Indonesian Journal of Global Health Research
Volume 6 Number 4, Agustus 2024
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

A CASE OF ELECTRICAL BURNS INJURY WITH A HISTORY OF HEART DISEASE: A CASE REPORT

Lutfi Rahman*, Erin Yuliandani, Rurin Masruroh, Ristina Mirwanti, Ayu Prawesti Priambodo
Faculty of Nursing, Universitas Padjadjaran, Jl. Raya Bandung Sumedang KM.21, Hegarmanah, Jatinangor, Sumedang, West Java 45363, Indonesia
*lutfi23001@mail.unpad.ac.id

ABSTRACT
Burns are serious injuries that can have significant physical and psychological impacts on individuals. Burns due to electric shock are relatively rare but carry a high risk of serious complications, including respiratory problems and fluid loss that can be life-threatening. Purpose: The purpose of this study is to present the case study of burn electrical burns injury with a history of heart disease. Methods: This study used a case report approach on one patient. Data were collected by conducting interviews and assessments to one patient with electrical burn injury with a history of heart disease. Data analysis was carried out by comparing the results of the assessment with the theory of electrical burn injury. Results: The results of this study indicate that Mr. P, aged 35 years, showed burns covering 65% of the total body surface, with grade III severity. The patient also experienced respiratory problems with SpO2 85%. In addition, other nursing diagnoses were found such as impaired airway clearance due to edema in the larynx, hypovolemia due to active fluid loss, and acute pain due to physical injurious agents. This is the importance of proper and rapid assessment to reduce the risk of more serious complications. Conclusions: Holistic therapy and a multidisciplinary approach are key in providing optimal care and minimizing the risk of complications in patients with complex conditions such as this.

Keywords: burns; electrical; patients

First Received	Revised	Accepted
14 March 2024	22 April 2024	24 April 2024
Final Proof Received		**Published**
11 May 2024		01 August 2024

How to cite (in APA style)
Rahman, L., Yuliandani, E., Masruroh, R., Mirwanti, R., & Priambodo, A. P. (2024). A Case of Electrical Burns Injury with A History of Heart Disease: A Case Report. Indonesian Journal of Global Health Research, 6(4), 1881-1890. https://doi.org/10.37287/ijghr.v6i4.3349.

INTRODUCTION

Electrical burn injury (EBI) is a type of burn injury caused by direct contact with electric current (Dash et al., 2021). This problem occurs when an electric current passes through a person's body, causing damage to surrounding tissues and organs. EBI can occur in varying degrees of severity, depending on factors such as the magnitude of the electrical current, the duration of exposure, and the path of the electrical current through the body (Gille et al., 2018). Damage resulting from electrical burns can include burns to the skin, damage to muscles and nerves, and serious complications such as heart rhythm disturbances or damage to internal organs (Shih et al., 2017a).

According to reports World Health Organization (2023), it is stated that approximately 265,000 individuals die each year due to fires, including exposure to flames, chemicals, electric shock, and other heat sources. Data shows that the highest prevalence of burns was recorded in the Southeast Asia region in 2016, with Indonesia occupying the highest position, followed by Cambodia and Laos (Zheng et al., 2019). In Indonesia itself, the incidence of burns is quite significant, with more than 250 people dying from burns every year (Kemenkes

RI, 2018). In addition, based on data from Basic Health Research in 2018, there was an increase in the prevalence of burns in East Java by 11.12%, while the overall rate of burns in Indonesia increased by 35% (Kemenkes RI, 2018).

EBI is a type of injury that has a significant impact on an individual's health and quality of life. The impacts include tissue damage, physiological disorders, medical complications, changes in appearance, functional limitations, as well as psychological and emotional impacts (Rosenberg et al., 2015). EBI often causes serious damage to the skin tissue and deeper underlying tissues, requiring intensive medical treatment and long-term rehabilitation (Srivastava et al., 2018). In addition, this injury can also cause disorders of the nervous system, respiratory system, and cardiovascular system, potentially resulting in heart rhythm disturbances, impaired breathing, and circulatory failure. Patients with electrical burns are also at risk of experiencing various medical complications, such as secondary infections and electrolyte disorders (Salehi et al., 2014). In addition to the physical impact, electrical burns can also cause aesthetically prominent scars, affecting the patient's self-confidence and psychosocial well-being. As a result of tissue damage and physiological disturbances, patients may also experience significant functional limitations, as well as psychological and emotional impacts such as stress, anxiety, and depression (Harvey et al., 2015).

