious medical attention. The increased nutritional needs are a major issue in burn cases, where fulfilling these needs is crucial to support the tissue repair process and address the metabolic consequences of the injury. The nutritional care process is a critical thinking approach that focuses on handling individual cases specifically. This article aims to assess the progression of patients following nutrition care process in cases of Superficial Dermal to Full Thickness Burns. **Method**: This study employed a case study design. Nutrition care process was provided to a 39-year-old male patient who sustained burns on his chest, hands, genital area, and legs after being scalded by hot water while working in a factory. The medical diagnosis was superficial dermal to full thickness burn covering 49% TBSA caused by hot water and chemicals. Nutrition care process was provided for a duration of five days. Data collection was conducted through observation, in-depth interviews, and medical record analysis, including physical and clinical examinations as well as laboratory parameters. **Results:** The nutrition care process for the patient with Superficial Dermal to Full Thickness Burns began with screening, assessment, diagnosis, intervention, monitoring, and evaluation. A high-energy, high-protein diet was administered for five days in the form of regular meals. There was an improvement in physical and clinical indicators, as well as dietary intake, following five days of nutritional care.

Introduction

Burns are a type of injury that require serious medical care and typically involve long-term treatment. Burns can be caused by various factors, including heat, chemicals, electricity, and radiation (1,2). Burns can result in significant skin damage, loss of physiological

functions, and systemic complications that affect the entire body (3). The severity of burns is classified based on the depth and total body surface area affected, with clinical consequences ranging from mild pain to organ failure and death(4).

Globally, burns are a public health issue causing high morbidity and mortality. The WHO reports approximately 180,000 deaths annually due to burns. Most deaths occur in low- and middle-income countries such as those in Southeast Asia, including Indonesia (5). In Indonesia, national prevalence data are not available and are generally based on hospital patient profiles. A study at Arifin Achmad General Hospital in Riau Province reported 111 severe burn patients from 2011 to 2013 (6). The report from RS Bhayangkara indicated a total of 26 cases recorded between 2018 and 2023 (7). Another report from Dr. Karyadi Hospital in Semarang noted 72 burn patients (8). Most patients were over 18 years old and predominantly male. The most common cause of burns was thermal (74%) (9).

In developing countries, the incidence of burns tends to be higher due to limitations in workplace safety, lack of health education, and limited access to adequate burn care facilities (10). Burn patient care not only involves immediate medical treatments such as debridement, specialized dressings, and antibiotic therapy but also optimal nutritional support. Adequate nutrition is crucial in the wound healing process, improving skin integrity, and reducing infection risks (11). Extensive and deep burns increase the body's metabolic needs, leading to heightened protein catabolism and significant electrolyte and fluid loss. Therefore, appropriate nutritional therapy is essential to support patient recovery (12).

Burn patients require tailored nutritional care strategies based on their clinical condition. Proper nutritional therapy can accelerate the healing process, improve immune status, and minimize complications (12). Therefore, this article aims to review the nutritional care process in burn patients and its impact on biochemical parameters, clinical physical status, and dietary patterns. This case study will provide insights into the importance of proper nutritional therapy in burn management and identify factors contributing to recovery effectiveness.

Materials and Methods

The research design used is a case study that was conducted in the inpatient ward at RSUPN Cipto Mangunkusumo, Jakarta, Indonesia, in May 2024. In 2023, there were 132 burn cases at RSUPN Cipto Mangunkusumo, providing the rationale for undertaking this study. The nutritional care process consists of several stages: assessment, diagnosis, intervention, monitoring, and nutritional evaluation. Data collection was carried out at the beginning and throughout the study for monitoring and evaluation purposes. The process began with assessment (13).

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The assessment covered four types of data groups: anthropometry, clinical physical vital signs, biochemical parameters, and dietary patterns. For anthropometry, weight was measured using a bed scale because the patient could not stand. Clinical physical vital signs included respiratory rate, blood pressure, heart rate, body temperature, and the general condition of the patient. Biochemical parameters included albumin, haemoglobin, lactate, sodium, chloride, random blood sugar, potassium, and calcium, which were measured in the laboratory at RSUPN Cipto Mangunkusumo, Jakarta, Indonesia. The analysis of albumin is used to assess nutritional status and liver function, which are crucial for tissue regeneration. Sodium and chloride are important for electrolyte balance and osmoregulation, which are often disrupted in patients with extensive burns. Haemoglobin measures the blood's capacity to carry oxygen, essential for wound healing. Lactate reflects the level of anaerobic metabolism and can indicate tissue hypoperfusion. Blood glucose provides information about the patient's metabolic status, particularly in managing stress and infection. Potassium is critical for cardiac and muscle function and can fluctuate significantly due to tissue damage. Calcium plays a role in many biological processes, including blood coagulation and nerve function, which can be impaired by burns. Monitoring these parameters helps manage the patient's clinical condition, prevent complications, and guide therapeutic interventions (14).

