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THE OCCURRENCE OF CONTRACTURE AND THE SEVERITY OF BURN INJURIES AMONG BURN PATIENTS TREATED AT DR. SOETOMO GENERAL ACADEMIC HOSPITAL, SURABAYA, INDONESIA (2020-2022)

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ABSTRACT

Introduction: Burn injuries are a worldwide issue and can happen for many reasons, often causing skin damage that leads to deformities and movement difficulties. Many burn patients, up to 50%, experience contractures, which limit movement in areas such as the shoulders, wrists, and torso. Proper management through medicine, surgery, and therapy is crucial for helping these patients. Research at Dr. Soetomo General Academic Hospital is focused on studying the frequency of contractures after burn injuries to improve treatment and prevention methods.
Methods: The research used descriptive analytics and gathered data from the Burn Unit at Gedung Bedah Pusat Terpadu (GBPT) and the Plastic Surgery Polyclinic at Dr. Soetomo General Academic Hospital in Surabaya. The study examined 40 eligible patients and assessed variables including burn severity, affected body area, and hospitalization duration.
Results: The results showed that the average age of patients was 26.30 years, with 70% of them being male. Only 5% of patients had other health problems, mainly related to hormones. Most burns were caused by fire (37.5%), and many were second-degree burns (42.5%). The percentage of the body affected by burns varied by age: children had around 9.86%, adolescents had around 15.96%, and adults had around 5.25%. Most injuries were on the left arm (67.5%), and many patients stayed in the hospital for a long time (67.5%).
Conclusion: All patients developed contractures following burns, irrespective of burn severity. There was a correlation between burn size and severity, except among older patients. Additionally, a notable association was observed between contracture occurrence and prolonged hospitalization.

Highlights:

1. A robust association was observed between total body surface area (TBSA) and burn injuries, except in the case of elderly individuals.
2. The duration of hospitalization is significantly associated with the occurrence of contracture.

INTRODUCTION

Burn injury is a prevalent issue worldwide and a significant cause of patient complications. According to the World Health Organization (WHO)[1], a lot of countries struggle to provide adequate care for individuals affected by burn injuries due to their widespread occurrence. Annually, approximately 180,000 deaths are attributed to burns, with a higher incidence observed in nations with lower to moderate economic status. In Southeast Asia, there is an estimated occurrence of 1.3 burn patients per 100,000 population.[1-3]

In Indonesia, approximately 195,000 deaths occur each year due to burn injuries, and this number is rising due to population growth and industrial development. The Burn Unit at Dr. Soetomo General Academic Hospital experiences an increasing number of cases annually, with a higher mortality rate.[4-7] Specifically, the Burn Centre at Cipto Mangunkusumo General Hospital receives over 130 patients annually from various parts of the country.[8] Perdanakusuma et al. (2019) the mortality rate among burn patients at Dr. Soetomo General Hospital in Surabaya, Indonesia, was 14.1% between 2007 and 2011.[9]

Burn injuries can result from various factors, including electrical shock, fire, cold, and friction, as discussed in this study. Based on data collected from the Burn Unit of Dr. Soetomo General Academic Hospital in 2017-2020, the leading causes of burns in sequential order were electricity (19%), fire (56%), and other (25%).[2,10] These injuries damage body tissues, potentially leading to deformities and loss of function, often resulting in complications such as contractures, which are a significant concern. Research indicates that contractures occur in 18 to 50 percent of burn patients, affecting both adults (up to 42%) and pediatric cases (up to 23%). These contractures can severely limit patients' range of motion in areas like the shoulder, wrist, and dorsiflexion, impacting their quality of life. Effective management of burn injuries involves pharmacological, surgical, and therapeutic interventions to improve patients' health and well-being.[11]

In response to the challenges posed by burn injuries, there has been a growing emphasis on research and public health initiatives aimed at prevention, early intervention, and improved treatment outcomes. Collaborative efforts between healthcare professionals, researchers, policymakers, and community organizations have led to the development of innovative strategies for burn prevention, including public education campaigns, improved building safety regulations, and advancements in burn care technologies. Additionally, interdisciplinary approaches to burn care, such as comprehensive rehabilitation programs and psychosocial support services, are being implemented to address the complex needs of burn survivors throughout their recovery journey.

