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CASE PRESENTATION

Nursing care in severe burn injury: case report and literature review

Viviana Gabriela Avecillas-Morejón[1], Andrea Valeria Coyago-Pulla[1], Verónica Daniela Yépez-Amores[1]

[1]Universidad Regional Autónoma de Los Andes. Puyo, Ecuador.

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ABSTRACT

Introduction: extensive burns constitute complex medical emergencies that compromise multiple physiological systems.
Objective: to describe a case and the associated literature regarding the systematic application of the nursing process in a patient with extensive burns and multiple associated complications.
Case presentation: a 27-year-old woman, a nurse working in rural service, sustained burn trauma following an air accident with subsequent explosion. She was admitted with second- and third-degree burns covering 90 % of total body surface area, airway involvement, hypovolemic shock, and severe metabolic disturbances. Emergency nasotracheal intubation, invasive mechanical ventilation, aggressive fluid resuscitation, and intensive multidisciplinary management were required. The nursing care process was applied using NANDA-NOC-NIC taxonomy, prioritizing four critical domains: Elimination/Exchange (respiratory function), Comfort (pain control), Safety/Protection (skin integrity), and Nutrition (fluid-electrolyte balance).
Conclusions: the systematic implementation of the nursing process through standardized taxonomies allows the establishment of clear care priorities in the severely burned patient. Comprehensive management should sequentially focus on: ensuring airway patency with protective mechanical ventilation, controlling pain through validated scales and multimodal analgesia, preventing infections through rigorous aseptic techniques and preventive isolation, and restoring fluid-electrolyte balance through calculated resuscitation. This structured approach optimizes clinical outcomes in highly complex situations.

Keywords: Critical Care Nursing; Nursing Process; Burns; Standardized Nursing Terminology.

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INTRODUCTION

The skin is the largest organ of the human body and plays vital roles in thermal regulation, immune defense, and maintenance of hydro-electrolytic balance. Under normal physiological conditions, insensible losses through the skin reach approximately 400 milliliters daily. However, when burn injuries occur, these losses can dramatically increase to 100 milliliters per hour, triggering a cascade of pathophysiological alterations that compromise patient survival.[1]

Burns represent a significant public health issue worldwide. The initial assessment of the burn patient in emergency services should be based on established trauma management principles, prioritizing the stabilization of vital functions and a systematic evaluation of injuries. The extent of the affected body area, measured using validated rules such as Wallace or Lund-Browder, along with the depth of the injuries, are the main prognostic determinants, directly influencing tissue functionality, aesthetic outcome, and overall morbidity and mortality.[2]

Extensive burns generate complex systemic responses involving multiple organs and systems. Among the most relevant complications is the obstruction of the upper airway, resulting from progressive edema of pharyngeal and laryngeal structures. This edema, which typically reaches its peak between 24 to 96 hours after the trauma, significantly elevates morbidity and often requires early interventions to ensure airway patency. Burns that involve the oral cavity can cause significant obstructions even in the absence of smoke inhalation.[3]

The classification of burns according to their depth comprises four degrees with distinctive characteristics. First-degree burns affect only the epidermal layer, presenting with dry skin, erythema, and painful sensation, with solar burn being the prototype. Second-degree burns involve both the epidermis and dermis, characterized by blister formation and increased pain intensity. Third-degree burns reach the hypodermis, causing local insensitivity due to the destruction of nerve endings and displaying tissue necrosis. Finally, fourth-degree burns destroy deep structures including skeletal muscle, tendons, and bone, invariably requiring reconstructive surgical intervention.[4,5]

According to epidemiological data from the World Health Organization, burns cause approximately 265,000 deaths annually, predominantly concentrated in countries with limited economic resources, particularly in African and Southeast Asian regions. More than 95 % of cases and the majority of deaths occur in low- and middle-income countries, with especially high rates in Southeast Asian and Eastern Mediterranean regions.[6]

Beyond their lethality, non-fatal burns generate substantial morbidity, including prolonged hospitalizations, permanent disfigurement, and various degrees of disability. These sequelae are often associated with social stigmatization and community rejection, significantly affecting the quality of life of survivors. Severe burn injuries, defined as those with a burned body surface area index greater than 20 %, account for approximately 8 % of admissions in specialized centers in developed countries such as Australia and New Zealand. Hospital mortality rates in these cases range from 27 % to 33 %, reaching figures of 54 % when injuries exceed 40 % of total body surface area.[7]

In the Latin American context, Chile records one of the highest occurrence rates in the region, with more than 6,000 annual hospitalizations due to burns, 569 deaths, and a mortality rate of 4,5 per 100,000 inhabitants. In Ecuador, burns represent a significant cause of morbidity and mortality, although limitations persist in the availability of national data; a study from the Baca Ortiz Hospital in Quito, considered a reference, reported 343 pediatric burn patients, 180 hospitalized, with a predominance of scald injuries and, to a lesser extent, electrical injuries.[8,9]