Handling emergency patients requires a structured approach, which begins with a triage process to determine treatment priorities. Nurses must ensure that patients experiencing emergencies, such as respiratory failure or obstruction of the Endotracheal Tube (ETT), are treated quickly and effectively (Gandhi et al., 2022). In burns, initial assessment should focus on airway, ventilation, and circulation. The main priority in treating patients with burns is maintaining airway, ventilation and systemic perfusion (Martins et al., 2014). If necessary, measures such as endotracheal intubation and infusion must be carried out immediately to maintain circulating volume. It is important to check the type and extent of the burn, including whether it is severe, moderate, or mild (Cleary et al., 2018). Handling of burns through physical examination must be aimed at identifying threats to the patient's comfort and includes assessment of airway, breathing and circulation (ABC) (Grove et al., 2013).

Emergency trauma cases in patients with EBI demonstrate a significant uniqueness in the context of emergency care. Although electrical burns have become a well-known topic in the medical literature, there is still a lack of in-depth understanding of the management of EBI cases in the emergency department. Based on this, the author is interested in conducting research on "A Case of Electrical Burns Injury With History Of Heart Disease: A Case Report ". The purpose of this study is to present the case study of burn electrical burns injury with a history of heart disease.

METHOD

This study used a case study approach to explore complicated electrical burns in patients. The sample consisted of one patient who suffered from electrical burns and was admitted to Dr. Slamet Garut Hospital in January 2024. The inclusion criteria for the sample were patients diagnosed with electric burns and had undergone a complete nursing assessment. The ethical principles followed in this study include autonomy, where patients have the right to decide about their care; beneficence, which emphasizes the obligation to act for the good of the patient; maleficence, which emphasizes the importance of not causing harm or harm to the patient; and veracity, where honesty and truth in the delivery of information to patients are emphasized. Data analysis was performed qualitatively by describing the results of the assessment, including the extent and degree of burns, symptoms experienced by the patient, as

well as vital data and other findings. The results of the analysis were then compared with existing theories in the literature to understand relevant aspects and treatment implications.

Mr. P with 35 years old was rushed to the emergency room after suffering serious burns due to an electric shock while repairing the roof of his house. The patient complained of severe pain throughout his body and his voice sounded hoarse. On examination, the patient appeared restless and appeared to be having difficulty breathing. The results of the assessment showed that the patient had extensive burns, especially on the face, arms, front and back of the body, and legs, with an estimated wound area reaching 65% of the total body surface, at grade III level. The patient also experienced severe pain accompanied by bullae, and airway obstruction was suspected. Family history indicated that the patient was electrocuted while repairing the roof of his house. The family said that the patient had coronary heart disease which was diagnosed by a doctor 4 years ago. Burned nose and eyebrow hairs were seen, accompanied by bullae. The patient experienced difficulty breathing (dyspnea), with a respiratory rate (RR) of 30 times per minute. The patient's oxygen saturation (SpO2) was 85%, indicating hypoxia. The patient's blood pressure (BP) is 100/70 mmHg, with a normal body temperature (S) of 36°C. The patient's pulse (N) was 140 beats per minute, and felt weak. There is a decrease in skin turgor and the acral (end of the body) feels cold, showing signs of shock. In addition, a urinary catheter was installed with dark yellow urine, and a 2 line RL fluid infusion was given to maintain the patient's hydration. The therapy given included katerolac 10 mg/8 hours/IV (as an analgesic), Ranitidine/8 hours/IV (to reduce stomach acid production), and Ceftriaxone/12 hours/IV (antibiotic). The patient is currently being treated intensively for the management of burns and other medical conditions related to the electrical injury he suffered.