Burn injuries often result in complications, with contractures being a prevalent concern, especially in relation to the injury's severity and complexity. Prior studies has indicated a significant correlation between the seriousness of burn contractures in adults and the size of the injury's surface area. The ongoing research at Dr. Soetomo General Academic Hospital aims to investigate the correlation between contracture occurrence and burn injuries, addressing gaps in current knowledge and contributing to the development of enhanced treatment and prevention strategies for patients.

METHODS

The study used a descriptive analytics approach to gather information from burn patients treated at Gedung Bedah Pusat Terpadu (GBPT) and the Plastic Surgery Polyclinic at Dr. Soetomo General Academic Hospital in Surabaya, Indonesia. Data was collected from medical records spanning from January 2020 to July 2022, covering

both burn injuries and subsequent contractures. Analysis of the data was conducted using IBM SPSS Software. The sample comprised individuals with burn injuries treated at GBPT and those with post-burn contractures treated at the Plastic Surgery Polyclinic of Dr. Soetomo General Academic Hospital during the specified time period. Approval for accessing patient records was obtained from the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital in Surabaya, Indonesia. (No.1199/LOE/301.4.2 /I/2023).

The study concluded with a total of 40 patients included. The selection criteria encompassed individuals with burn injuries, those who developed post-burn contractures, and those hospitalized for burn injuries at Dr. Soetomo General Academic Hospital between January 2020 to July 2022. The gathered data underwent processing using IBM SPSS Software and was presented through graphs, tables, and analytical discussions. Data analysis involved descriptive tests and correlation tests.

RESULTS

Table 1 below presents patient demographics, including information on the distribution of ages in years, gender, and the medical history and comorbidities of patients.

Table 1. Patient Demographics

Patient Demographics (n = 40)	**n**	**%**
Age (years)		
Mean ± SD	26.30 ± 20.21	-
Median	26.5	-
0 – 9 years	14	35
10 – 59 years	24	60
> 60 years	2	5
Sex		
Male	28	70
Female	12	30

From a total of 40 cases analyzed in this study, the average age was 26.30 years with a standard deviation of 20.21, and a median of 26.5 years. The ages ranged from 1 to 71 years old. The most common age group was between 10 to 59 years old, accounting for 24 cases (60%) of the total. Conversely, the least common age group was >60 years old, with only 2 patients (5%). Additionally, the majority of cases were male, comprising 28 patients (70%), while female patients accounted for 12 cases (30%).

Table 2. Patient's Past Medical History and Comorbidities

Patient's Past Medical History and Comorbidities (n = 40)	**n**	**%**
Endocrine		
Disorders of plasma protein metabolism	2	5
Diabetes mellitus	1	2.5
Anaemia	1	2.5
Hypokalaemia	1	2.5
Neurological disorders		
Developmental disorder of speech and language	2	5
Adjustment disorders	1	2.5
Cardiovascular		
Essential hypertension	2	5
Digestive		
Hepatitis B	2	5
Musculoskeletal		
Talipes equinovarus	1	2.5
Stiffness of joint	1	2.5
Integumentary system		
Open wound	1	2.5
Keloid scar	1	2.5
Respiratory		
COVID-19	1	2.5
Others		
Non-Hodgkin lymphoma	1	2.5
Ca mammae dextra	1	2.5
Undernutrition	1	2.5

As depicted in Table 2, patient medical histories varied, with endocrine disorders being the most prevalent comorbidities, including plasma protein metabolism

disorders (5%), diabetes mellitus, anaemia, and hypokalaemia (2.5% each). Neurological disorders, such as developmental and adjustment disorders, were the second most common (5% and 2.5%, respectively). Uncategorized comorbidities like non-Hodgkin lymphoma, breast cancer, and undernutrition each comprised 2.5% of cases.