To collect information on dietary patterns before hospital admission, the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) was used. For dietary intake during the hospital stay, the 24-Hour Food Recall method was utilized. Nutritional intake analysis was performed using Nutrisurvey software. Nutritional intervention and monitoring evaluation were conducted over five days.

The case involves a 39-year-old male, Muslim, married, with a high school education level, and of Sundanese ethnicity. He works as a factory labourer. The patient was brought to RSUPN Cipto Mangunkusumo with burn injuries on his chest, hands, genital area, and legs after being scalded by hot water while working in the factory. The medical diagnosis was superficial dermal to full thickness burn covering 49% of the total body surface area (TBSA) due to hot water and chemical exposure. There was no history of secondary diseases or significant weight loss.

Results

The results of the physical and clinical assessments are detailed in Table 1. The examination showed that the patient was compos mentis, calm, able to interact, and not fitted with a nasogastric tube (NGT). The examination results for the parameters of respiratory rate, blood pressure, heart rate, and body temperature fluctuated during the monitoring and evaluation period. The initial assessment upon hospital admission showed

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a respiratory rate of 19 breaths per minute. There was a decrease on the first follow-up day to 16 breaths per minute, an increase on the fourth follow-up day to 26 breaths per minute, and a subsequent decline to 22 breaths per minute on the fifth follow-up day.

Table 1. Progression of Physical/Clinical Parameters

Periods	Parameters			
	Respiratory Rate **(per minute)**	**Blood pressure (mmHg)**	***Heart Rate*** **(per minute)**	**Body temperature (^{0}C)**
Follow Up day 1	16	119/71	102	38,2
Follow Up day 2	20	105/65	106	37
Follow Up day 3	20	118/77	100	37
Follow Up day 4	26	130/87	110	40
Follow Up day 5	22	94/72	100	37

Most blood pressure readings during the nutritional care process were within optimal limits, although there were fluctuations, particularly on the fourth monitoring day (15). The initial examination showed a blood pressure of 96/60 mmHg, which increased on the first follow-up day. Subsequently, the blood pressure decreased to 105/65 mmHg. On the third and fourth follow-up days, the readings increased to 118/77 mmHg and 130/87 mmHg, respectively. On the final monitoring day, the blood pressure decreased to 94/72 mmHg (Table 1).

The presented table (Table 1) shows the changes in the patient's heart rate over five consecutive days during the monitoring and evaluation of nutritional care. The initial heart rate examination recorded the patient's heart rate at 101 beats per minute. On the first monitoring day, the heart rate was recorded at 102 beats per minute. There was an increase on the second day to 106 beats per minute, which then decreased to 100 beats per minute on the third day. On the fourth day, the heart rate increased again, reaching a peak of 110 beats per minute before finally decreasing to 100 beats per minute on the fifth day.

Changes in the patient's body temperature are presented in Table 1. On the first day, the patient's body temperature was recorded at 38.2°C. On the second day, the temperature dropped to 37°C, approaching normal values (16). However, on the fourth day, the patient's body temperature sharply increased to 40°C.

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Table 2. Progression of Biochemical Parameters

Periods	Indicators	Result	Interpretation
Initial Examination	Albumin	2.1 g/dL	hypoalbuminemia, increased lactic acid, hyponatremia, hypochloremia
	Hemoglobin	14.9 g/dL	
	Lactate	4.9 mmOl/L	
	Sodium	128 mEq/L	
	Chloride	97 mEq/L	
	Blood sugar	110 mg/dL	
Follow Up 1	Albumin	2 g/dL	hypoalbuminemia, anemia, hyponatremia, hypokalemia
	Hemoglobin	10.1 g/dL	
	Sodium	134 mEq/L	
	Potassium	3.2 mEq/L	
Follow Up 2	Albumin	2.7 g/dL	hypoalbuminemia, uremia, hyperglycemia, anemia, hypocalcemia
	Urea	44.9 mg/dL	
	Blood Sugar	147 mg/dL	
	Hemoglobin	9.5 g/dL	
	Calcium	7.5 mg/dL.	

