ORIGINAL ARTICLE

Evaluating incorrect management of transferred pediatric burn patients

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ABSTRACT

BACKGROUND: Burns constitute one of the most important, potentially fatal types of trauma. Appropriate emergency management is essential in the avoidance of complication and the success of treatment. Emergency management and indications of transfer throughout the country were reviewed in the present study.

METHODS: Charts of 187 patients transferred to the present hospital from other cities between January 2009 and December 2013 were evaluated. Factors included demographics, referral vehicles, intravenous fluid therapy, respiratory conditions, urine drainage, and surgical complications.

RESULTS: According to transfer criteria, only 15 patients (8%) were transferred under appropriate conditions. In the transfer of 172 (92%) patients, at least 1 error was found.

CONCLUSION: Transport failure, and incorrect management and treatment causing complications such as the development of respiratory problems after unnecessary sedation, occur in developing countries such as Turkey. Referral protocols for burn patients have already been defined in the country, though training and feedback regarding effective treatment is still lacking.

Keywords: Burns; children; prevention; therapy.

INTRODUCTION

Acute burn management is necessary for survival. Organ damage, infection, and pain during burn treatment are widely regarded as the primary problems.[1,2] Burn injury may occur on an individual basis, or may be sustained by multiple people in conditions such as those of an earthquake.[3] Simple procedures to treat acute injury are effective in achieving survival.[4]

Assessing need for hospitalization is a component of treatment.[1] Hospitals with facilities inadequate for burn treatment should have transfer strategies. Some indications for patient transfer are 2nd-degree burns covering 10% or more of total body surface area (TBSA), 3rd-degree burns, burns in certain locations, chemical burns, electric burns, inhalation injury, associated trauma, current diseases, and unskilled staff.[5] The error rate of non-specialist physicians has been reported as high as 75%.[4,6,7] In addition, unfortunately, 58% of burn centers have no treatment protocols.[8]

Errors in management during burn patient transfer were presently evaluated in an effort to improve accountability and reform emergency care strategies.

MATERIALS AND METHODS

Patients transferred from other cities were evaluated in the present retrospective study. Reports of status at arrival were recorded and compared with the standards of transfer. Parameters evaluated were: transfer status, TBSA of burn, intravenous access status, bladder catheterization, intubation, respiratory problems, infections, and surgical problems. Results were compared with those reported.

RESULTS

Between January 2009 and December 2013, 187 patients (106 males, 81 females) were admitted to the present institution from other cities. Mean patient age was 41 months. De-

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Table 1a. Patient demographics

Demography	Findings
Male/female	106/81
Mean age (month)	41.34
Mean hospitalization (days)	22.2

Table 1b. Burn types, numbers, and percentages

Burn type	Findings
Scald burn	137
Flame	30
Electricity	10
Contact burn	2
Flame+inhalation	6
Chemicals	2
1–19% burn area	69
20–39%	77
40% and higher	41

mography and burn features are described in Tables 1a and b. The summary of evaluated parameters and their percentages were shown in Table 2.

When calculated burn area differed more than 5% at initial and final examination, the discrepancy was assumed to be based on miscalculation. According to the criteria, 38% (n=71) of burn rates had been miscalculated. In addition, 11 transferred patients had burns of less than 10%, rendering the transfer unnecessary.

Intubation and Respiratory Problems

A total of 21 patients (13%) were intubated prior to arrival or in the present unit. Average burn percentage of these patients was 38%. If intubation indications were accurate, ventilation was continued. If indications were inaccurate, as in the majority of cases, patients were extubated, typically within the first 2–4 hours of admission. In total, 17 patients were extubated on the first day of admission, all of whom had been intubated due to respiratory depression of narcotic analgesics. All had scald burns, inhalation burns were not detected. Two other patients, intubated due to concerns of sepsis, had inhalation-related problems. One patient recovered, after the development of cerebral palsy. Patient numbers and causes of intubation are shown in Table 3.