Table 3. Clinical Characteristics of Burn

Clinical Characteristics of Burn (n = 40)	**n**	**%**
Causes of Burn		
Fire	15	37.5
Electrical burn	14	35
Boiling water	6	15
Boiling oil	4	10
Vehicle exhaust	1	2.5
Degree of Burn		
First degree	8	20
Second degree	17	42.5
Third degree	15	37.5
TBSA in Children (0-9 years)		
Mean	9.86 ± 2.26	-
Median	7	-
< 5%	6	15
5 – 10%	2	5
> 10%	6	15
TBSA in Adolescence and Adults (10-59 years)		
Mean	15.96 ± 3.19	-
Median	10	-
< 10%	11	27.5
10 – 20%	6	15
> 20%	7	17.5
TBSA in Elderly (>60 years)		
Mean	5.25 ± 4.75	-
Median	5.25	-
< 5%	1	2.5
5 – 10%	1	2.5
> 10%	0	0
Location of Burn Injury		
Left superior extremity	27	67.5
Right superior extremity	26	65
Anterior trunk	9	22.5
Posterior trunk	3	7.5
Head and neck	15	37.5
Left inferior extremity	14	35
Right inferior extremity	17	42.5

Table 3 highlights fire as the primary cause of burn injuries (37.5%), followed by electrical burns (35%) and boiling water (15%). Burn degrees, showed second-degree burns as most prevalent (42.5%). Total body surface area (TBSA) classifications, following Singer et al. (2008)[6] criteria, revealed varying means across age groups. Children had a mean TBSA of 9.86 ± 2.26%, with prevalent cases having TBSA <5% and >10% (15% each). Adolescents and adults showed a mean TBSA of 15.96 ± 3.19%, with less than 10% TBSA being most prevalent (27.5%). The elderly exhibited a mean TBSA of 5.25 ± 4.75%, with cases falling below 5% and between 5-10% (2.5% each). Burn injury locations varied, with the superior extremities being most common (67.5% left, 65% right), followed by inferior extremities (35% left, 42.5% right), and the posterior trunk being least common (7.5%).

Table 4. Outcome of Burn Patients

Outcome of Burn Patients	**n**	**%**
Length of hospitalisation		
Mean	8.85 ± 0.81	-
Median	8	-
Short (<4 days)	6	15
Intermediate (4-6 days)	7	17.5
Prolonged (>6 days)	27	67.5
Patient outcomes		
Hospital discharge due to improved conditions	39	97.5
Deceased	1	2.5
Complications		

Integumentary disorders	10	25
Shock	3	7.5
Inhalation trauma	1	2.5
Compartment syndrome	1	2.5
Gastrointestinal tract disorder	1	2.5

Table 4 presents burn injury patient outcomes in terms of hospital stays. The mean hospital stay was 8.85 ± 0.81 days, with 67.5% experiencing prolonged stays, 17.5% intermediate stays, and 12.5% short stays. Patient outcomes included 2.5% deaths and various complications. Integumentary disorders were most prevalent (25%), followed by shock (7.5%), inhalation trauma, compartment syndrome, and gastrointestinal tract disorders (each 2.5%). The study offers valuable insights into burn injury patient outcomes and associated complications.

Table 5. Characteristics of Contracture

Clinical Characteristics of Contracture (n = 40)		**n**	**%**
Occurrence of contracture			
Yes		40	100
Location of contracture			
Left superior extremity	Shoulder	2	5
	Axilla	1	2.5
	Elbow	2	5
	Wrist	8	20
	Fingers	13	32.5
	Unspecified	1	2.5
Right superior extremity	Shoulder	3	7.5
	Axilla	2	5
	Elbow	5	12.5
	Wrist	8	20
	Fingers	10	25
	Unspecified	2	5
Anterior trunk	Unspecified	4	10
Posterior trunk	Unspecified	2	5
Head and neck	Face	4	10
	Neck	5	12.5
Left inferior extremity	Knee	6	15
	Ankle	2	4.5
	Toes	4	10
Right inferior extremity	Hip	1	2.5
	Knee	5	12.5
	Ankle	2	5
	Toes	6	15
	Unspecified	1	2.5

As detailed in Table 5, all patients in this study experienced contracture, with the right superior extremity being the most prevalent location (75%). Contractures in wrists and fingers (both sides) accounted for 20% and 32.5% in the left side and 20% and 25% in the right side, respectively. Inferior extremities had 30% on the left side and 37.5% on the right side, with the knee (12.5%) and toes (15%) as the most common locations. The study employed the one-sample T-test in IBM SPSS to analyze the occurrence of contracture and degree of burn injury, with results presented in Table 6.