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Nursing care for the severely burned patient requires specialized knowledge and the application of standardized methodologies. Various institutions have implemented care models based on recognized nursing theories, such as Virginia Henderson's proposal of the 14 Basic Needs, which allows for a comprehensive and personalized assessment. The use of standardized NANDA, NOC, and NIC taxonomies facilitates the systematic identification of diagnoses, the establishment of measurable goals, and the planning of evidence-based interventions.[10]

Considering the above, this research was developed, aimed at describing a case and the literature associated with the nursing process systematics in a patient with extensive burns and multiple associated complications.

CLINICAL CASE REPORT

A 27-year-old female patient, a nursing professional, residing in the province of Pastaza, Ecuador. She was completing a year of rural service in a geographically difficult-to-access community, requiring air transport for mobility. There were no relevant clinical personal or family pathological history. The traumatic event occurred during a work-related flight on a small plane, which experienced mechanical failure followed by a crash and subsequent explosion. The patient was initially assisted by private individuals at the accident site and later transported by ECU 911 integrated security system personnel.

Initial assessment in emergency service

Upon hospital admission, the patient was conscious, oriented to person, time and space, with a Glasgow score of 15/15. She reported intense pain quantified at 10/10 using the Visual Analog Scale, presented confused speech and psychomotor agitation. Initial vital signs revealed severe hypothermia (temperature 34°C), tachycardia (heart rate 120 beats per minute), tachypnea (respiratory rate 22 breaths per minute) and arterial hypotension (91/40 mmHg). Oxygen saturation was 92 % breathing room air.

Physical examination revealed severe dehydration, charred skin with second and third-degree burns affecting 90 % of total body surface area. Generalized erythema was observed, with presence of blisters on face, chest, abdomen, lumbar region and extremities. Respiratory autonomy was initially preserved. The chest presented preserved symmetry and expandability. The abdomen was soft, depressible, painful to deep palpation. Upper and lower extremities showed symmetry with presence of blisters.

Assessment and decisions in critical area

After evaluation by the attending physician in the critical area, an extremely severe condition was confirmed with second and third-degree burns affecting 90 % of total body surface area. Urgent indication for definitive airway securing through orotracheal or nasotracheal intubation was identified. Telephone communication was established with family members, informing them of reserved prognosis and requesting authorization for invasive procedures, which was granted.

Preparatory sedation and analgesia for rapid sequence intubation was administered. During direct laryngoscopy, complete airway compromise was evidenced with burns of all pharyngolaryngeal mucosa and significant edema. Given technical impossibility of orotracheal intubation, successful nasotracheal intubation was opted for. Subsequently, invasive mechanical ventilation was programmed in volume control mode, with parameters: tidal volume 420 ml, respiratory rate 15 per minute, maximum pressure 30 cmH2O, inspired oxygen fraction 60 %,

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trigger 3, inspiration:expiration ratio 1:2. With these parameters, oxygen saturation between 96-98 % was achieved.

Initial management and stabilization
Following airway securing, vasopressor support and continuous sedation and analgesia were initiated. The patient remained in the critical area under continuous vital signs monitoring. Topical application of silver sulfadiazine was performed on all burned areas, covered with sterile dressings and gauzes until availability of definitive surgical intervention in the burns unit. An orogastric tube was placed with clear gastric content output evidenced. Administrative procedures for transfer to specialized burns unit were initiated.

Hemobimetry revealed marked leukocytosis (17,430 leukocytes/μL) and thrombocytosis (495,000 platelets/μL), indicative of systemic inflammatory response. Elevated hemoglobin (18.5 g/dL) and hematocrit (52,9 %) confirmed hemoconcentration secondary to severe dehydration. In blood chemistry, significant hyperglycemia (268 mg/dL), elevated creatinine (1,10 mg/dL) and increased liver enzymes (AST 99 U/L, ALT 41 U/L) were documented, evidencing incipient renal and hepatic dysfunction. Arterial blood gas demonstrated severe metabolic acidosis with pH 7,1 and bicarbonate 15,1 mmol/L.

Medical diagnosis and assessment according to Marjory Gordon's functional patterns
Burns and corrosions of multiple body regions (ICD-10 T29.0). Major second and third-degree burn 90 % of total body surface area. Total airway burn (ICD-10 T20). Hypovolemic shock (ICD-10 R57,1).