Fluid Management

Intravenous catheter had not been administered in 22 (12%) patients upon admission. In addition, no intravenous fluid had been administered in a total of 128 patients (68%), including the 22, upon admission. Hypotonic fluid had been administered to 38 (24.5%) patients; Ringer's lactate and 0.9% NaCl solution had been administered to only 21 (12.2%) patients. Fluid management is shown in Table 4.

Burn Area Measurements

A total 136 (72%) patients had scald burns, 37 (19%) had flame burns, and 11 (6%) had electrical burns. Three (2%) patients had contact burns and chemical injuries (Table 5), and 5 patients had flame burns with inhalation injuries.

Burn area measurement errors were evaluated. Measurement errors of less than 5% were considered insignificant. A total of 71 (38%) patients had burns that covered less TBSA than had been originally recorded. Eleven of the 71 patients (16%) had burns covering less than 10% TBSA. A total of 116 patients (62%) had been transferred with correct burn area measurements. Burn conditions, which are important for transfer indication, are summarized in Box 1.

Urinary Bladder Catheterization

Urinary catheters had been administered in only 27 patients. Burn areas were less than 20% TBSA in 67 patients, who should have been transferred without catheterization. Among patients with burn areas greater than 20%, 93 patients had not been administered a catheter. The transfer of these patients without urinary catheterization was assumed to be an error. Rates of urinary catheterization are shown in Table 6.

Table 2. Referral parameters of burn patients. Well-maintained is defined as optimal conditions for transfer (effective fluid, right solution, urinary monitoring)

Transferring conditions	Present	Absent	Wrong indication findings	% Wrong ind.
Intravenous catheter	165	22	22	11.7
Ringer's lactate	21	166	166	88.7
Urinary catheter	27	160	93	49.7
Intubated patient	21	166	17	9
Air ambulance	18	169	–	
Well-maintained	15	172	172	91.9

Table 3. Intubations and related problems are shown

Intubation	Number of patients	Wrong indications
Respiratory depression	17	17
Septic problem	2	0
Inhalation	2	0
Total	21	17

Table 4. Fluid management of patients

Fluid management	Number of patients	TBSA burn percentage
No intravenous fluid	128*	25
Hypotonic solutions	38	30
Ringer lactate	21	30
Total	187	–

*22 patients did not have intravenous catheter, and 106 patients had intravenous catheter without fluid. TBSA: Total body surface area.

Infection and Other Acute Problems

Infection was detected in 6 patients by specimens obtained at arrival. Candidiasis (n=3), Acinetobacter (n=2) and Enterococcus with Klebsiella (n=1) were identified. Two patients died 48 hours after arrival. Median burn area of these patients was 28%. One died of acute renal failure, the other of septicemia due to Acinetobacter. Rates of infection are shown in Table 7.

Emergency Fasciotomy

Emergency fasciotomy is considered to be an important burn treatment, particularly of circular burns. The procedure was not performed in 5 patients, and was performed inadequately in 1. Refasciotomy was performed in 5 patients and fasciotomy was extended for 1. Three patients in this group died during follow-up.

Transfer Types

Three types of transfer vehicles were used: vehicles belonging to the patient, land ambulance, and air ambulance. Eighteen patients (9.6%) were transferred from other cities in their own vehicles, 13 of whom had burns covering more than 10% of TBSA (mean: 23%; min: 10%; max: 50%), and who should have been transferred by ambulance. Eighteen patients (9.6%) arrived by air ambulance, 3 of whom died within 24–72 hours. A total of 151 patients arrived by land ambulance. Although transfer indication is a burn area of 10% TBSA or greater, 10 patients transferred by land ambulance had a burn area of less than 10%. Types of transfer and information regarding indication are shown in Table 8.