RESULTS

Triage Assessment

In the triage assessment Mr. P, a 35 year old man, was categorized as red triage considering his serious injury due to electric shock while repairing the roof of his house. The patient experienced severe pain throughout his body and difficulty breathing, indicating respiratory problems that required immediate treatment. Physical examination showed extensive burns, especially on the face, arms, front and back of the body, and legs, with the wound area reaching 65% of the total body surface, at grade III level. Patients also experience bullae, hoarse breath sounds, and signs of shock such as decreased skin turgor, cold palpable acral, and increased breathing rate and pulse. The patient's oxygen saturation (SpO2) decreased to 85%, indicating hypoxia. Family history indicated that the patient was electrocuted while repairing the roof of his house, with physical evidence of burnt nose hair and eyebrows. Medical measures that have been taken include administering analgesics, reducing stomach acid production, antibiotics, and intravenous fluids to maintain hydration. The patient is currently being treated intensively for the management of burns and other medical conditions related to the electrical injury he suffered.

Primary Assessment

Airway and Cervical Control: The patient's breath sounds are not patent, indicating the possibility of a blockage or narrowing of the upper airway. There were no visible cervical fractures. Subjective data shows that the family reported white discharge from the patient's nasal cavity amounting to ±10 cc at home, and ±3 cc when in the emergency room. Additionally, there were reports that the patient's tongue and nose hairs and eyebrows were burned, indicating possible injury to these areas. Breathing: The patient's respiratory rate is 30 times per minute, indicating difficulty breathing. The patient's oxygen saturation (SpO2) was

85%, indicating hypoxia. The patient experienced shortness of breath, which was also reported by the family that the patient complained of shortness of breath on the way to the hospital. The breathing rhythm is irregular, with chest percussion producing dull sounds in both lung fields. Chest development appears symmetrical. The patient's breath sounds were vesicular, with no visible jugular venous distension. There were no visible wounds or fractures.

Circulation: The patient has a blood pressure of 100/70 mmHg and a body temperature of 36°C, indicating a relatively stable hemodynamic condition. However, the patient's pulse had an increased frequency, reaching 140 beats per minute. The patient's skin and extremities feel cold, indicating signs of shock. There is pallor of the skin, and the capillary refill time (CRT) is more than 2 seconds, which indicates decreased peripheral perfusion. There were no sunken eyes or visible diaphoresis. Skin turgor is palpably decreased, indicating dehydration. The patient's lips felt dry, but there were no complaints of significant chest pain. Disability: The patient shows a compos mentis level of consciousness, with GCS values M: 6, V: 5, E: 4, positive light reflex, indicating eye response to light stimulation. The patient's pupils are isochorous, indicating the same pupil size between both eyes. There was no visible neck stiffness in the patient. Exposure: The patient had extensive burns on several parts of his body. Wounds were found on the face (4.5%), right arm (4.5%), left arm (4.5%), chest (4.5%), back (9%), buttocks (9%), right foot (13.5%), and left foot (13.5%). The total area of burns reaches 65% of the total body surface, with grade III burns. Bullae can be seen on some wounds, especially on the hands, feet and back. Burns appear reddish-white in color, indicating significant severity Foley Catheter: Insertion of a Foley catheter is indicated by an output of 40 cc/hour for the last hour. The urine excreted is dark yellow, indicating that there are no signs of complaints related to the inability of the Foley catheter Gastric Tube: There is no gastric tube installed in the patient. Heart Monitor: ECG picture of sinus tachycardia