The initial examination of biochemical data indicated hypoalbuminemia, increased lactic acid, hyponatremia, and hypochloremia (Table 2). During the first follow-up, in addition to hypoalbuminemia and hyponatremia, anemia and hypokalemia were also observed. Subsequent examinations during the second monitoring revealed continuing hypoalbuminemia, along with the emergence of uremia and hyperglycemia. The patient also continued to experience anemia and hypocalcemia.

Table 3. Progression of Energy and Protein Consumption

Periods	Indicator	
	Energy (Kcal)	Protein (g)
Follow Up day 1	1275	59
Follow Up day 2	1745	85,5
Follow Up day 3	1950	80
Follow Up day 4	2450	98
Follow Up day 5	2100	94

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The dietary pattern before hospital admission consisted of three main meals and two snacks per day. The amount of rice consumed in one meal was 1.5 servings, 1.5 servings of animal protein, and ½ serving of plant-based protein and vegetables. The patient had a habit of drinking coffee twice a day. The consumption of meatballs was once a week, instant noodles once a week, along with bread and crackers. The analysis of total energy intake showed 1800 kcal. After hospital admission, the patient was given a high-energy, high-protein diet consisting of regular food with the addition of 200 mL of high-protein liquid food. The estimated energy intake at the beginning of hospitalization was 750 kcal. Gradually, there was an increase in the fulfilment of energy and protein needs each day during the nutritional care process.

Tabel 4. Nutrition Diagnosis

Nutrition Diagnosis
Increased energy and protein needs related to tissue recovery, indicated by 49% burns and hypoalbuminemia

Based on the results of the nutritional assessment conducted, and referring to the issues identified in the patient, a nutritional diagnosis was formulated (Table 4). The prioritized nutritional problem formulated as the nutritional diagnosis in this case study is the increased energy and protein needs related to tissue recovery, indicated by 49% burns and hypoalbuminemia. The dietary goal targeted is to meet the nutritional needs with a minimum intake of 80% of 1750 kcal within 24 hours. The dietary management provided includes a high-energy, high-protein diet administered gradually starting from 1750 kcal, with 81 g of protein. The form of food includes regular rice meals with two extra portions of animal protein and high-protein liquid food 3 times 150 mL. The eating frequency is three main meals and three snacks orally.

DISCUSSION

Patients with burns experience hypermetabolism as a response of the body to injury by increasing the metabolic rate to accelerate the healing process (3). Burns cause extensive tissue damage, requiring higher energy for tissue repair and enhancing the immune system due to increased susceptibility to infection (11). Hypermetabolism is characterized by increased body temperature, faster heart rate, and increased respiratory rate. Additionally, stress hormones such as catecholamines, cortisol, and glucagon also increase, promoting the breakdown of proteins and fats to meet the increased energy demands (11,17).

To address the hypermetabolic condition, burn patients in this case were provided with a high-energy and high-protein diet. A high-energy diet ensures that the body has

sufficient energy to meet the increased demands, thus preventing excessive protein turnover from body tissues for energy. Meanwhile, a high-protein diet supports the synthesis of new proteins required for the repair and regeneration of damaged tissues as part of the wound healing process. Protein also helps maintain muscle mass and immune function, which are crucial in the healing process and in preventing complications such as infections. By providing a high-energy and high-protein diet, the healing process of burn patients is expected to be more effective (3,11,18). The study results indicate a decrease in the number of white blood cells, monocytes, and neutrophils in burn injuries that received protein nutritional support. Additionally, there was a reduction in pro-inflammatory parameters such as tumour necrosis factor-α and interleukin-6 (IL-6), as well as chemokines including macrophage chemoattractant protein-1, regulated upon activation normal T cell expressed and secreted factor, and C-C motif chemokine 11. Conversely, anti-inflammatory parameters such as IL-4, IL-10, and IL-13 were significantly increased. Markers of kidney function, including blood urea nitrogen and serum creatinine, showed a significant decrease, while albumin levels increased (19). Previous case reports related to burn injuries have indicated that high protein administration improves laboratory parameters and morbidity (18).