Table 6. Correlation between Occurrence of Contracture with the Degree of Burn Injury

	Degree of Burn Injury			**p-value**
	First	**Second**	**Third**	
Contracture	8	16	16	0.000

Data in the table indicates that, irrespective of burn severity, most patients experienced contractures. Occurrence in second and third-degree burns was 16 cases each, while first-degree burns had 8 cases. Statistical analysis revealed significant correlation (p-value = 0.000, below the cut off of 0.05).

Table 7 reveals 14 cases of contracture in children, 24 in adolescents/adults, and 2 in the elderly. Statistical analysis indicates significant correlation in children and adults (p-values 0.001 and 0.000 respectively, below 0.05), but not in the elderly group.

Table 7. Correlation between Occurrence of Contracture with the TBSA of Burn Injury

	TBSA		
	Children	**Adolescence and Adults**	**Elderly**
Contra-cture	14	24	2
p-value	0.001	0.000	0.468

The table 8 indicates 6 cases of contracture in patients with short hospital stays, 7 in intermediate stays, and 27 in prolonged stays. Statistical analysis reveals significant correlations (The p-values are 0.0025 for short stays and 0.000 for both intermediate and prolonged stays, all of which are below 0.05).

Table 8. Correlation between Occurrence of Contracture with LOS

	LOS		
	Short	**Intermediate**	**Prolonged**
Contra-cture	6	7	27
p-value	0.025	0.000	0.000

DISCUSSION

The average age in the study was 26.30 ± 20.21, ranging from 1 to 71 years, with the majority of participants falling between the ages of 10 and 59 (60%). Male patients outnumbered female patients, accounting for 70% and 30% respectively, consistent with findings from Australia and New Zealand, where males comprised 72.4% of burn injuries compared to females at 27.6%.[12,13] It was observed that until the age of 84, men had a higher proportion of burn injuries compared to women; however, after that age, both genders had equal proportions. Another study also discovered a higher percentage of male patients (56%) compared to female patients (44.8%).[14] The explanation for the gender discrepancy in the adult population varies with the mechanism of burn injury. Men are generally more involved in high-risk occupations, leading to a higher prevalence of burn injury caused by petrol fire, interpersonal violence, fire burns, hot liquid burns, and incidents involving alcohol or other substances. On the other hand, women have a higher prevalence of burn injuries caused by kerosene stove explosions and self-inflicted burns, which may be attributed to their tendency to be more involved in household activities and chores.[15]

Most patients in the study had a history of endocrine diseases (12.5%), followed by neurological disorders (7.5%) and cardiovascular illnesses (5%). Previous research identified diabetes and congestive heart failure as the most common comorbidities among burn patients. Over 57% of elderly patients had additional health conditions.[16] In this study, the presence of comorbidities did not affect patient outcomes; most patients were discharged upon showing signs of improvement, and only one death was recorded, although this correlation was not statistically tested. Additionally, no worsening of conditions related to comorbidities was documented during hospitalization, further supporting this statement.