Secondary Assessment

Medical History (SAMPLE): The patient experienced extensive burns covering approximately 65% of his body surface at grade III, accompanied by bullae and severe pain. There is no history of allergies to food or drugs, and does not take medication regularly or has a history of previous illnesses. Recent intake history includes a meal of rice with eggs approximately 3 hours ago. The patient was electrocuted while repairing the roof of his house, which caused extensive burns over almost his entire body. Vital Signs: Blood pressure 100/70 mmHg, respiratory rate 30 times per minute, pulse 140 times per minute, body temperature 36ºC, and oxygen saturation 85%. Pain Assessment: The patient complains of severe pain in the burn area, especially when moving or in contact with other objects, with a pain scale of 8. The patient appears restless, grimaces in pain, and occasionally screams in pain. Psychosocial Assessment: The patient shows symptoms of anxiety, panic, and sadness. Patients also have difficulty concentrating and appear restless. Head to Toe Assessment: There are burns on various parts of the body, with some wounds causing bullae, especially on the hands, feet and back. The patient's tongue looks burned, and there is white fluid from the patient's nose. There were no signs of inflammation or enlargement of the lymph nodes and parotid glands. Cardiac auscultation revealed a normal single heart sound, and abdominal palpation revealed a flat abdomen with intestinal peristalsis of approximately 16 beats per minute.

Cardiac examination revealed several findings. On inspection, a positive ictus cordis was seen, with a combustio area around the ictus chordis to the diaphragm of 1%. However, palpation could not be performed because of the burns. Meanwhile, percussion also cannot be observed due to the same conditions. However, on auscultation, regular I-II heart sounds were

heard, without any suspicious murmur or heart murmur. These findings provide a picture of a relatively normal heart condition, even though there are burns around it. The results of the EKG examination showed the presence of depressed t waves.

The results of the blood laboratory examination carried out on May 3 2023 at 13.29 WITA showed several findings that were important to assess. The hemoglobin (Hb) measured reached 16.9 g/dl, exceeding the normal range of 11.0 - 16.0 g/dl, indicating excess. The number of leukocytes was also recorded as high, namely 16.80 x 10^3/mm^3, while the normal range is 3.5 - 10.0 x 10^3/mm^3, indicating an immune response or infection. The PCV (Packed Cell Volume) value was 49.6%, also above the normal limit of 35.0 - 50.0%, indicating the possibility of relative dehydration. Platelets, which normally range between 100 - 300 x 10^3/mm^3, were recorded as high at 446 x 10^3/mm^3, which could indicate an increased risk of blood clots. On liver function examination (FH), the SGOT (Serum Glutamic Oxaloacetic Transaminase) level was recorded at 60 U/L, exceeding the normal limit (<37 U/L), indicating liver damage. However, the SGPT (Serum Glutamic Pyruvic Transaminase) value is within normal limits, namely 36 U/L. Albumin, which normally ranges from 3.8 - 4.4 g/dl, was recorded as low at 2.4 g/dl, indicating a possible problem with liver function or nutrition. The BUN (Blood Urea Nitrogen)/Ureum value is within the normal range, namely 17 mg/dl, while creatinine is at 0.7 mg/dl, within the normal range of 0.6 - 1.1 mg/dl, indicating normal kidney function . Electrolyte levels such as sodium, potassium and chloride are within the normal range, indicating a good electrolyte balance in the body.

Establishing a Nursing Diagnosis

Based on subjective information (DS), the patient reported that he suffered burns caused by an electric shock while repairing the roof of his house. Apart from that, the family reported that there was approximately ±10 cc of white fluid coming out of the patient's nose at home, and the patient had difficulty breathing on the way to the hospital. In terms of observation (DO), it appears that the patient's airway is not patent, there is white fluid from the nose of around ± 3 cc, and the patient's tongue and eyebrows look burnt. The patient also appeared to have difficulty breathing with stridor sounds, a breathing frequency of up to 30 times per minute, and an irregular breathing rhythm. The patient's oxygen saturation level (SpO2) was recorded at 85%. Based on the etiology and symptoms that appear, the diagnosis made is ineffective airway clearance due to edema in the larynx. Based on subjective information (DS) provided by the family, the patient suffered burns caused by an electric shock while repairing the roof of his house. This caused almost the patient's entire body to be affected and burned. From an observation perspective (DO), the patient appeared to be experiencing serious illness with a general condition that appeared weak. It was seen that the patient had burns involving various parts of the body, such as the face (4.5%), right arm (4.5%), left arm (4.5%), chest (4.5%), back (9%), buttocks (9%), right leg (13.5%), and left leg (13.5%). The total area of the burn reached 65%, with severity level III, and bullae were seen forming in several parts of the burn. Apart from that, the patient's pulse feels weak and irregular, the skin turgor decreases, the acral feels cold, and he looks pale. The capillary refill time (CRT) is more than 2 seconds, and the patient's lips appear dry. The patient's blood pressure was 100/70 mmHg, indicating active fluid loss, with the diagnosis being hypovolemia.

