Research Article

Frequency and Pattern of Post Burn Contractures in Children

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Abstract

Background: Burn injuries are a global public health concern. Despite timely treatment many patients go on to develop post-burn contractures. Rehabilitation of contractures that are functionally limiting can be challenging.

Objective: To determine the frequency and pattern of post burn contractures in children

Methodology: This comparative cross-sectional study was conducted at the Department of Plastic Surgery, HMC, over a duration of 6 months. Children diagnosed with post-burn contractures during physical examinations involving limitation of movement were included in the study according to the inclusion and exclusion criteria. A detailed history was taken with special reference to demographic characteristics, duration of burn, and pattern of post-burn contractures and clinical examination of the patients. Data were analyzed using SPSS 23.0 and clinical examination of the patients was carried out at the time of admission

Results: The mean age of the patients was 8 years ±4.04. A total of 107(58%) children were male and 78(42%) were female. The frequency of post-burn contractures in children sustaining burn was 39% of all contractures 40% occur in fingers, 28% in wrist and elbow, 22% in axilla, and 10% in ankle/foot.

Conclusion: Our study concludes that the frequency of development of post burn contracture after sustaining burn injury in children is quite high and should be an alarm to devise effective policies to prevent and treat it.

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Introduction

Burn injuries are a major public health concern worldwide. According to the WHO, the number of deaths resulting from burn injuries is estimated to be 180,000 every year.[1] With advancements in the medical field, there have been significant improvements in the survival of patients with severe burn injuries. Subsequently, rehabilitation for the functionally limiting sequelae after severe burns and social integration of the patient has become an attention- demanding issue. Contractures in the tissues with severe burns are quite common. However, we have limited data of the prevalence of the post burn contractures.[1,2] Astudy carried out in India showed that the children and infants were the most common victims of burn injuries with a M:F ratio of 1.3:1.[3] In a recent review, the prevalence of post burn contractures in children was 38- 54%. Another study reported the incidence of post burn contractures to be 23% in pediatric population.[4]

The most common etiological factor for such injuries is flame burns. Involvement of the right hand was observed in 53.33% of patients, with the fingers being the most common anatomical location of the burn (90% of the cases), followed by the wrist and palm.[3] Post burn contractures are responsible for restricting the motion of the affected body part. Data from a study of 1031 patients showed that post-burn contracture was the most commonly affected shoulder joint (27.9%). The

other joints contracted after the burn were the elbow (17.6%), wrist (14.2%), knee (13.3%), and ankle (11.9%).[4] Additionally, these contractures were severely disfiguring, painful, and associated with unacceptable aesthetic results. These contractures limit the daily life activities of the affected patients.[5,6] They often marginalized and encounter considerable difficulties in securing work and acquiring education.[7] The factors responsible for increasing occurrence of contractures include neglect, poverty, delayed treatment, poor initial burn management, lack of well-equipped as well as well-staffed set ups and lack of follow up by the patients.[8] The data from a study suggested that a large percentage (46.67%) of the study patients received initial treatment from paramedics or quacks and only 23.33% of the burn patients received initial treatment from the specialists.[3]

Patients with contractures and disfigurements associated with burn injuries constitute a major portion of the workload of plastic surgeons, particularly in government hospitals. After contracture develops in a burn patient, improvement in the function and aesthetics of the affected part requires surgical management.[9,10,11] To achieve optimal surgical outcomes, proper tissue planning and selection is necessary. Skin shortage is an important problem encountered when dealing with neglected burn contractures. Other factor affecting the surgical management is secondary changes in surrounding tissues like neurovascular structures, tendon, bones and joints and other soft tissues.[2,8]

The aim of this study is to determine the frequency and pattern of post burn contracture in children as no study has ever been published on post burn contractures and its pattern in children in our local population. This study will be shared with the local health care planners to formulate effective strategies for prevention and timely management of post burn contractures of the pediatric burn patients in our local population.