- Health perception and management pattern: severe disruption is identified in health perception and management, evidenced by severe trauma compromising bodily integrity and vital functions, negatively impacting prognosis and self-care capacity.
- Nutritional-metabolic pattern: patient with severe metabolic acidosis, elevated liver enzymes indicating hepatic dysfunction, and hyperglycemia suggestive of insulin resistance secondary to metabolic stress. Hypermetabolism characteristic of major burns.
- Elimination pattern: elevated creatinine signals incipient renal dysfunction, aggravated by massive fluid loss through burned surfaces. Respiratory function severely compromised requiring immediate nasotracheal intubation and invasive mechanical ventilation.
- Activity-exercise pattern: compromised by intense pain (VAS 10/10), generalized inflammation and physical limitations secondary to dressings and invasive devices. Once hemodynamic stabilization is achieved, progressive early mobilization will be essential.
- Sleep-rest pattern: constant pain associated with extensive burns makes sleep onset difficult and prevents adequate rest, resulting in fatigue and compromising the healing process.
- Cognitive-perceptual pattern: post-traumatic stress, intense pain and psychological impact of trauma affect cognition and perception, hindering information processing and decision-making. Crucial to provide emotional support and coping strategies.
- Self-perception-self-concept pattern: traumatic transformation of body image negatively affects physical, mental and social well-being. Significant alteration of self-concept requiring specialized psychological intervention.
- Role-relationships pattern: interpersonal relationships play crucial role in recovery. Care team, family and friends must provide continuous emotional support to counteract psychological impact.
- Sexuality-reproduction pattern: extensive burns can affect sexual and reproductive function due to pain, scars and changes in body image, influencing intimacy and interpersonal relationships.
- Coping-stress tolerance pattern: since admission, patient presents signs and symptoms of acute stress. Presence of acute stress constitutes predictor of post-traumatic stress, requiring early psychological intervention.

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- Values-beliefs pattern: severe burns may pose challenges to values and beliefs related to health, illness and suffering, requiring spiritual and emotional support for adaptation and meaning-seeking.

DISCUSSION

The systematic analysis of the clinical case was performed through application of standardized taxonomies: NANDA International Nursing Diagnoses Classification, Nursing Outcomes Classification (NOC) and Nursing Interventions Classification (NIC). This approach allows comprehensively addressing identified needs, using a standardized basis for formulation of precise diagnoses, establishment of measurable objectives and planning of evidence-based interventions. Based on this, four prioritized care plans are established according to affected domains: airway management, pain management, skin integrity; and fluid management.[11]

The case analyzed illustrates the complexity of multidisciplinary management of the major burned patient in acute phase, evidencing the imperative need for systematic implementation of the nursing care process through standardized taxonomies. The application of NANDA-NOC-NIC allows structuring prioritized interventions according to affected domains, optimizing clinical outcomes in situations of high criticality.[12]

Airway management constitutes the absolute priority in the major burned patient, especially when documented compromise of upper respiratory structures exists. Early intubation, ideally within the first hour after trauma, prevents potentially lethal complications secondary to progressive pharyngolaryngeal edema. Various studies demonstrate that airway edema reaches its maximum expression between 24 and 96 hours post-trauma, justifying anticipatory intervention even in absence of evident respiratory compromise at admission. In the presented case, the decision for immediate nasotracheal intubation proved determinant for preserving respiratory function in the face of evidence of complete respiratory mucosa burn.[1,2]

Invasive mechanical ventilation in the burned patient requires particular considerations. Ventilatory parameters must be adjusted according to lung protective ventilation principles, using low tidal volumes (6-8 mL/kg of ideal weight), limited plateau pressures (<30 cmH2O) and appropriate positive end-expiratory pressure levels. The ventilatory strategy implemented in this case, with tidal volume of 420 mL for a patient of approximately 52 kg (equivalent to 8 mL/kg), aligns with current recommendations for prevention of ventilator-induced lung injury.[3]

Pain in the major burned patient presents characteristics of extreme severity, requiring aggressive multimodal approach. The Visual Analog Scale constitutes the standard assessment instrument, allowing objective quantification of pain intensity and consequent adjustment of analgesic therapy. Analgesia based on potent opioids administered in continuous infusion, complemented with analgesic adjuvants and non-pharmacological techniques, represents the current therapeutic standard. Inadequate pain control is associated with multiple complications including immunosuppression, sleep disorders, delayed healing and development of persistent chronic pain.[4,5]

Preservation of skin integrity and infection prevention constitute central therapeutic objectives. The loss of skin barrier in 90 % of body surface area, as in the presented case, eliminates the first line of defense against pathogenic microorganisms, exponentially increasing the risk of local infection and sepsis. Infections represent the main cause of morbidity and mortality in major burned patients, even surpassing cardiovascular and respiratory complications. Topical

