

Children With Burn Contractures in Rural Areas of Northern Bangladesh: Etiology, Acute Burn Management, and Recommendations of the Parents

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ABSTRACT

OBJECTIVES: Burn contractures severely affect quality of life. In this study, we examined burn causes, acute management, and caregiver recommendations for children with contractures from burns in rural northern Bangladesh.

MATERIALS AND METHODS: We conducted a mixed-methods retrospective study using both quantitative and qualitative data. Questionnaire surveys were administered to 22 children with burn contractures who received surgical care at the Friendship Emirates Floating Hospital in rural northern Bangladesh. Seven caregivers were selected for in-depth interviews.

RESULTS: The study included 22 children (age range of 6 months to 12 years) with contractures affecting joints like the hand, foot, neck, axilla, and elbow. Burns from hot fluids (n = 9; 40.9%) were most common, often occurring during cooking. Immediate cooling for more than 5 minutes was absent in 41% of cases. Most caregivers sought care from village doctors or traditional healers. Recommendations from caregivers included promoting safe cooking practices to prevent burns.

CONCLUSIONS: High burn injury rates in young children and resulting contractures underscored the need for improved burn management in rural Bangladesh. The study highlighted a lack of initial cooling and a knowledge gap among caregivers and local health care providers in seeking effective treatment. Targeted burn prevention campaigns based on caregiver insights could reduce injury rates and contractures, improving children's quality of life.

KEY WORDS: *Burn prevention, Cooling, Wound closure*

INTRODUCTION

Burn injuries are a global public health problem with an estimated 180 000 deaths annually.¹ Most burn injuries occur in low- and middle-income countries (LMIC), with nearly 75% in South-East Asia and Africa.¹ Burn injuries are associated with substantial morbidity and mortality.^{1,2}

Survivors of severe burns often experience significant long-term consequences because of the development of burn scar contractures.^{3,4} Contractures occur when excessive scar tissue forms and contracts, leading to a loss of flexibility. This can result in limited range of motion, which has a significant effect on the well-being and quality of life.^{5,6} Factors that influence burn scar deformities, such as contractures, can be minimized through prompt cooling, adequate wound closure, correction of tissue deficiencies, and diligent postoperative splinting and compression therapy.^{7,8} To provide such advanced burn management, a certain level of basic health care is required.⁹

Research is scarce on burn contractures in LMIC.^{10,11} Most studies focused on the prevalence and consequences of burn injuries in Bangladesh are derived from limited-scale surveys at the community level or from records of hospital admissions.^{12,13} In Bangladesh, people living in the northern river areas and southern coastal belt have little or no access to health care. Friendship NGO aims to diminish

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life in extreme poverty in these areas by providing basic health care services.¹⁴ One of their initiatives is the Floating Hospital, a boat platform that mobilizes health care provision by being able to relocate throughout the area. Effective primary and secondary prevention strategies are crucial to reduce both the incidence of burn injuries and the long-term complications, such as burn scar contractures.¹⁵⁻¹⁸

In this study, we aimed to provide comprehensive data to inform the development of effective burn prevention campaigns tailored to rural areas in northern Bangladesh. Specifically, we aimed to understand the circumstances leading to burn injuries, assess care-seeking behaviors and barriers to medical care, and evaluate current preventive measures and safety practices. These findings will guide the creation of targeted strategies to reduce the incidence of burn injuries and resulting contractures.

MATERIALS AND METHODS

Study population

This study included children requiring reconstructive surgery for burn contractures who were screened in November 2022 at the Friendship Emirates Floating Hospital. The recruitment of patients at the Emirates Floating Hospital was conducted through a multifaceted outreach initiative. Announcements were broadcast via speakers at local markets, serving as a direct call to action for those affected. All patients were from the remote northern islands, a region where access to medical facilities is substantially limited.