Methodology

This comparative cross-sectional study was conducted at the Department of Plastic Surgery, Burns & Plastic Surgery Center, for a duration of six months from 17/12/2021 to 17/6/2022. This study aimed to determine the frequency and pattern of post-burn contracture in children and was approved by the institutional ethical review board. Post Burn Contacture (PBC) was defined as contraction of the skin after a second- or third-degree burn, resulting in restriction of movement around the injured area confir-med on physical examination and clinical history of the patient.

A sample size of 185 was calculated, keeping 38% proportion of post burn contractures in children, with 95% confidence interval, 7% margin of error calculated on WHO formula for sample size determination.

This study included children aged 1–15 years with post-burn contractures in any region of the body. Exclusion criteria, included ongoing acute treatment, individuals older than 15, and lack of parental consent to participate.

Patients visiting the OPD of our hospital with past Hx of burn injury were enrolled according to our inclusion criteria. Parents/guardians of the patients meeting were asked to provide informed consent and were properly briefed about the nature of this study.Adetailed history was obtained, and clinical examination of the patients was carried out at the time of admission. Variables such as age, gender, duration since burn, initial treatment, social class, mode of initial burn, site of contracture, frequency, and pattern of post-burn contracture in children were recorded on a predetermined proforma.

Data was entered and analyzed using SPSS Version 23.0. Descriptive statistics were used for analyses. Mean and SDs were calculated for numerical variables, such as age and burn duration. Frequencies and percentages were calculated for categorical variables such as gender, mode of initial burn, site of contracture, social class, initial treatment, incidence, and pattern of post-burn contractures in children. The frequency and pattern of post- burn contractures were stratified by age, gender, mode of initial burn, initial treatment, side of contracture, and social class to observe effect modifications. A post-stratification chi-square test was applied, with Pvalue <0.05 as significant.

Results

Of 185, 107(58%) children were male and 78(42%) children were female with male to female ratio of 1.4:1. The mean age of the patients was 8 years ±4.04. 39(21%) children were age range 1-7 years and 146(79%) children were age range 8-15 years. The duration of burn was stratified on 6 months basis. 65 (35%) children had duration of burn ≤ 6 months and 120(65%) children had duration of burn >6 months. 122(66%), 50(27%) and 13(7%) children were from lower, middle and upper class respectively. There were three modes of burn i.e. Flame, scalds and electricity with relative distribution of 68%, 21% and 11% respec-tively. 56(30%) children

had contracture on left, 61(33%) children had contracture right, 68(37%) children had contracture on both sides. Initial treatment was mostly from General Practitioner i.e. 107(58%).Only 28(15%) children had initial treatment from Burns and Plastic surgery Specialist. There were 72(39%) children who had post burn contracture. There were different patterns of contractures. The frequency distribution of all these variables is given in Table 1.

Table 1: *Distribution of variables*

Sr.No	Variables	Distribution	
		Frequency (n)	Percentage (%)
1	Age		
	1-7 years	39	21%
	8-15 years	146	79%
	Total	185	100%
2	Gender		
	Male	107	58%
	Female	78	42%
	Total	185	100%
3	Social Class		
	Lower	122	66%
	Middle	50	27%
	Upper	13	7%
	Total	185	100%
4	Duration of Burn		
	≤ 6 months	65	35%
	> 6 months	120	65%
	Total	185	100%
5	Mode of Initial Burn		
	Flame	126	68%
	Scalds	39	21%
	Electric	20	11%
	Total	185	100%
6	Initial Treatment		
	General Practitioner	107	58%
	Pediatric Surgeon	50	27%
	Burns and Plastic Surgery specialist	28	15%
	Total	185	100%
7	Post-burn Contracture		
	Yes	72	39%
	No	113	61%
	Total	185	100%
8	Pattern of Post-burn Contracture Fingers		
	Fingers	29	40%
	Wrist and Elbow	20	28%
	Axilla	16	22%
	Ankle/Foot	7	10%
	Neck	0	0%
	Knee	0	0%
	Groin	0	0%
	Total	72	100%

