
Outdoor Recreational Fires: A Review of 329 Adult and Pediatric Patients

Keith C. Neaman, MD,* † Viet H. Do, MD, † Emily K. Olenzek, BS, ‡
Marissa Baca, BS, ‡ Ronald D. Ford, MD, † § Richard M. Wilcox, MD* §

Outdoor recreational fires are a frequent occurrence during the summer months and can be associated with burns resulting in significant morbidity. Both pediatric and adult populations can be affected, and their mechanism of injury is often different. Understanding these mechanisms is important when designing prevention programs. It is the goal of this study to review our experience with outdoor recreational fires. All patients who presented to Spectrum Health Blodgett Regional Burn Unit for burns secondary to an outdoor recreational fire over an 8-year period were reviewed. Demographic data, mechanism of injury, body area involved, TBSA burned, treatments undertaken, and subsequent complications were recorded. Pediatric patients (aged 16 years and younger) were analyzed independently, and risk factors were determined. A total of 329 patients suffered burns secondary to outdoor recreational fires over the length of the study. More than 35% required inpatient treatment, with an average length of stay of 4.8 days. Hands were the most frequently affected body part, with the mean TBSA involved being 3.5%. Ninety-four patients (28.6%) required split-thickness skin grafting. The most common mechanism of injury in both adult and pediatric populations was falling into an ongoing fire. Wound infection was the most common complication. Alcohol intoxication was associated with a higher burn severity and complication rate. Pediatric patients represented 39.8% of the sample. Burns secondary to outdoor recreational fires are associated with significant morbidity. Adult prevention programs should target awareness with respect to alcohol consumption and campfires secondary to the morbidity associated with these injuries. Pediatric patients are particularly susceptible, and parents should remain diligent about campfire safety and be educated about the inherent dangers of both active and extinguished fires. (J Burn Care Res 2010;31:926–930)

In the summer months, burn units frequently see an increase in the number of burns related to outdoor recreational fires (eg, barbecues and campfires). These injuries can result in significant morbidity in both pediatric and adult populations. The mechanism of injury is inherently different between these age groups and warrants careful attention when attempting to design prevention programs. In the adult pop-

ulation, alcohol is frequently involved, as is the use of various accelerants.^{1,2} Children are more likely to sustain injury secondary to a fall into the fire or hot embers.³ The goal of this study is to review our institutional experience with outdoor recreational fires in both pediatric and adult populations, with the hope of delineating the various mechanisms of injury and to develop improved educational measures.

METHODS

A retrospective cohort of 329 patients over an 8-year period (June 2001–June 2009) was reviewed. Demographic data, mechanism of injury, body area involved, TBSA burned, treatments undertaken, and subsequent complications were recorded. When available, toxicology results were reviewed. The data were analyzed for risk factors comparing and contrasting adult and pediatric populations. Pediatric patients were defined as those patients aged 16 years or younger.

*From the *Grand Rapids Medical Education and Research Center, Michigan State University General Surgery Residency, †Grand Rapids Medical Education and Research Center/Michigan State University Plastic Surgery Residency; ‡College of Human Medicine, Michigan State University; and §Spectrum Health Blodgett Regional Burn Unit, Grand Rapids, Michigan.*

Address correspondence to Richard M. Wilcox, MD, Blodgett Regional Burn Unit, 1840 Wealthy Street SE, Grand Rapids, Michigan 49506.

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Table 1. Type of fire and mechanism of injury

| | Adult, n (%) | Pediatric, n (%) |
|---------------------------------------|-----------------|---------------------|
| Type of fire | | |
| Campfire | 162 (81.8) | 123 (93.9) |
| Barbecue | 14 (7.1) | 2 (1.5) |
| Other | 22 (11.1) | 6 (4.6) |
| Mechanism of injury | | |
| Fell | 97 (49) | 76 (58) |
| Putting Objects/accelerants into fire | 29 (14.6) | 10 (7.6) |
| Walked | 6 (3) | 26 (19.8) |
| Starting fire | 15 (7.6) | 1 (0.8) |
| Putting out fire | 4 (2) | 0 (0) |
| Unknown | 16 (8.1) | 2 (1.5) |
| Other | 31 (15.7) | 16 (12.3) |

RESULTS

Demographics

Over the study period, 118 of 329 patients (35.9%) required inpatient treatment, with an average length of stay of 4.8 days (range: 1–66 days). Those seen in the clinic required an average of 3.1 visits (1–19 visits). A majority of patients were male (n = 241; 73.3%), with an average age of 22.7 years (1–85 years). Pediatric patients comprised 39.8% of the sample. The type of fire and mechanism of injury are detailed in Table 1. Thirty-nine adult patients (11.9%) were intoxicated at the time of presentation

to the emergency room. This number likely fails to capture the true incidence of alcohol use at the time of injury given that many campfire burn patients presented to the clinic the next morning and could deny the use of alcohol. Figures 1, 2 depict the frequency of second- and third-degree burns to various body segments in pediatric and adult patients. Table 2 details the frequency of involvement of various body segments irrespective of age. The hands were the most frequently affected body part followed by the arms, legs, and feet. The mean TBSA burned (second- and third-degree only) was 3.5% (<1–37%).