DISCUSSION

Based on the results of the assessment carried out, the patient experienced EBI (EBI). EBI is generally caused by direct exposure to electric current, as is the case in this casewas electrocuted while repairing the roof of his housewhich affects almost the entire patient's body. The serious effects of EBI, as observed in patients, include burns to various areas of the

body and vital disorders such as shortness of breath, vocal stridor, and decreased oxygen saturation (Srivastava et al., 2018). These findings are in line with previous research confirming that EBI can cause significant medical consequences and requires rapid and intensive medical intervention to minimize the risk of long-term complications (Salehi et al., 2014).

The factor that causes burns in patients is electric shock. Although fire is the predominant cause of burns in patients, there is an increasing incidence of burns due to electric shock, particularly in patients involved in accidents or activities involving direct contact with electrical sources (Suzan, R. & Diyah, 2017). These findings are consistent with previous research suggesting that most burns requiring medical treatment are caused by exposure to heat or fire, but electric shock is also a significant cause. Apart from fire, burns can also be caused by hot water, electricity, chemicals and radiation contact (Rahayuningsih, 2012). The extent of burns reaching 65% of the total body surface in this patient indicates significant severity and can have a serious impact on the prognosis and course of healing. The severity scale of burns classified as grade III indicates deeper damage to the skin layers, as well as potential damage to underlying tissues such as muscles, nerves and blood vessels. Patients are at risk of experiencing serious medical complications, including heart rhythm disturbances, respiratory disorders, circulation disorders, and secondary infections due to burns in up to 65%. In addition, the large area affected by the burn can also cause significant loss of body fluids, resulting in the risk of dehydration and electrolyte imbalance. The healing process for burns of this severity may also require intensive care that includes surgery, careful wound care, and coordinated rehabilitation (Zheng et al., 2019).

Respiratory disorders that occur in patients with EBI, which are characterized by SpO2 of 85%, are an alarming condition and require immediate treatment. These respiratory disorders can be caused by various factors related to electrical injury, including damage to lung tissue due to heat generated from electric current passing through the body, as well as laryngeal edema which can occur in response to trauma due to electric shock. In addition, fluid accumulation in the lungs or pleural effusion can also cause disturbances in gas exchange, which can result in hypoxia as occurs in patients with SpO2 85%. The impact of this respiratory disorder can be very serious and life-threatening if not treated quickly and appropriately (Kilburn & Dheansa, 2014). Actions that must be taken immediately include ensuring the patient's airway remains open, providing adequate oxygenation, and monitoring and managing respiratory complications that may arise, such as laryngeal edema or pleural effusion (Angus et al., 2020).

The current path determines which tissues are at risk and what type of injury results. Electric current passing through the head or chest is more likely to produce fatal injuries. Transthoracic flow can cause fatal arrhythmias, direct cardiac, or respiratory damage. Transcranial current can cause direct brain injury, seizures, respiratory arrest, and paralysis (Dash et al., 2021). The location of the entry point for the electric current (point of entry) & the location of the exit point varies so that the effect of the electric current varies from mild to severe. Electric current entering from the left side of the body is more dangerous than if it enters from the right. The greatest danger can arise if the heart or brain is in a position where the electric current flows. People who are barefoot are more dangerous if exposed to electricity. Footwear can function as an insulator, especially those made of rubber (Suzan, R. & Diyah, 2017).