In this study, fire combustion (37.5%) was the leading cause of burns, followed by electrical burns (35%) and scald burns (15%). This aligns with past research showing that flame burns were most common among young adults aged 18 to 64, while scald injuries became more prevalent with age. Many burns in the elderly occur during cooking or bathing, consistent with this mode of injury.[13] Mechanism of injury are also influenced by the geographical factors. According to one meta-analysis, gas and kerosene are the most common fuels in Iranian homes and workplaces, resulting in burns primarily from fire combustion. In contrast, scalds are the most frequent cause of burns in nations like Singapore and Denmark, although the underlying causes remain unknown.[14] Another study found

scald burns to be the leading cause (39%), followed by flame burns (33.6%) and electrical burns (26.6%). Diverse causes may stem from cultural and population variations. Children often experience steam burns, while adults face higher risks of electrical and flame burns, often associated with hazardous occupations. Scald injuries in children result from unsupervised play near hot liquids in kitchens.[17]

Second-degree burn was found the most predominant in this study, compromising of 16 (40%) cases, followed by third-degree burn injuries, which comprised 15 cases (37.5%), and first-degree burn injuries, comprising 8 (20%) cases. This finding is consistent with that of Alajmi et al. (2021), who discovered that the prevalence of second-degree burns was highest (71.1%), followed by third-degree burns (16.1%), and first-degree burns (12.8%).[18] However, no plausible explanation for the varying prevalence of the degree of burn injury has been found. Research suggests that the mechanism of injury strongly influences the degree of burn injury. Electrical burns, for example, are mostly full-thickness because nerves, blood vessels, and muscles conduct electricity and are easily damaged. Age groups also plays contributing factor in this phenomenon. The pediatric and elderly populations are prone to burn injuries due to their thinner skin depth, which might contribute to the higher prevalence of second-degree burns. Adults and the elderly often endured full-thickness burns while younger age groups commonly experience superficial second-degree burns. The type of burn, influenced by flame and electrical sources, contrasts with scalding, which causes first and second-degree burns.[17]

In children, the mean Total Body Surface Area (TBSA) was 9.86 ± 2.26%. Most cases comprised TBSA less than 5% or more than 10%, with 6 (15%) cases each. In the adolescence and adult group, the mean TBSA was 15.96 ± 3.19%, with burn injuries compromising less than 10% of the body surface area being the most prevalent, consisting of 11 (27.5%) cases. Meanwhile, in the elderly group, the mean TBSA was 5.25 ± 4.75%. Each case (2.5%) of 1 patient was found to suffer from less than 5% of total body surface injury and 5-10% of total body surface injury, respectively. This finding was similar to study conducted by Mulatu et al. (2022), where the mean TBSA in adults was 15.49%, ranging from1% to 64%. Similar to degree of burn injury, TBSA is also highly influenced by mechanism of injury. In flame burns, higher TBSAs (>20%) are more common than in other burn types. This could be attributed to the type of offending agent used and the duration the victim was in contact with it.[10] Patients with flame and explosion injuries had a higher average TBSA compared to those with scalding burns.[19]

The location of burn injury varies widely in this study. The most prevalent locations ware the left and right superior extremities, followed by left and right inferior extremities. The least prevalent location in this study was the posterior trunk. This finding was similar to previous study where it was found that most patients sustained burns on the upper (62.2%) and lower limbs (49.4%), followed by the head (46.7%) and chest (20%)[18]. Differences in sample size may account for variations in burn injury prevalence across studies. Despite percentage variations, most studies find extremities as a commonly affected site due to their susceptibility to manipulation and exposure to boiling liquids, particularly affecting lower extremities.[20]

Hospital stay length (LOS) poses a substantial financial burden on patients, families, providers, and hospitals. Numerous studies highlight age, burn size, and inhalation injury as predictors of mortality and extended LOS post-acute burn injury.[21] The average LOS in our study was found to be 8.85 ± 0.81 days, with the majority of patients experiencing prolonged stays, lasting more than 6 days. The length of stay is strongly correlated with the degree

of burn injury. A study indicated that most patients hospitalized for more than 14 days suffered from more than 20% Total Body Surface Area (TBSA) burns.[22] Age and comorbidities also impact LOS. The proportion of patients with comorbid conditions increases with age, and the presence of comorbidities, particularly in the older adult population, may contribute to increased hospital LOS.[23]