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application of silver sulfadiazine, use of rigorous aseptic techniques and maintenance of strict preventive isolation are fundamental measures to minimize this risk.[6,7]

Continuous monitoring of vital signs, body temperature and inflammatory markers allows early detection of infectious processes. The microorganisms most frequently involved include Pseudomonas aeruginosa, Methicillin-resistant Staphylococcus aureus and Candida species. Implementation of serial microbiological cultures of burned surfaces and blood cultures when bacteremia is suspected facilitates directed antimicrobial treatment when infection is documented.[8]

Aggressive fluid resuscitation represents another fundamental pillar of treatment. Multiple formulas have been proposed to calculate fluid requirements, with the modified Brooke formula being one of the most widely validated. This formula estimates fluid needs at 2 mL/kg per percentage of burned body surface area during the first 24 hours, distributing 50 % of the calculated volume in the first eight hours and the remaining 50 % in the subsequent 16 hours. For the patient in the case, with 90 % burned surface area and approximate weight of 52 kg, this represents approximately 9,360 mL in 24 hours.[9]

However, formulas constitute only initial guides, with fluid resuscitation needing adjustment according to individual physiological parameters. Strict monitoring of diuresis (goal >0.5 mL/kg/hour), central venous pressure, serum lactate and cardiovascular function allows titration of fluid administration avoiding both insufficient resuscitation (with risk of shock and multiple organ failure) and excessive resuscitation (with risk of abdominal compartment syndrome and pulmonary edema). Hourly fluid balance constitutes an indispensable tool for optimizing replacement therapy.[10]

Laboratory findings documented at admission evidence the severe metabolic alterations characteristic of burn shock. The marked leukocytosis (17,430/μL) reflects the massive systemic inflammatory response triggered by extensive thermal trauma. Hemoconcentration manifested by elevated hemoglobin and hematocrit (18,5 g/dL and 52,9 % respectively) confirms significant intravascular volume depletion secondary to massive plasma extravasation to the third space. The severe hyperglycemia (268 mg/dL) indicates activation of the neuroendocrine stress axis with release of catecholamines, cortisol and growth hormone, generating a state of temporary insulin resistance.[11]

The documented metabolic acidosis (pH 7,1 and bicarbonate 15,1 mmol/L) results from the combination of tissue hypoperfusion with lactate production, bicarbonate loss through burned surfaces and probable incipient renal dysfunction evidenced by elevated creatinine. This acid-base alteration requires correction through adequate fluid resuscitation that restores tissue perfusion, with direct bicarbonate administration reserved only for cases of severe refractory acidosis with pH <7,1 and significant hemodynamic compromise.[12]

The elevation of hepatic transaminases (AST 99 U/L, ALT 41 U/L) suggests early hepatic dysfunction, probably secondary to splanchnic hypoperfusion during the shock phase. The liver performs critical metabolic functions in the burned patient, including synthesis of acute phase proteins, drug metabolism and production of coagulation factors. Preservation of hepatic function through adequate fluid resuscitation and early nutritional support is essential for preventing late metabolic complications.[13]

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The systematic approach through structured nursing process, guided by internationally recognized taxonomies, demonstrates its utility in organizing complex care. The precise identification of priority nursing diagnoses, establishment of measurable objectives through NOC indicators and planning of specific NIC interventions constitute the standard methodology for ensuring quality evidence-based care. This approach also facilitates interdisciplinary communication and objective evaluation of outcomes, contributing to continuous improvement of care quality.

CONCLUSIONS

The nursing care process for the major burned patient in acute phase demands structured prioritization through NANDA-NOC-NIC taxonomies, which guide evidence-based interventions to optimize results in a context of extreme complexity. The first priority focuses on the Elimination/Exchange domain, ensuring airway patency through early intubation and protective mechanical ventilation to prevent serious respiratory complications. In the Comfort domain, rigorous pain control is achieved through systematic assessments and multimodal analgesia that improves patient cooperation and reduces the risk of chronic pain. The Safety/Protection domain involves strict infection prevention measures, the main cause of morbidity and mortality, through aseptic techniques, topical antimicrobial agents, isolation and continuous monitoring. Finally, the Nutrition domain includes aggressive fluid resuscitation based on validated formulas, with adjustments according to physiological response, strict control of diuresis, electrolytes and hemodynamic parameters, consolidating a comprehensive indispensable approach for survival in the initial critical phase.

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Conflict of Interests
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Authorship Contribution
VGAM: participated in conceptualization, investigation, project administration, supervision, visualization, writing - original draft, writing - review and editing.
AVCP: participated in conceptualization, investigation, visualization, writing - original draft, writing - review and editing.
VDYA: participated in conceptualization, investigation, writing - original draft. All authors approved the final version of the manuscript.

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