In addition, the heat generated by electric current will damage the sarcolemma in skeletal muscles and involve the leakage of large amounts of intracellular fluid (myoglobin, creatinine kinase, potassium, phosphate and uric acid) into the plasma. This is called rhabdomyolysis. In adults, rhabdomyolysis has 3 characteristics, namely muscle weakness, myalgia and dark brownish urine. However, these three characters sometimes rarely appear together (Bayuo et al., 2020). Myoglobin resulting from muscle cell damage will enter the bloodstream and enter the kidneys. This myoglobin easily passes through the glomerulus and is easily excreted in the urine (myoglobinuria). This indicates that there is deposition of myoglobin in the renal tubules which will result in acute renal failure. If there are severe burns, paralytic ileus can be found. In the acute phase, intestinal peristalsis decreases or stops due to shock, while in the mobilization phase, peristalsis can decrease due to a lack of potassium ions (Bagheri et al., 2021).

In this case, the main nursing diagnosis is airway clearance due to laryngeal edema, which is a crucial thing to pay attention to in treating patients with EBI. Edema of the larynx can occur in response to trauma from an electric shock, which causes inflammation and swelling of the tissue layers around the larynx. This can result in narrowing of the airway and serious breathing problems. Edema of the larynx can be one of the main causes of stridor heard on the patient's physical examination. Respiratory problems caused by laryngeal edema can threaten the patient's life if not treated quickly and appropriately (Tsourouflis et al., 2021). Therefore, actions that must be taken include ensuring that the patient's airway remains open by positioning the patient's head and neck appropriately, as well as providing adequate oxygenation (Angus et al., 2020). In addition, administering pharmacological therapy such as corticosteroids or nebulization with bronchodilators can help reduce swelling of the larynx and improve respiratory function. Close monitoring of signs and symptoms of respiratory distress and response to interventions is also essential to ensure effective management of laryngeal edema in patients with IBI (Struck et al., 2014).

The nursing diagnosis of hypovolemia due to active fluid loss in patients with EBI is the result of extensive skin damage and grade IIb burns that cause increased capillary permeability and fluid leakage into the surrounding tissue. Active fluid loss occurs due to evaporation and exudation of fluid through burn wounds. This can result in a significant decrease in blood volume, disrupt blood circulation, and lower blood pressure (Annane et al., 2013). As a result, patients experience life-threatening hypovolemia if not treated immediately. Signs of hypovolemia in patients can include low blood pressure, weak and rapid pulse, pale and cool skin, and decreased skin turgor. Actions that must be taken include administering intravenous fluids in appropriate volumes to replace lost fluids, as well as close monitoring of the patient's vital signs and hydration status (Shih et al., 2017b). In addition, identifying and treating burns appropriately is also important to reduce ongoing fluid loss. These efforts must be carried out immediately and continuously to avoid the possibility of serious complications that can arise due to hypovolemia in patients with EBI (Gille et al., 2018).

The nursing diagnosis of acute pain due to a physical injurious agent, such as a burn in a patient with EBI, arises due to stimulation of the nociceptors by tissue damage that occurs due to electrical exposure. Patients experience acute pain that can be felt throughout the burn area, with intensity increasing when there is movement or contact with other objects. This pain is the body's natural response to trauma and is an indication of an ongoing healing process (Dash et al., 2021). Pain management in patients involves a multimodal approach that includes administering analgesics, such as opioids or non-opioids, according to the patient's

pain scale. In addition, non-pharmacological techniques, such as relaxation therapy, distraction, or hot-cold therapy, can also be used as part of pain management (Mehrabi et al., 2022). It is important to monitor the patient's response to the analgesics administered and periodically evaluate the patient's pain intensity. Providing adequate attention to pain management in patients will help increase patient comfort, speed up the healing process, and support overall recovery (Rosenberg et al., 2015).