Proper monitoring and adjustment of nutrient intake are essential to support the effective healing process in burn patients, ensuring that the increased energy and protein needs are met. Based on Table 3, there is an observed increase in daily energy and protein intake in the patient. The first day of intervention started gradually with 1750 kcal and 81 g of protein. The first follow-up results showed 72.8% fulfilment of energy and 5 g of protein intake. The follow-up plan included a diet of 1950 kcal and 80 g of protein via oral intake, regular rice meals totalling 1100 kcal, additional animal protein, and high-protein liquid food 3x200 mL. As the patient's ability to consume food increased, the total food intake was gradually increased to meet 100% of energy and protein needs. Energy provision ranged from 1950 kcal to 2450 kcal, with 98 g of protein. On the fifth day of intervention, monitoring, and evaluation, a decrease in energy intake to 2100 kcal was observed, which was related to the onset of gastrointestinal disturbances, such as nausea and shortness of breath. The presence of shortness of breath was corroborated by an elevated respiratory rate of 22 breaths per minute (20).

The patient's heart rate showed daily variations during the observation period. There were two substantial increases, on the second and fourth days, with the highest increase on the fourth day. Conversely, there were two points where the heart rate decreased to normal levels, on the third and fifth days. These fluctuations reflect variability in the patient's physiological response, possibly related to the recovery process or other factors influencing the clinical condition. One influencing factor was the increase in body temperature on the fourth day, which coincided with the peak heart rate of 110 beats per minute. Prospective studies have shown a correlation between an increase in body temperature and heart rate

(21). Retrospective studies on adult patients indicate that each 1°C increase in body temperature can raise the heart rate (22). Physiologically, an increase in body temperature is accompanied by an increase in metabolic rate (23). Other physiological factors such as pain and anxiety also contribute to an increased heart rate (21). Additionally, the increase in heart rate serves as a compensatory mechanism to ensure adequate oxygen delivery to potentially poorly perfused organs (21,22). Despite the heart rate increases on certain days, it tended to return to the normal range of 100 beats per minute after each spike (20,24).

Anaemia in the patient also contributed to the elevation of vital signs such as respiratory rate, blood pressure, and heart rate. Cross-sectional studies have shown a correlation between haemoglobin concentration and respiratory rate, blood pressure, and heart rate (25). On the fourth monitoring day, the highest increases in all vital signs were observed: respiratory rate of 26 breaths per minute, blood pressure of 130/87 mmHg, and heart rate of 110 beats per minute, coinciding with a drop in haemoglobin level to 9.5 g/dL.

The initial biochemical examination showed hypoalbuminemia, increased lactic acid, hyponatremia, and hypo chloremia, indicating nutritional problems, metabolic disorders, or physiological effects of burns. The first and second follow-up results revealed a decrease in haemoglobin levels, indicating anaemia, with values of 10.1 g/dL and 9.5 g/dL, respectively, along with other mineral deficiencies such as hypokalaemia and hypocalcaemia. These conditions indicate reduced red blood cell production and further electrolyte imbalances. Additionally, the emergence of hyperuremia and hyperglycaemia suggests increased protein turnover and disrupted glucose metabolism (3,11,18).

Patients with severe burns (TBSA greater than 40%, as in this case with 49%) experience changes in metabolic rate (3). Research has shown that metabolic disturbances occur following thermal injury (26). Severe burns, hypermetabolism, and oxygen deprivation in cells activate anaerobic glycolysis, converting glucose to lactic acid (27). In severely burned patients, increased glucose production occurs through gluconeogenesis, with alanine as the main substrate (in addition to lactic acid). This leads to amino acids becoming the primary energy source, resulting in a shortage of amino acids for protein synthesis and increased nitrogen excretion, primarily as urea (28).

Conclusion

There is patient progress towards improvement following nutritional care for Superficial Dermal to Full Thickness Burn. This is particularly evident in the improvement of dietary intake. The patient's dietary intake increased from an initial energy consumption of 750 kcal before nutritional care to 2100 kcal by the end of the monitoring evaluation, meeting the required needs. Additionally, there were improvements in clinical physical indicators such as respiratory rate, blood pressure, heart rate, and body temperature.

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