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Original Research

Helicopter Transport in Regionalized Burn Care: One Program's Perspective

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A B S T R A C T

Background: The decision to use helicopter EMS (HEMS) for the transport of burn patients is a complex decision. This analysis sought to evaluate burn patients flown to burn centers who met predetermined criteria for patients who likely benefit from HEMS care.
Methods: A retrospective transport chart review of all burn transports covering the preceding nine and a half years was conducted to evaluate for HEMS appropriate criteria defined as patients requiring advanced airway management, ventilator support, facial burns, inhalation injury, circumferential burns, electrical or chemical burn, or major burns. All ages were included.
Results: A total of 171 cases were identified. Thirty-one (18.1%) were pediatric. Facial burns constituted the most frequent criteria met with 112 (65.5%) patients identified. Sixty-nine (40.4%) had suspected inhalation injuries. Fifty-five (32.2%) patients were intubated. Forty (28.6%) adults and twelve (38.7%) children had major burns.
Conclusion: Of the 171 burn patient transported, twenty-one (12.3%) patients did not meet any HEMS criteria. Excluding those who did not meet any criteria, 98 (57.3%) patients were flown with non-major burns. Efforts are needed to determine the risks burn patients face if slower, non-critical care transport is utilized and which patients are appropriate for HEMS.

The proper use of helicopter emergency medical services (HEMS) for the transport of burn patients provides an avenue of rapid access to definitive care at specialty burn centers. The decision to transfer a patient to a designated burn center should conform to currently accepted guidelines in conjunction with local physician-driven protocols in order to ensure the appropriate use of HEMS. Such guidelines should consider the impact of depletion of local ground emergency medical services (EMS), especially in rural areas where those resources may be scarce.

Our review sought to evaluate a single HEMS program's burn transfers across 6 proposed clinical factors to better define current trends in HEMS use as part of regionalized burn care. The flight program studied is a 3-base HEMS program in Central Virginia that provides air medical coverage to approximately 22,000 square miles of primarily rural and suburban central and eastern Virginia. The majority of this area has limited advanced life support (ALS) coverage, especially at night and on weekends when there tends to be a high reliance on the availability of minimally staffed career or volunteer EMS personnel. As a 9-1-1 response agency and consistent with most other ambulance providers across the country, transports are not refused based on clinical grounds.

There currently is no consensus statement regarding the selection of transport mode or level of care for the transport of burn patients. Although the American Burn Association (ABA) provides clear recommendations for patients requiring referral to burn care experts, there is a lack of recommendations for which patients should be emergently transferred to a burn center and what mode of transport and level of care during transport is appropriate. Given the expense associated with HEMS transport, there remains a significant need to better define the burn population benefiting from HEMS transport and establish standards.

Methods

After institutional review board approval, a preexisting quality assurance/quality improvement database was queried for all burn patients transported between July 1, 2005, and December 31, 2014, to evaluate the characteristics of the burns across 6 primary metrics. These metrics were selected based on prior expert

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1. Patients needing critical care services, to include
    a. Airway management for patients with inhalation injuries, significant facial burns, or ingestions of caustic substances
    b. Need for mechanical ventilation during transport
2. Need for rapid transport
    a. Circumferential extremity burns with compartment syndrome and need for emergent escharotomy
    b. Circumferential chest or neck burns
    c. Chemical burns requiring specific antidote therapy not available locally; though some chemicals cannot be flown without complete decontamination
    d. Electrical injury given the often extensive and initially difficult to evaluate nature of these often latent injuries
3. Concomitant trauma requiring evaluation at an American College of Surgeons verified Level 1 trauma center

Figure 1. Criteria for burn patients appropriate for helicopter EMS transport.

recommendations and conditions that likely make patients appropriate for HEMS transport.[1-3] The criteria included intubation, major burns defined as the percent of total body surface area (TBSA) > 25% in adults and > 20% in children, facial burns, suspected inhalation injury, circumferential burn, and chemical or electrical burn. Children were defined as less than 18 years of age. This is summarized further in Figure 1.