Interventions

Escharotomies were required in 17 patients (5.2%), occurring most frequently in the lower extremities (n = 9, 2.7%). Two patients required mechanical ven-

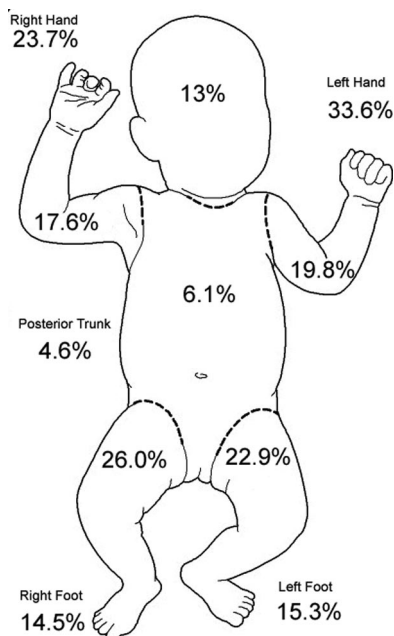


Figure 1. Percentage of involvement of various body segments in pediatric patients (aged 16 years and younger).

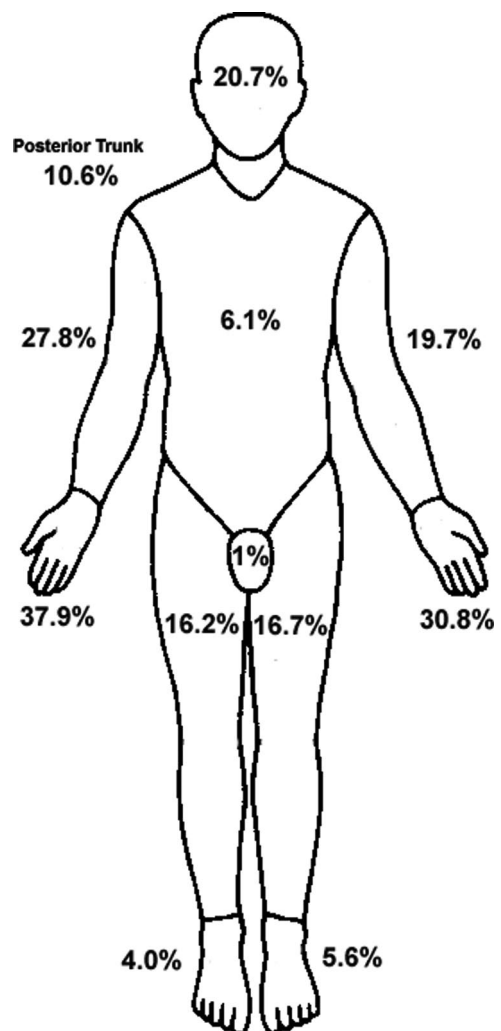


Figure 2. Percentage of involvement of various body segments in adult patients (aged older than 16 years).

tilation secondary to inhalation injury or underlying chronic lung disease. Ninety-four patients (28.6%) underwent an average of 1.2 trips (1–7 trips) to the operating room for split-thickness skin grafting. The average total area grafted was 363 cm² (1–8394 cm²). At the time of clinic evaluation, 118 patients (35.9%) required debridement of their wounds. Silvadene was the most frequent topical ointment used (n = 184, 55.9%).

Complications

Twenty-five patients (7.6%) suffered a complication secondary to burn injury, with wound infection being the most common (5.8%). Seven patients (2.1%) required admission for intravenous antibiotics. Hypertrophic scarring was seen in 2.4% of patients, with keloid scarring occurring in one patient. Five patients (1.5%) developed contractures as a result of their burns, requiring surgical treatment. One patient developed a chronic open ankle wound that was treated with a local muscle flap.

Pediatric vs Adult Population

A higher proportion of the adult patients were male, relative to the pediatric patients ($P < .001$). With regard to the mechanism of injury, both adult and pediatric patients were more likely to fall into the campfire ($P < .001$). Pediatric patients more frequently burned their hands, feet, and/or legs ($P < .04$). Admitted adult patients had a longer length of hospital stay (5.9 vs 3.0 days, $P = .02$), with a greater average TBSA burned (4.3 vs 2.4%, $P < .001$). The TBSA grafted was less in pediatric patients (99.7 vs 514.7 cm², $P < .03$), indicating a decreased severity of injury.