Patient outcomes were recorded in terms of discharge due to improved conditions and any occurrences of death. In this study, only one case of death was documented, involving a 19 year old patient. Although no comorbidity was documented, the patient suffered from extensive third-degree burn injuries covering 55% of Total Body Surface Area (TBSA). During hospitalization, the patient developed multiple complications including septicemia, acute respiratory distress syndrome, gastrointestinal hemorrhage, and open wounds to other parts of the head, among others. This finding is consistent with previous research, which indicated that the most severe conditions leading to death included septic shock, acute respiratory distress, and the presence of multiple traumas.[8]

Thirty out of 40 patients in our study developed complications. The most prevalent complication was integumentary disorders, followed by shock. Other complications included inhalation trauma, compartment syndrome, and gastrointestinal tract disorders. The frequency of patients developing more than three complications simultaneously during hospitalization was observed to be highest in the children age group, those sustaining burn injuries from fire combustion, and those with more than 20% TBSA. Mechanism of injury and TBSA may be related to the severity and extent of damage caused, thus influencing the development of complications. In children, intensive care may be more complex, and hemodynamic instability may contribute to a higher risk of complications.

Complications in burn cases exhibited significant variability among studies. One study identified burn wound site infection and sepsis as prevalent early in-hospital issues, with subsequent occurrences of anemia, hospital-acquired pneumonia, respiratory failure, and electrolyte imbalance. Meanwhile, amputation of extremities and hypertrophic scars were common long-term complications.[17]

All patients in our study developed contracture, regardless of the degree of burn. This finding is consistent with previous research, which identified contracture as one of the most common long-term complications.[17] There are numerous reasons for the relatively high incidence of contracture, including larger TBSA and skin grafting, which statistically increase the risk of developing contractures.[24] The study found that contractures were most common in the wrists and fingers of both left and right superior extremities. Contractures were also observed in the knees on the left side and toes on the right side of the inferior extremities. This aligns with research highlighting post-burn contractures as frequently occurring in hands, especially the fingers.[25] Hand involvement in burns explains the common occurrence of contractures in this study, which differs from other research findings.[24] Differences in contracture location may result from various factors, with the site of burn injury being a significant factor. Male sex, 40% TBSA burns, and surgical burn treatment are all risk factors for contracture development.[26]

A study identified a correlation between burn severity and hand contractures. First and superficial second-degree burns typically heal within two weeks, demonstrating good function and appearance. Deeper burns require a longer healing time and can lead to the formation of scar tissue. Utilizing skin grafts or

substitutes in acute management accelerates healing, promotes early motion, and reduces the development of contractures. The location of the burn also influences contracture formation, with the dorsal skin and extensor mechanism being more prone to contractures than the palmar side due to their unique properties.[27] This finding is consistent with our study, which observed that the majority of contractures occurred in the second- and third-degree burn group.

In our study, contractures were prevalent irrespective of the severity of burns, with 16 instances observed in both second and third-degree burns, and 8 cases in first-degree burns. Statistical analysis confirmed the significance (p-value 0.000) for all burn degrees, consistent with prior findings associating burn depth with contracture severity. Full-thickness burns are more likely to result in severe contractures, emphasising the correlation between burn depth and contracture outcomes.[28] Significant and full-thickness burns pose a higher risk of initiating joint mobility deficiency and disability in ambulation, fine motor duties, as well as daily functional activities.[29]

Myofibroblasts play a vital role in scar contraction by releasing TGF-1 and other cytokines, along with various cell types such as inflammatory cells, fibroblasts, endothelial cells, and epithelial cells. This secretion forms a positive feedback loop, maintaining myofibroblast activation.[30] The depth of burn injuries, influencing myofibroblast generation, exhibiting a potential linear relationship. Microenvironments, such as mechanical tension and integrin interactions, contribute to scar contracture. Extensive burns may disrupt healing, leading to excessive myofibroblasts and heightened contracture severity.[31] Post-burn contractures in children and young adults often involve early inflammation, particularly in mobile areas like the thorax and upper limb, lasting for months. This phenomenon may transiently occur during the initial two years and subsequently resolve.[32]