Study design

This study was designed as a retrospective study with mixed methods (quantitative and qualitative). We gathered data on the causes of burn injuries, first aid practices, barriers to accessing care, and preventive measures for child burn injuries in these areas. We then sought parental input on spreading this knowledge.

Before inclusion of the study, written informed consent was obtained from the parents, grandparents, or guardians of all participants. If participants were illiterate, the informed consent was read aloud to them in Bengali, and they were able to provide their informed consent with a fingerprint.

Quantitative study: questionnaire on burn injuries and management

A questionnaire was developed to collect data on causes of burns in children with burn contractures, the first aid provided, and the barriers to accessing care in rural char areas in northern Bangladesh. We also asked every parent or grandparent about potential measures to prevent burn injuries in children, as well as their suggestions on spreading such knowledge. If the parent or grandparent of the

child was illiterate, the questionnaire was conducted orally with 2 of the authors (A.A. and M.S.).

Qualitative study: in-depth interviews

To explain and elaborate on the quantitative findings, we conducted 7 qualitative face-to-face in-depth interviews, focusing specifically on children with hand burn contractures, as they represent the most severe and homogenous group within the study population. Although the quantitative questionnaire was designed to provide a broad overview of the causes of burns, first-aid practices, and barriers to care, we conducted interviews to explore in greater depth the cultural and contextual factors influencing burn injuries, the barriers to accessing adequate care, and caregivers' perspectives on burn prevention and management. Interviews were also aimed to gather practical, experience-based recommendations from caregivers, taking into account cultural practices and norms, to inform future prevention strategies. The interviews were done at the Emirates Floating Hospital by 2 of the authors (M.U. and M.S.). Whenever possible, the interview was conducted in English. If not, one of the authors provided a Bengali translation. All interviews were audio-recorded, transcribed verbatim, and subjected to a meticulous content analysis conducted manually to ensure a comprehensive understanding of the data collected.

The semi-structured interview format allowed for flexibility to explore individual experiences and to obtain rich, detailed insights while maintaining consistency in covering the core themes. The interview questions were semi-structured and organized into the following themes: demographics (general information), circumstances during the injury, immediate response and first aid, treatment and wound healing, and burn prevention (Table 1). Questions were designed to explore not only the details of the injuries and care but also the caregivers' perceptions, challenges, and recommendations. During the interviews, we also specifically asked the children's caregivers for their advice to other parents on how to prevent burn injuries, allowing us to gather practical and experience-based insights.

The interviews lasted, on average, 50 minutes. Afterward, data were organized into categories corresponding to each theme.¹⁹

Statistical analyses

For the quantitative data, all questionnaire responses were scored and entered into IBM SPSS Statistics version 25.0 for analysis. We used descriptive statistics to summarize demographic data, causes of burn injuries, first aid practices, and barriers to accessing care. We presented categorical variables as frequencies and percentages and continuous variables as means, medians, and ranges.

For the qualitative data, the audio-recorded interviews were transcribed verbatim and analyzed using thematic content analysis. A coding framework was developed based on the core themes outlined earlier, including demographics, circumstances during the injury, immediate response and first aid, treatment and wound healing, and burn prevention. We identified and categorized emerging themes, which we analyzed to provide deeper insight on caregivers' perspectives and culturally relevant recommendations for burn prevention and management.

RESULTS

Results of quantitative questionnaire

Our study included 22 children with burn scar contractures who underwent surgical reconstruction and their parent(s) or guardian(s). Among the 22 children, 14 were girls and 8 were boys, with median age of 18 months (range, 0.5-7 y). Questionnaires showed that mean postburn period was 4.19 years (range, 0.5-12 y). Parents or guardians fully completed the questionnaire. Table 2 shows the sociodemographic characteristics at the time of injury.