Ethanol

When alcohol was involved, patients were more likely to require inpatient management ($P < .001$; Table

Table 2. Frequency of involvement for various body segments

| Area of Involvement | N (%) |
|---------------------|------------|
| Head | 58 (17.6) |
| Anterior trunk | 20 (6.1) |
| Posterior trunk | 27 (8.2) |
| Right arm | 78 (23.7) |
| Left arm | 65 (19.8) |
| Right hand | 106 (32.2) |
| Left hand | 105 (31.9) |
| Right leg | 66 (20.1) |
| Left leg | 63 (19.1) |
| Right foot | 27 (8.2) |
| Left foot | 31 (9.4) |
| Perineum | 2 (0.6) |

Table 3. Comparison of adult patients with respect to alcohol involvement

| Adult | ETOH | Non-ETOH |
|------------------------------|------|----------|
| Total number | 39 | 159 |
| Required inpatient treatment | 25 | 73 |
| Required STSG | 18 | 41 |
| Total complications | 8 | 11 |
| Fall into fire | 29 | 68 |

STSG, split-thickness skin graft; ETOH, ethanol.

3). Complications occurred more frequently in patients who were intoxicated ($P = .001$). These complications included wound infections ($P = .001$) and hypertrophic scarring ($P = .023$). The severity of injury was higher as evidenced by the increased length



Figure 3. A 39-year-old man who suffered 30% TBSA burns while applying accelerant to a campfire.

of stay (10.6 vs 3.2 days, $P < .001$), the number of procedures (1.7 vs 1.1, $P < .001$), total area grafted (1129 vs 179 cm^2 , $P < .001$), and TBSA burned (7.7 vs 3.0%, $P < .001$). The most common mechanism of injury when alcohol was involved was falling into the fire ($P < .001$), suffering burns to their posterior trunk ($P < .023$) and arms ($P < .001$). Figures 3 to 6 depict several patients who suffered campfire burns.

DISCUSSION

Campfires and barbecues are a frequent part of outdoor recreation. A review of the literature revealed a paucity of studies detailing the frequency of this po-



Figure 4. A 2-year-old boy who walked into a campfire, suffering 13% TBSA burns to bilateral lower extremities.



Figure 5. A 21-year-old man who suffered 24% TBSA burns to head, trunk, back, and bilateral upper extremities after putting items into the fire.

tentially life-threatening injury. There were no mortalities recorded. When comparing campfire injuries in adults, if alcohol was involved, the morbidity was higher as evident by the increased involved TBSA, the number of procedures, longer hospitalization, and higher complication rate. Alcohol has also been shown to lead to increasing morbidity associated with these injuries in adults. This is likely secondary to the failure of intoxicated individuals to realize the severity



Figure 6. A 28-year-old man who sustained 20% TBSA burns after starting a campfire.

of their burns, as well as an increased length of exposure at the time of injury. This patient population more often sustained a campfire burn secondary to falling into the fire. Thus, the hands were the most frequent body part burned.

A common occurrence in the adult population was injuries sustained at the time of application of an accelerant, such as gasoline. Klein et al¹ recently reviewed the University of Washington's adult inpatient experience with campfire burns. With a sample of 27 patients, the most common mechanism of injury was secondary to falling into the fire and flash injuries at the time of igniting or extinguishing the fire. These results are similar to our findings. However, they only captured inpatient encounters, which potentially miss a significant percentage of the patients injured by campfire burns. In our study, a significant portion of patients were treated on an outpatient basis. Two smaller studies by Pellard et al⁴ and Khalessi et al² describe barbecue burns. The mechanism of injury was usually secondary to improper lighting of the barbecue. Although our study had few barbecue-related burns, we did find a surprising number of children injured by outdoor recreational fires.

Burn injuries to pediatric patients can be devastating to all those involved. Most injuries occur as a result of accidental falls into an active fire and infants walking into burned ashes. Choo et al³ documented their experience with 31 pediatric patients, showing nearly 70% were burned by embers or ashes. More than half were burned the morning after, when caregivers thought the fires were extinguished. In our series, 39.8% of patients were aged 16 years or younger, representing a significant portion of patients injured by campfires. Outdoor activities such as campfires create a fun and relaxing environment for all, which could lead to decreased vigilance of the adults.

Our results will hopefully serve as an impetus for other regional burn centers to increase their outreach and injury prevention efforts in their community. Other centers on review of their experience have initiated prevention programs with the intent to prohibit beach fires, use safer and higher rings with gates, and educate the public via outreach programs.^{5,6} Our senior authors plan to use these findings to educate our local community about the dangers of campfires via the written and televised media. It is our intention to inform not only the campground campers but also the backyard recreational fire pit users. The public should be educated about the proper method of extinguishing and starting fires, and parents should be made aware of the potentially devastating consequences when children are not closely watched.

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