DISCUSSION

Millions of people world-wide sustain burn injuries in a single year.[1] Burns are a major problem, particularly in developing countries.[9–11] In spite of the number and scale of injuries, primary burn management has yet to be perfected.[1] Many factors may contribute to insufficient management. Lack of data feedback regarding mistakes is a major problem, usually caused by insufficient data collection training of primary care

Table 5. Burn type, mean burn total body surface area, and number of patients

Burn area measurements	Scald burns	Flame burns	Electric burns	Chemical burns
Number (% patients), n (%)	136 (73)	37 (20)	11 (6)	3 (1)
Burn total body surface area percentage (%)	34	24	9.70	15

Box 1: Number of patients with misidentified burn areas.

Diagnostic difference	Number of patients
Incorrect burn area measurement	71
Burn area less than10%	11

Table 6. Catheterization of urinary bladder, according to burn total body surface area

Urinary catheter	Number of patients	1–19%	20–39%	40–59%	60-↑
Present	27	2*	11	9	5
Absent	160	67*	65	23	5
Total	187	69*	76	32	10

*Transferring without urinary catheterization was suggested as acceptable.

Table 7. Infections of referred patients are shown

Infection	Number of patients
Candidiasis	3
Acinetobacteria	2
Other	1
Death	2

providers. It was reported that degree of burn was incorrectly defined in 75% of cases, with incorrect burn classification in the majority of patients.[6]

Primary care physicians manage the majority of burn cases.[6] A primary goal of these physicians is to evaluate indications for hospital admission or outpatient care.[1] If necessary, patients should be consulted, and transfer, if appropriate, must be conducted properly.[12,13] Transfer criteria have been identified[5] as follows: Patients must be transferred if they have 2nd-degree burns covering 10% or more of TBSA, 3rd-degree burns, burns in certain locations, chemical burns, electric burns, inhalation injury, associated trauma, current disease, and/or if staff at the immediate institution are unskilled.[5] These indicators should be reported correctly, in addition to time of injury.[5]

In some countries, burns are sufficiently treated in a few tertiary management centers in certain big cities.[14] Burn units and centers are distributed all over Turkey, and are collectively integrated with structured protocols. The Turkish Ministry of Health has also prepared protocols for the adequate treatment of burn patients, and related training and graduate programs exist.[15] These criteria have also been published by the Scientific Burn Council of Ministers.[16] Although a theoretically well-defined protocol is available, significant errors affecting efficiency and outcome of burn management are common, as is demonstrated by the present results. To our knowledge, the present is the first report to assess emergency burn management in Turkey. There was, surprisingly, insufficient information available in the literature in English. As a result, we prefer to individually discuss each parameter of the transfer criteria.

Children have narrower airways than adults.[8] Particularly in cases of inhalation injury, intubation may be performed when needed,[6,17] as it may be life-saving if correctly performed. However, the present results show that intubation has often been incorrectly performed, and that a majority of patients should not be intubated. By evaluating transfer reports, it was discovered that intubation was often performed after incorrect doses of inappropriate sedative agents were administered. Unfortunately, 1 patient with ischemic hypoxia developed cerebral palsy after an incorrectly administered intubation.

In Turkey, one of the most significant errors in burn management during transfer is failure of fluid resuscitation. Suitable organ perfusion is a protective agent against shock.[5,13,18] Crystalloid solutions are important in the protection of vital organs.[5,13,18] Timing is also important; if fluid resuscitation is not initiated within 2 hours of injury, risk of death may increase.[18,19] Standard criteria for adequate fluid resuscitation exist.[20,21] However, rates of incorrect fluid resuscitation have been reported as 23%.[22] Although this percentage was greater in the present study, results of resuscitation (11.3%) were also better. Patient transfer is a major handicap for fluid resuscitation. When transfer time is long, risk of complication increases.[14] Though the national burn management protocol includes guidelines for fluid resuscitation,[15] these guidelines have not been correctly implemented, as is regrettably demonstrated by the present results.