TABLE 1. Questions for Semi-Structured Interviews

CATEGORY AND QUESTION
GENERAL INFORMATION
Name, address, phone number, age, gender
Household members at the time of the injury (children: ... / others:), Ages:
Occupation parents, monthly income
Char/village, Union, District
DURING THE INJURY
Describe how the burn injury occurred: agents/cause
Who caused the burn (self/someone else)
What was the location of the child?
At the moment of the injury, who was the one who was taking care of the child?
Moments when the child/children were unsupervised. When? Why?
Who was there at the time of the injury?
AFTER THE INJURY
What happened directly after the injury? Who was the first that saw the injury?
What did he/she do? Did he/she seek help?
Initial reaction after the burn accident?
What did you do?
What first aid was given?
If water was used: what temperature and for how long (hot, lukewarm, warm, hot)? Was it streaming?
Did you face any challenges to treat the patient/search medical care? (eg, money, transportation, knowledge, time, lack of assistance)
Circumstances in the family that could possibly have played a role? (eg, resignation, divorce, move, death, pregnancy, illness)
How big was the wound?
TREATMENT
After how long was the wound treated?
How was the wound treated?
If not treated correctly, what was the reason?
How long did it take for the wound to heal completely? (closed)
PRIMARY PREVENTION
Do you think the burn accident could have been prevented?
What would have been necessary to do so?
Safety in the home
Made/not made adjustments? What about after the accident?
Awareness of the risk of sustaining a burn
Ever thought about it? Why yes/no?

Location of burn contracture

Among study patients, 63.6% (14 children) had hand contractures, 13.6% (3 children) had foot contractures, 13.6% (3 children) had axillary contractures, and 4.5% (1 child) had a neck contracture. In addition, 1 child (4.5%) presented with combined elbow, wrist, and hand contracture (Table 2).

Burn injuries, causes and treatment

At the time of the burn injury, average age of children was 2 years (24.9 mo). The most common causes of burn injuries were hot fluids, ashes, and open fires. Most burns occurred during or just after cooking (63.6%). Table 3 shows the circumstances during the burn injury.

After the burn injury, 3 patients (13.6%) did not undergo cooling of the injured area with water. The remaining 19 patients (86.3%) had water applied to cool their burns. Of these, 6 patients underwent cooling for <5 minutes, 7 patients for between 5 and 10 minutes, and 6 for >10

minutes. In most patients, nothing was applied to the affected area (40.9%). For most patients, either nothing or egg yolk was applied to the affected areas. Table 3 displays the acute management following the injury.

Most wounds (95.5%) took longer than 1 month to close. Table 3 provides an overview of wound closure durations after burn injury as reported by parents, grandparents, or guardians. Only 1 patient received a split skin graft.

All parents, grandparents, or guardians sought medical care for their children. Most consulted a village doctor or local healer (59.1%) or visited the hospital (31.8%). It should be noted that village doctors and traditional healers in this context are individuals without formal medical training.²⁰⁻²² Table 3 shows the medical care-seeking patterns for parents, grandparents, or guardians of children with burn injuries.

Barriers to seeking more qualified health care providers are shown in Table 3. Almost half of parents, grandparents, or guardians mentioned that the initial health care provider

TABLE 2. Sociodemographic Characteristics at Time of Injury and Location of the Burn Contracture