CONCLUSION

Based on the results of the study on Mr. P, a 35 years old patient, was found to have EBI with burns covering 65% of the total body surface, with grade III severity. The patient also experienced respiratory problems with SpO2 85%. Nursing diagnoses made include impaired airway clearance due to edema in the larynx, hypovolemia due to active fluid loss, and acute pain due to physical injurious agents. When treating patients, it is important to provide comprehensive attention to burn wound management, stabilization of respiratory conditions, fluid replacement, and pain management. An interdisciplinary and coordinated approach between the medical team will be key to optimally caring for these patients.

REFERENCES

Angus, D. C., Derde, L., Al-Beidh, F., Annane, D., Arabi, Y., Beane, A., van Bentum-Puijk, W., Berry, L., Bhimani, Z., Bonten, M., Bradbury, C., Brunkhorst, F., Buxton, M., Buzgau, A., Cheng, A. C., de Jong, M., Detry, M., Estcourt, L., Fitzgerald, M., … Summers, C. (2020). Effect of Hydrocortisone on Mortality and Organ Support in Patients With Severe COVID-19: The REMAP-CAP COVID-19 Corticosteroid Domain Randomized Clinical Trial. JAMA, 324(13), 1317–1329. https://doi.org/10.1001/jama.2020.17022

Annane, D., Siami, S., & Jaber, S. (2013). Effects of fluid resuscitation with colloids vs crystalloids on mortality in critically ill patients presenting with hypovolemic shock: the CRISTAL randomized trial. JAMA, 310. https://doi.org/10.1001/jama.2013.280502

Bagheri, M., Fuchs, P. C., Lefering, R., Grigutsch, D., Busche, M. N., Niederstätter, I., the German Burn Registry, & Schiefer, J. L. (2021). Effect of comorbidities on clinical outcome of patients with burn injury — An analysis of the German Burn Registry. Burns, 47(5), 1053–1058. https://doi.org/10.1016/j.burns.2020.04.040

Bayuo, J., Bristowe, K., Harding, R., Agbeko, A. E., Wong, F. K. Y., Agyei, F. B., Allotey, G., Baffour, P. K., Agbenorku, P., Hoyte-Williams, P. E., & Agambire, R. (2020). "Hanging in a balance": A qualitative study exploring clinicians' experiences of providing care at the end of life in the burn unit. Palliative Medicine, 35(2), 417–425. https://doi.org/10.1177/0269216320972289

Cleary, M. i. c. h. e. l. l. e., Visentin, D. e. n. i. s. C., West, S. a. n. c. i. a., Andrews, S. h. a. r. o. n., McLean, L. o. y. o. l. a., & Kornhaber, R. a. c. h. e. l. (2018). Bringing research to the bedside: Knowledge translation in the mental health care of burns patients. International Journal of Mental Health Nursing, 27. https://doi.org/10.1111/inm.12491

Dash, S., Arumugam, P. K., Muthukumar, V., Kumath, M., & Sharma, S. (2021). Study of clinical pattern of limb loss in electrical burn injuries. Injury, 52(7), 1925–1933. https://doi.org/https://doi.org/10.1016/j.injury.2021.04.028

Gandhi, G., Parashar, A., & Sharma, R. K. (2022). Epidemiology of electrical burns and its impact on quality of life - the developing world scenario. World J Crit Care Med, 11.

https://doi.org/10.5492/wjccm.v11.i1.58

Gille, J., Schmidt, T., Dragu, A., Emich, D., Hilbert-Carius, P., Kremer, T., Raff, T., Reichelt, B., Siafliakis, A., Siemers, F., Steen, M., & Struck, M. F. (2018). Electrical injury – a dual center analysis of patient characteristics, therapeutic specifics and outcome predictors. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 26(1), 43. https://doi.org/10.1186/s13049-018-0513-2

Grove, S. K., Burns, N., & Gray, J. (2013). The practice of nursing research: appraisal, synthesis, and generation of evidence.