In our study, contracture occurrence was observed in 14 cases in children, 24 cases in adolescents and adults, and 2 cases in the elderly. Statistical analysis revealed a significant relationship in the children as well as the adolescent and adult population, but no significant relationship was found in the elderly group. Studies indicate that a higher Total Body Surface Area (TBSA) increases the likelihood of crossing multiple joints, posing a high risk of contractures.[29] Another study states that TBSA grafting and TBSA burn are independent predictors of contracture occurrence and number. Various injury-related factors, including burn depth, extent, cause, and location, are traditionally associated with contracture development. Larger burns often necessitate multiple surgeries, requiring postoperative immobilization for proper healing. Prolonged ICU stays, common in extensive burn cases, correlate with high contracture rates. The limited sample size in the elderly group might explain the observed insignificant correlation, highlighting the need for a more substantial sample size for thorough analysis.

In our study, contracture occurrence correlated significantly with hospital stay length: 6 cases in short stays, 7 in intermediate, and 27 in prolonged stays. This aligns with previous research highlighting hospitalisation duration as a contributing factor to contracture incidence.[29] In another study, 39% of non-burn-injured ICU patients who stayed longer than two weeks had contractures, with 34% of those being functionally limiting. Prolonged ICU stays (>14 days) may significantly contribute to contracture development.[24] Extended immobility, such as more than 2 weeks in a normal joint, results in fibrosis, synovial shortening, and reduced synoviocyte proliferation. Local factors like catheters and restraints, along with generalized immobility, contribute to multiple contractures.[33]

This study is reliable and comprehensive, with a diverse range of samples, from children to elderly, providing broad insights into burn injuries. Meticulous analysis of demographics and clinical characteristics, along with robust statistical analyses, strengthens scientific validity. The study's novelty lies in correlating contractures with patient characteristics, offering quantifiable insights. Focused on Dr. Soetomo General Academic Hospital, it addresses a specific gap in burn injury research. However, there are certain restrictions that affect generalizability, such as a small sample size, a retrospective design, and the absence of a control group. Future research with larger samples and comprehensive data can overcome these limitation.

This information gives a nuanced understanding of how age and gender play roles in the occurrence and causes of burn injuries, contributing to a comprehensive view of burn injury patterns in the studied population. Complications were noted in a significant number of patients, particularly in children, those injured by fire combustion, and those with higher TBSA, suggesting a link between the mechanism of injury, TBSA, and complication development. The novelty of the study lies in its comprehensive analysis of burn injuries across diverse age groups, providing nuanced insights into gender-based differences in mechanisms of injury. The study uniquely correlates burn types with age groups, emphasizing variations in injury mechanisms and outcomes. Additionally, it sheds light on the prevalence of endocrine diseases among burn patients, particularly in the elderly, contributing to the existing body of knowledge on comorbidities associated with burn injuries. The study's focus on correlating contractures with patient characteristics, including age, burn severity, and treatment methods, adds a distinctive dimension. The detailed exploration of complications and their variability among different patient groups provides valuable information. The inclusion of Total Body Surface Area (TBSA) analysis across age groups contributes to understanding burn severity patterns.

Furthermore, the study's emphasis on geographical factors influencing burn mechanisms, such as the prevalence of gas and kerosene in Iranian homes, adds a unique perspective. The study also addresses the correlation between hospital stay length and contracture occurrence, offering insights into the impact of prolonged immobility on patient outcomes.

CONCLUSION

All patients experienced post-burn contracture across all degrees. There is a positive correlation between Total Body Surface Area (TBSA) and burn injury, except in the elderly group. Moreover, an association has been observed between the incidence of contracture and the duration of hospital stay. Additionally, there is a correlation between the occurrence of contracture and TBSA in children, adolescents, and adult patients, but not in the elderly.

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CONFLICT OF INTEREST

The authors state that they have no conflicts of interest to disclose.

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None.

AUTHOR CONTRIBUTION

Designed the study and drafted the manuscript: GMQH and IDS. Collected data and performed background literature review: GMQH. Performed statistical analysis: GMQH. Supervised results and discussion: IDS, DMI, LS. The final version of

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