Patient No.	Age	Sex	No. in Household	No. of Siblings	Location Burn Contracture	Time Since Burn Occurred
1	6 mo	M	4	0	Hand L digits 3, 4	2 y
2	11 mo	M	3	0	Hand R digits 2, 3, 4	6 mo
3	12 mo	M	5	2	Hand L digits 3, 4, 5	8 y
4	2.5 y	F	4	0	Hand L digits 1-5	6 mo
5	8 mo	F	4	1	Foot L digits 1-5	8 mo
6	24 mo	M	4	0	Hand L digits 2-5	Unknown
7	14 mo	F	5	3	Axilla L	8 y
8	3 y	F	4	2	Axilla R and hand R digit 5	1 y
9	18 mo	M	4	0	Axilla L, elbow L, wrist L	1.5 y
10	2.5 y	F	7	2	Elbow L, wrist L, hand MCP 1-5 L	5 mo
11	18 mo	F	6	1	Hand R digits 1-5	3.5 y
12	24 mo	F	5	1	Foot L digits 1-2	2 y
13	7 y	M	3	0	Axilla R + L	2 y
14	6 y	F	4	1	Hand R, MCPs and digit 5	4 y
15	9 mo	F	3	1	Hand L digits 4, 5	1 y
16	10 mo	M	5	1	Foot R, digit 4	1 y
17	11 mo	F	7	1	Hand L, digit 3	12 y
18	2.5 y	F	8	1	Neck	10 y
19	24 mo	M	10	1	Hand R digits 1, 5	10 y
20	11 mo	F	4	1	Hand L digits 1, 2	13 y
21	2.5 y	F	4	0	Hand L digits 2, 4, 5	2 y
22	24 mo	F	6	3	Hand L digits 4, 5	5 mo

Abbreviations: F, female; L, left; M, male; MCP, metacarpophalangeal joint; R, right

they consulted did not suggest referrals to other health care providers. Furthermore, 25% mentioned that there was a financial barrier to seeking medical care.

Qualitative results: in-depth interviews

Seven face-to-face in-depth interviews were conducted. Interviews involved caregivers of 2 boys and 5 girls with a median age at time of injury of 18 months (range, 9 mo to 2.5 y). All 7 children exhibited burn scar contractures on their fingers, and 2 also had burn scar contractures on elbows. Figure 1 presents images of burn scar contractures taken during initial screening of patients. Analysis of interview responses revealed 3 key themes: kitchen safety measures, child supervision, and fire safety practices. These themes highlighted the most critical areas for intervention to prevent burn injuries among children.

In addition to these recommendations, caregivers shared practical suggestions for spreading awareness, such as face-to-face discussions, community meetings, posters, and public speeches (micing). For example, a caregiver explained, “The oven should be in a safer place. It should be high, not on the floor,” emphasizing the importance of keeping cooking equipment out of children’s reach. Another caregiver added, “Tell in every class, including the teacher. Children will hear in school and teach their parents,” demonstrating how schools could play a vital role in spreading safety practices. These insights underscored the caregivers’ understanding of how to prevent injuries and their approaches for sharing this knowledge within the community. Table 4 provides an overview of interview results and recommendations from parents or guardians on preventing burn injuries and their required measures.

TABLE 3. Circumstances During the Burn Injury, Acute Management, Duration Wound Closed, Medical Care Seeking Patterns, and Barriers to Seeking Medical Care

	Frequency	Percent
Circumstances during the burn injury		
During cooking or just after cooking	14	63.6
Playing	2	9.1
During heating of the house or bath	2	9.1
During drying the rice	2	9.1
During burning waste	1	4.5
Self/ignition of clothing	1	4.5
Acute management		
Nothing	9	40.9
Egg or egg with salt	8	36.4
Leaves with water or with oil	3	13.6
Cow dung	1	4.5
Cream	1	4.5
Duration until wound closed		
<1 month	1	4.5
1-3 months	14	63.6
>3 months	7	31.8
Medical care-seeking pattern for guardians of children with burn injuries		
Village doctor or local healer	13	59.1
Hospital	7	31.8
General practitioner	1	4.5
Pharmacist	1	4.5
Barriers to seeking medical care (multiple answers possible)		
No referral suggested	12	43
Financial barrier	7	25
Distance	3	11
Did not know where to go	4	14
Other reasons	2	7

TABLE 4. Interview Results: Recommendations From Parents or Guardians on Preventing Burn Injuries and Required Measures