Burn wounds are expressed as a percentage of TBSA, and evaluation of TBSA is an important factor in appropriate burn management.[1] For children, the Lund and Browder chart is the easiest and most accurate form of measurement.[23] In addition, it is possible to calculate the appropriate amount of liquid for treatment.[24] On this issue, the present findings may contribute to decreasing the number of unnecessary referrals, as well as rates of morbidity during transfer. It was found that in 38% of cases, initial burn area measurements recorded were lower than those conducted at the present institution. A similar rate (37%) was reported in a study in which burn percentages were compared.[25] In addition, as the burn area was less than 10% in 16 of the present patients, hospitalization was not indicated.

Organ perfusion is an important concern during burn treatment.[5,13,18] A main determinant of proper perfusion is urine output.[18] Proper fluid administration is classified as 1 mL/kg/h.[5,13] Patients must be monitored for urine output with urinary catheterization in intensive care units. Among the 160

Table 8. Transfer types of patients

Transfer types	Number	Wrong indication	Reason of wrong indication
Own vehicle	18	13*	>10 burn TBSA
Land ambulance	151	10**	<10 burn TBSA
Air ambulance	18	0	0

*Patients with more than 10% burn TBSA were not supposed to be transferred using their own vehicles. **Patients with less than 10% burn TBSA were not supposed to be transferred. TBSA: Total body surface area.

present patients without urinary catheters, no urinary catheter had been administered in 93 patients with burns covering more than 20% of TBSA. In the present assessment, this finding was considered a failure of treatment. In fact, rates of urinary catheterization may indicate efficacy of treatment.

In the present series, 6 patients had infection upon arrival, though none were colonized. It is believed that primary causes of infection were poor wound care, poor excision of dead tissue, inadequate surgical procedure, and unnecessary use of antibiotic. All infected patients had been transferred late, suggesting that infection may spread during the transfer. Ethical problems are also present.

Escharotomy and fasciotomy are the most important surgical procedures performed in burn patients. Indications are typically high-voltage electrical injury, and fractured bone or vascular injuries.[13] Compartment syndrome is the main reason to perform fasciotomy,[13,18] though fasciotomy is rarely necessary.[13] However, if these procedures are not performed when necessary, irreversible problems occur. In a total of 6 patients (3%), fasciotomies were performed or revised upon arrival. As a result, performance of emergency fasciotomy was found to be insufficient.

Land and air ambulances are effective tools for patient transfer. In the present study, 151 patients arrived with land ambulance, 18 arrived with air ambulance, and 18 arrived in their own vehicle. Medial burn percentage of TBSA was 45% for patients transferred by air, all of whom were transferred with correct indications. Air ambulance transfers were found to be incorrect in nearly 50% of cases, in a study with an English population. In Turkey, air transfers are a new function, which may be the reason for the high percentage of correct transfer performance.[26] Three patients transferred by air ambulance died.

Presently revealed are significantly high rates of errors made by emergency staff during burn transfer management. Major mistakes were evident in selection of fluid (88.7%), use of urinary catheter (49.7%), intubation (9%), and fasciotomy (3%). Each may cause death. Other problems may arise during transfer, and some patients may travel to various hospitals before being admitted. This too will contribute to increased morbidity and/or mortality.[27]

As mentioned above, little related information is available in the literature, constituting a limitation of the present study. Nevertheless, the present may be a pioneering study in the evaluation of burn transfer management.

Conclusion

Burn injuries are common, and fortunately, death is a rare outcome. Complications may arise when emergency management is inappropriately performed, which may occur in any care center. Transfer to a more advanced center is a logical means of minimizing complications. However, rational transfer strategies are needed. If transfer policy is to be improved, training is necessary. For this purpose, as an example, the American Burn Association has published an Advanced Burn Life Support protocol. Treatment protocol for burn patients has been published in most countries. In Turkey, protocol published by the Ministry of Health was implemented in all emergency service departments. However, universal adaptation has been difficult to achieve in Turkey and in other developing countries, as the present results demonstrate. Effective management of burn patients requires appropriate transfer decisions and timing, as well as accurate recording of information. In order to ensure optimal burn management, training must be provided to all staff, and feedback is vital in the efficacy of this education.