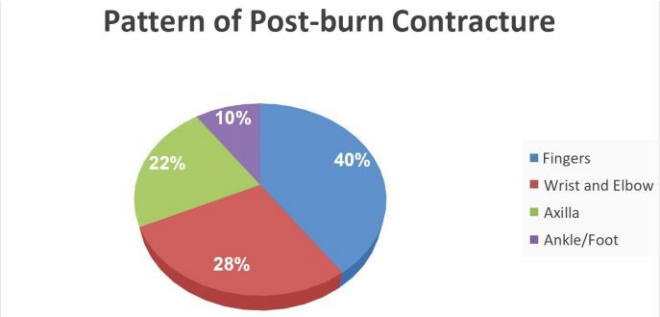

Fig. *Pattern of Post-burn Contracture*

Among 72 children having contractures, 29(40%) children had post burn contracture on fingers, 20(28%) on wrist and elbow, 16(22%) on axilla and 7(10%) on ankle/foot while no patient reported with contracture on knee, groin and neck.

Table 2: *Stratification Of Post Burn Contracture with respect to other variables*

Sr. No.	Variables	Association			
		Yes	No	Total	p-value
1	**Age (years)**				
	1-7	18(46%)	21(54%)	39(100%)	**0.297**
	8-15	54(37%)	92(63%)	146(100%)	
	Total	72(39%)	113(61%)	185(100%)	
2	**Gender**				
	Male	44(41%)	63(59%)	107(100%)	**0.472**
	Female	28(36%)	50(64%)	78(100%)	
	Total	72(39%)	113(61%)	185(100%)	
3	**Social Class**				
	Lower	49(40%)	73(60%)	122(100%)	**0.478**
	Middle	20(40%)	30(60%)	50(100%)	
	Upper	3(23%)	10(77%)	13(100%)	
	Total	72(39%)	113(61%)	185(100%)	
4	**Duration of Burn**				
	≤ 6months	27(42%)	38(58%)	65(100%)	**0.591**
	> 6 months	45(38%)	75(62%)	120(100%)	
	Total	72(39%)	113(61%)	185(100%)	
5	**Mode of Initial Burn**				
	Flame	50(40%)	76(60%)	126(100%)	**0.921**
	Scalds	15(38%)	24(62%)	39(100%)	
	Electric	7(35%)	13(65%)	20(100%)	
	Total	72(39%)	113(61%)	185(100%)	
6	**Initial Treatment**				
	General Practitioner	43(40%)	64(60%)	107(100%)	**0.727**
	Pediatric Surgeon	20(40%)	30(60%)	50(100%)	
	Burns and Plastic Surgery specialist	9(32%)	19(68%)	28(100%)	
	Total	72(39%)	113(61%)	185(100%)	

Stratification of frequency and patterns of post burn contracture with respect to age, gender, duration of burn, social class, side of contracture, mode of initial burn, initial treatment is given in table 2.

Discussion

Alarge number of people are affected by burn injuries every year all over the world. There are approximately 180,000 deaths annually reported in patients experiencing severe burns. However, with the advancements in the fields of plastic and reconstructive surgery, there has been a significant improvement in the prognoses of patients with burn injuries thus reducing the mortality associated with them. Consequently, much of the focus has now been shifted to improve the morbidity in such patients with special attention on rehabilitation, limiting the functional impairment in the affected organs secondary to the post-burn complications and integration of the person into the social machinery.[12,13,14] Post-burn contractures are a prevalent complication insuch patients and have a significant impact on the patient's prognosis and morbidity. However, the data about the prevalence of the contracture are scarce.[14]