Theme	Recommendations on Prevention	How to Spread These Recommendations
Kitchen safety measures	"The child should be away from the cooking place."	"Build a fence. I built a fence with bamboo sticks around the kitchen. My neighbors copied this."
	"After cooking, immediately close the oven and build a fence."	"Spread to women, posters, micing*, and Facebook."
	"The oven should be in a safer place. It should be high, not on the floor."	"Tell in every class (also the teacher). So children will hear in school and teach the parents."
	"The oven should have a fence and should not be on the ground but should be higher."	"Face-to-face, micing*."
	"Cooking should not be on the ground (put up) and should be protected by a fence."	"Face-to-face (one-to-one), "hone people to tell."
Child supervision	"Child should be in a different place, not close to the water cooker."	"Face-to-face with women."
Fire safety practices	"Lighter should be kept in a safe place and do not stand too close around the fire in winter time."	"Hard to describe how. Just make people aware!"

*Micing: speech in public places with a microphone

FIGURE 1. Seven Pediatric Patients With Burn Scar Contractures of Fingers



DISCUSSION

Two-thirds of the children with contractures requiring surgical intervention in our study had sustained burn injuries in cooking-related situations and had an average age of 24.9 months at time of the burn injury. Moreover, almost half of the burn wounds were not cooled properly after the burn injury. More than half of the patients were treated by the village doctor or local healer only. This striking finding emphasizes the need for targeted burn prevention, both

primary and secondary. To design these prevention campaigns, parents, guardians, and grandparents of children in our study provided valuable recommendations.

Among the 22 pediatric patients with burn contracture included in our study, the most common causes of burn injuries were hot liquids followed by ashes and open fire. Three patients (13.6%) did not receive cooling with water to the affected area at all, and 6 (27.3%) were rinsed with water for <5 minutes. Immediate cooling of a burned area

is a critical first aid measure that has been extensively studied for its benefits in reducing burn severity and improving clinical outcomes.²³⁻²⁵ Effective acute burn management can minimize the depth of the burn injury, reduce post-burn hyperthermia, minimize pain, and reduce overall morbidity.²⁶ Guidelines from the Emergency Management of Severe Burns have recommended cooling the affected area with lukewarm running water for at least 20 minutes.²⁷ Similarly, the International Society for Burn Injuries (ISBI) Practice Guidelines for Burn Care has emphasized the importance of proper first aid, including the use of clean, running water, as a foundational step in acute burn care. The ISBI Guidelines provide a framework for acute burn management, highlighting 5 key components: immediate first aid, wound care, pain management, referral and transport, and public education.^{28,29}

Our findings revealed large gaps in burn care practices compared with these recommendations. For example, only 59% of patients received any form of cooling, and many did not meet the ISBI-recommended 15 to 20 minutes of cooling. Moreover, over half of the caregivers to patients resorted to harmful practices, such as applying raw eggs, oil, or cow dung to patients' burns, which are strongly discouraged because of their potential to cause infection and delay healing. These results highlight a pressing need to educate communities on evidence-based first aid practices. In more than half of the patients, raw eggs or eggs with salt, leaves with oil or water, and stool of a cow were used on the wound after the burn injury. These common practices were also found in other studies in rural areas of Bangladesh and other LMICs.³⁰⁻³⁴ Although some research has suggested that egg white formulations or egg membranes may have positive effects on wound healing, of note, these were tested in controlled settings or later stages of care and are not appropriate for immediate first aid.³⁵⁻⁴⁰ The continued use of these substances as first aid highlights the urgent need to provide culturally relevant education to communities about safe and effective practices for acute burn care.