Two separate reviewers independently entered data, one from 2005 to July 2008 and a second from July 2008 onward using a standardized extraction tool to create the preexisting quality assurance/quality improvement database. Both reviewers were active flight crewmembers. Each chart was reviewed as necessary to characterize each category as either yes or no. All burn factors were based on the transport record because hospital records were not available. Facial burns were recorded as yes if the chart specifically indicated facial burns as the reason for intubation, burns were noted to the eyebrows, there was singed nose hair, or there were partial thickness or greater burns to the face. Inhalation injury was recorded as yes if the providers indicated an inhalation injury as a reason for intubation, a change in voice, or carbonaceous sputum production.

During portions of the analyzed time period, Virginia did not have any ABA-verified burn centers. At the time of data collection, all American College of Surgeons level 1 trauma centers were recognized as capable of handling burn patients of all age groups by the Virginia Department of Health and the prehospital and medical communities in Virginia.

Results

A total of 171 cases were identified. This represents 1.53% of the 11,175 transports completed during this period. Thirty-one (18.1%) were pediatric, and 140 (81.9%) were adults. The median age of transported adults was 43.5 years and 4 years for pediatric cases. Seventy-one (50.7%) adults and 9 (29.0%) children were interfacility transfers.

Facial burns constituted the most frequent criteria met, with 112 (65.5%) patients identified. Sixty-nine (40.4%) patients had suspected inhalation injuries. Fifty-five (32.2%) patients were intubated. Of the patients suspected to have facial burns and inhalation injuries, 42 (75.0%) were intubated. Of the patients with only facial burns, 2 (1.2%) were intubated. TBSA burned for intubated children was 22.3% compared with 13.7% for nonintubated children. Intubated adults were also more severely burned (23.5%) compared with nonintubated adults (15.2%).

Forty (28.6%) adults and 12 (38.7%) children had major burns, defined as ≥ 25% TBSA burned for adults and ≥ 20% TBSA for children. One hundred nineteen (69.6%) patients had nonmajor burns. TBSA burned was similar between adult interfacility (17.6%) and scene (19.0%) transfers. TBSA for children was 13.3% for interfacility transfers and 16.6% for scene flights.

Twenty-one (12.3%) patients did not meet any transfer criteria. Eight (25.8%) of these were children, and 13 (9.3%) were adults. All pediatric cases and 11 adults were scene requests. Only 52 (30.4%) patients were flown with major burns. Excluding those who did not meet any criteria, 98 (57.3%) patients were flown with nonmajor burns (< 20% in children and < 25% in adults) because of concerns related to 1 of the other identified criteria. Eight (4.7%) patients had isolated extremity burns. Tables 1 and 2 summarize this information.

Table 1
Characteristics of Adult and Pediatric Burn Transports

Total Cases, 171	Interfacility Transfers, 80 (46.8%)	Scene Requests, 91 (53.2%)	Major Burns, 52 (30.4%)	Nonmajor Burns, 119 (69.6%)	No HEMS Criteria Met, 21 (12.3%)
Adults: 140 (81.9%)	71 (50.7%)	69 (49.3%)	40 (28.6%)	100 (71.4%)	13 (9.3%)
Pediatric: 31 (18.1%)	9 (29.0%)	22 (71%)	12 (38.7%)	19 (61.3%)	8 (25.8%)

HEMS = helicopter emergency medical service.

Table 2
Helicopter Emergency Service Appropriate Criteria Met Among Transported Burn Victims

Criteria Met	Total Cases, 171 Cases	Facial Burns, 112 (65.5%)	Suspected Inhalation Injury, 69 (40.4%)	Facial Burns and Suspected Inhalation Injury, 56 (32.7%)
Intubation status	Total intubated: 55 (32.2% of total cases)	Intubated with isolated facial burns: 2 (1.8% of facial burns)	Intubated with isolated suspected inhalation injury: 11 (15.9%)	Intubated with both facial burns and suspected inhalation injury: 42 (75.0%)

Discussion

The role and value of HEMS in trauma systems continues to be debated, and more work is needed to best identify patient populations benefiting from this level of care. Among burn patients, there continues to be a lack of guidance on which patients should be flown emergently to regional burn centers. Current ABA guidelines do not directly address these questions and, instead, only provide guidance on the need for referral to designated burn centers. These guidelines do not provide direction for prehospital and emergency department providers to determine if patients need emergent transfer to a burn center and what mode of transport is most appropriate.[4]

Patients with severe burns require intensive resources for recovery at centers designated for these injuries. However, the mainstay of initial management of even severe burns is airway