The results of our study coincided with a recent study conducted by Ekka et al.15 In this study, the mean age of the patients was 20 years (age of the patients ranging between 1-52 years). This cohort consisted of 5 groups based on their age i.e. 1-10, 11-20, 21-30, 31-40, and >40. The most commonly involved age group was 1- 10 which made up 40% of the cohort (24 of 60). Among the most commonly affected were those who predominantly lived at home including preschool children and those adolescents who stayed at home (33.3%). This group was followed by students (30%) and housewives (23.33%). The least affected population included crude and skilled manual workers were the ones least affected (6.67% each). The study found that the most common etiological factor of the burn injuries was flame burn. This has further ben discussed and confirmed in another study of India.16 In 53.33% of the cases, right hand was affected by the burn. On the hands, the most common anatomical sites of burn injury were fingers (involving 90% of patients) that were followed by wrist and palm. In terms of initial management and treatment, only 23.33% of the patients initially received treatment by a specialist while majorities of them (46.67%) received initial treatment by quacks or paramedics.[3]

We observed similar results in another study conducted by Goverman et al.[17] In this study, at least 1 post-burn contracture was developed in 237 (23%) out of 1031 patients at hospital discharge. In these patients, there were an average three (mean = 3.3) contractures per person. Among the joints, the shoulder joint was the most frequently contracted (27.9%), followed by the elbow (17.6%), wrist (14.2%), knee. The post-burn contractures were divided into mild, moderate or severe. The data suggested that, most of the times, the severity of the contractures was either mild (38.5%) or moderate (36.3%). In terms of the severity of the contracture, the predictors of statistical significance included age of the patient, ICU length of stay, presence of amputation, and black race. While in terms of the number of contractures the statistically significant predictors were total age, length of stay, length of ICU stay, presence of amputation, TBSAburned, and TBSAgrafted.[2,14]

Our study is the first to report the epidemiology of post-burn contractures in the pediatric population. The data suggests that about 39% of the children with a major burn injury developed a contracture. Also, the growth of the children further worsens this problem. In such patients, despite the early therapeutic interventions like splinting and positioning, the contractures develop that suggest the need to identify and develop novel and more effective prevention strategies.

The results of our study highlight several key areas for improving clinical practice in managing post-burn contractures in children. With 39% of patients developing contractures, it is essential to implement targeted interventions, particularly for common sites like fingers, wrists, and elbows. The reliance on general practitioners for initial burn treatment indicates a need for enhanced access to specialized care, suggesting that timely referrals to burns and plastic surgery specialists could improve patient outcomes. The high incidence of flame burns points to the importance of strengthening fire safety education, especially for environments where children are at risk. Additionally, the slightly higher prevalence of contractures in lower socioeconomic groups underlines the necessity for targeted resource allocation and community-based interventions.Although factors such as age, gender, and burn duration did not show significant associations with contracture development, further research is needed to explore additional contributing factors. This study's findings should inform local healthcare policies and strategies to better prevent and manage post-burn contractures, ultimately improving care for pediatric burn patients.

There are few limitations in our study. It was a single center study with limited targeted population. A multicenter larger study involving a bigger population is recommended for future to know the actual burden of the morbid condition. However, our study will be of help to formulate effective strategies for prevention

and timely management of post burn contractures of the pediatric burn patients in our local population.

Conclusion:

In conclusion, our research sheds light on the significant issue of post-burn contractures in children, with up-to 1/3 of patients of burn injuries going on to develop contractures. The study highlights the importance of awareness for better prevention and early intervention strategies. The prevalence of flame burns as the main cause also points to the need for more effective fire safety education and preventive measures. Our findings may assist health-care planners in creating targeted approaches to reduce the incidence of post-burn contractures and enhanced care for paediatric burn patients.

Conflict of interests: None

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Author's Contribution

Dr. Hira Adil: Conception and design of the study, data collection, analysis and interpretation, Drafting the work Final approval of the version to be published and accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Dr. Sara Riaz: Study design, drafting of work, Data Collection and final approval of the version

Dr. Sumayya Riaz: Data collection, Manuscript Revision, analysis and interpretation of data and final approval of the version.

Dr. Saima Ayub: Contribution to conception and design of study, Data Interpretation and Analysis and final approval of the version.

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