Harvey, L. A., Connolley, S., & Harvey, J. G. (2015). Clothing-related burns in New South Wales, Australia: impact of legislation on a continuing problem. Burns, 41. https://doi.org/10.1016/j.burns.2014.10.013

Kemenkes RI. (2018). Hasil Riset Kesehatan Dasar Tahun 2018. Kementrian Kesehatan RI, 53(9), 1689–1699.

Kilburn, N., & Dheansa, B. (2014). Socioeconomic impact of children's burns - A pilot study. Burns, 40(8), 1615–1623. https://doi.org/10.1016/j.burns.2014.03.006

Martins, J. T., Bobroff, M. C. C., Ribeiro, R. P., Soares, M. H., Robazzi, M. L. C. C., & Marziale, M. H. P. (2014). Feelings experienced by the nursing team at a burns treatment center. Escola Anna Nery, 18. https://doi.org/10.5935/1414-8145.20140074

Mehrabi, A., Falakdami, A., Mollaei, A., Takasi, P., Ghorbani Vajargah, P., Jafari, H., Mazloum, S. M. H., Rahimzadeh, N., Ghazanfari, M. J., Emami Zeydi, A., Mobayen, M., & Karkhah, S. (2022). A systematic review of self-esteem and related factors among burns patients. Annals of Medicine and Surgery, 84, 104811. https://doi.org/https://doi.org/10.1016/j.amsu.2022.104811

Rahayuningsih, T. (2012). Penatalaksanaan Luka Bakar (Combustio). Profesi, 08(September), 1–13.

Rosenberg, M., Mehta, N., Rosenberg, L., Ramirez, M., Meyer, W. J., & Herndon, D. N. (2015). Immediate and long-term psychological problems for survivors of severe pediatric electrical injury. Burns., 41. https://doi.org/10.1016/j.burns.2015.06.006

Salehi, S. H., Fatemi, M. J., Aśadi, K., Shoar, S., Ghazarian, A. D., & Samimi, R. (2014). Electrical injury in construction workers: a special focus on injury with electrical power. Burns., 40. https://doi.org/10.1016/j.burns.2013.05.019

Shih, J. G., Shahrokhi, S., & Jeschke, M. G. (2017a). Review of adult electrical burn injury outcomes worldwide: an analysis of low-voltage vs high-voltage electrical injury. J Burn Care Res, 38. https://doi.org/10.1097/BCR.0000000000000373

Shih, J. G., Shahrokhi, S., & Jeschke, M. G. (2017b). Review of adult electrical burn injury outcomes worldwide: an analysis of low-voltage vs high-voltage electrical injury. J Burn Care Res., 38. https://doi.org/10.1097/BCR.0000000000000373

Srivastava, S., Kumari, H., Singh, A., & Rai, R. K. (2018). Electrical burn injury: a comparison of outcomes of high voltage versus low voltage injury in an Indian scenario. Ann Burns Fire Disasters, 31.

Struck, M. F., Reske, A. W., Schmidt, T., Hilbert, P., Steen, M., & Wrigge, H. (2014). Respiratory functions of burn patients undergoing decompressive laparotomy due to secondary abdominal compartment syndrome. Burns., 40. https://doi.org/10.1016/j.burns.2013.05.007

Suzan, R. & Diyah, E. A. (2017). Tata Laksana Nutrisi Pada Pasien Luka Bakar Listrik. Jmj, 5(1), 1–13.

Tsourouflis, G., Pikoulis, A., & Pararas, N. (2021). Burn Management BT - Emergency Medicine, Trauma and Disaster Management: From Prehospital to Hospital Care and Beyond (E. Pikoulis & J. Doucet (eds.); pp. 329–335). Springer International Publishing. https://doi.org/10.1007/978-3-030-34116-9_25

World Health Organization. (2023). Burns. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/burns

Zheng, Y., Lin, G., Zhan, R., Qian, W., Yan, T., Sun, L., & Luo, G. (2019). Epidemiological analysis of 9,779 burn patients in China: An eight-year retrospective study at a major burn center in southwest China. Experimental and Therapeutic Medicine, 2847–2854. https://doi.org/10.3892/etm.2019.7240.