For patients in our study, most parents, grandparents, or guardians sought medical care at a village doctor or local healer. Only one-third went to a hospital. The most commonly mentioned barriers to seeking medical care were the lack of referrals from the initial health care provider and financial barriers. Another study in Bangladesh indicated that factors such as education, economic status, and place of residence play a significant role in determining health care provider selection. Parents with higher incomes and greater levels of education choose more qualified health care providers over other options.⁴¹ Enhancing the health-seeking behavior of parents or guardians could play a critical role in diminishing the incidence of permanent disabilities from burns. Education of parents or guardians

on effective health care-seeking behavior has been effective.⁴² Therefore, education of caregivers is essential. In addition, in this area, the Friendship Community Medic-aides could play a vital role in improving early burn care and prevention. These women, trained by the Friendship NGO, provide primary health care, health education, and counseling within their communities.⁴³ Furthermore, it would be beneficial to pursue collaborative efforts with village doctors and traditional healers to enrich referral practices. The forging of partnerships and respecting the valuable role that they play in community health can work toward a more integrated approach to burn care and prevention.

The findings of our survey provided insights to inform potential solutions for reducing the burden of burn injuries and their long-term consequences in these communities. We identified primary causes of burn injuries, such as cooking-related incidents and inadequate first aid practices. With these insights, we can tailor burn prevention campaigns to address specific risks, such as improving kitchen safety measures and emphasizing the importance of immediate cooling. Furthermore, the survey showed gaps in health care-seeking behavior, including reliance on unqualified health care providers and financial barriers, highlighting the need for educational interventions and strengthened referral systems. The practical recommendations shared by parents, grandparents, or guardians during the qualitative components of this study offer culturally relevant, actionable strategies for reducing risk of burns and improving early management. These findings lay a foundation for developing targeted interventions, such as community education programs and collaboration with local health care providers, to promote timely and effective burn care.

Limitations

This study had several limitations. First, the study had a small sample size with only 22 children with burn scar contractures. Therefore, the findings may not be generalizable to all children with burn injuries in rural char areas in northern Bangladesh. The limited sample size may restrict the statistical power and precision of our results, making it challenging to draw definitive conclusions about the entire population. Furthermore, because of the retrospective study design that relied on questionnaires and interviews, there is a potential for recall bias and self-reporting bias. Caregivers of the children may not have accurately remembered or reported specific details, such as the circumstances during the burn injuries or the care-seeking behaviors. In addition, there is a selection bias, as the study only included children who presented with severe contractures requiring surgical intervention, potentially excluding

less severe cases in which surgery was not required. These biases can introduce a degree of uncertainty into our findings, potentially affecting the accuracy and completeness of the data collected. Although our results provided valuable insights, acknowledgment of limitations that may influence our conclusions is important.

Strengths

One of the strengths of this study lies in its unique cohort of children who presented with contractures necessitating surgical intervention. Furthermore, the study benefited from exceptional circumstances that provided sufficient time and resources to conduct in-depth interviews with participants, during which the parents, grandparents, and guardians of the patients gave insightful recommendations for future prevention programs.

Future research should focus on assessing the effectiveness of educational programs tailored for parents and caregivers. These programs can enhance the understanding of burn prevention, improve acute burn management practices, and encourage appropriate health care-seeking behaviors. Such research can help assess the effectiveness of educational interventions in reducing burn incidence and severity. Future studies should also explore the role and engagement of local health care providers, including village doctors and traditional healers, in burn injury management and prevention strategies. Understanding their influence and cooperation in the context of burn care can inform collaborative efforts and improve access to timely and appropriate health care.

CONCLUSIONS

To minimize the incidence of burns in the northern rural part of Bangladesh, a crucial aspect is to restrict a child's access to the cooking area during or after cooking (primary prevention). Furthermore, improvements in acute burn care are needed, including providing information on proper cooling after burn injuries and having an adequate referral strategy. It would be helpful to encourage cooperative initiatives with village doctors and traditional healers. By building partnerships and acknowledging their important contributions to community health, we can collectively enhance primary and secondary prevention of burns scar contractures.

There is room to improve the health-seeking behavior of caregivers after burn injuries. Parents, grandparents, and guardians of children with burn injuries shared valuable recommendations, which, along with our findings, could inform burn prevention campaigns in these areas. These insights may also enhance primary care practices, leading to better burn management and potentially reducing the risk of complications like burn contractures.

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