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REFERENCES

1. Morgan ED, Bledsoe SC, Barker J. Ambulatory management of burns. Am Fam Physician 2000;62:2015–26, 2029–30, 2032.
2. Düzgün AP, Senel E, Ozmen MM, Kulaçoğlu H, Işik Y, Coşkun F. The evaluation of the patients admitted to a burn center in Turkey. Ulus Travma Acil Cerrahi Derg 2003;9:250–6.
3. Dursun R, Karadaş S, Görmeli G, Işık Y, Cakır C, Görmeli CA. Analysis of burn cases observed after the 2011 Van earthquake. Ulus Travma Acil Cerrahi Derg 2013;19:251–5. Crossref
4. Allison K, Porter K. Consensus on the prehospital approach to burns patient management. Emerg Med J 2004;21:112–4. Crossref
5. Mlcak RP, Buffalo MC, Jimenez CJ. Pre-hospital management transportation and emergency care. In: Hendron DN, editor. Total Burn Care, London: Elsevier Saunders; 2014. p. 93–102.
6. Spanholtz TA, Theodorou P, Amini P, Spilker G. Severe burn injuries: acute and long-term treatment. Dtsch Arztebl Int 2009;106:607–13.
7. McCormack RA, La Hei ER, Martin HC. First-aid management of minor burns in children: a prospective study of children presenting to the Children's Hospital at Westmead, Sydney. Med J Aust 2003;178:31–3.
8. Holland AJ. Pediatric burns: the forgotten trauma of childhood. Can J Surg 2006;49:272–7.
9. Senel E, Yasti AC, Reis E, Doganay M, Karacan CD, Kama NA. Effects on mortality of changing trends in the management of burned children in Turkey: eight years' experience. Burns 2009;35:372–7. Crossref
10. Cuenca-Pardo J, de Jesús Alvarez-Díaz C, Comprés-Pichardo TA. Related factors in burn children. Epidemiological study of the burn unit at the "Magdalena de las Salinas" Traumatology Hospital. J Burn Care Res 2008;29:468–74. Crossref
11. Razzak JA, Luby SP, Laflamme L, Chotani H. Injuries among children in Karachi, Pakistan--what, where and how. Public Health 2004;118:114–20. Crossref
12. Mandl KD, Kohane IS, Brandt AM. Electronic patient-physician communication: problems and promise. Ann Intern Med 1998;129:495–500.
13. White CE, Renz EM. Advances in surgical care: management of severe burn injury. Crit Care Med 2008;36(7 Suppl):318–24. Crossref
14. Ahuja RB, Bhattacharya S. Burns in the developing world and burn disasters. BMJ 2004;329:447–9. Crossref

15. Turkish Republic Ministry of Health. Available at: http://www.tkhk.gov.tr/Eklenti/307,23022012-tc-sb-yanik-algoritmasi.pdf?0.
16. Yastı AÇ, Şenel E, Saydam M, Özok G, Çoruh A, Yorgancı K. Guideline and treatment algorithm for burn injuries. Ulus Travma Acil Cerrahi Derg 2015;21:79–89. Crossref
17. Foley FD, Moncrief JA, Mason AD Jr. Pathology of the lung in fatally burned patints. Ann Surg 1968;167:251–64. Crossref
18. Latenser BA. Critical care of the burn patient: the first 48 hours. Crit Care Med 2009;37:2819–26. Crossref
19. Wolf SE, Rose JK, Desai MH, Mileski JP, Barrow RE, Herndon DN. Mortality determinants in massive pediatric burns. An analysis of 103 children with > or = 80% TBSA burns (> or = 70% full-thickness). Ann Surg 1997;225:554–69. Crossref
20. Warden GD. Burn shock resuscitation. World J Surg 1992;16:16–23.
21. Carvajal HF. Fluid therapy for the acutely burned child. Compr Ther 1977;3:17–24.
22. Hagstrom M, Wirth GA, Evans GR, Ikeda CJ. A review of emergency department fluid resuscitation of burn patients transferred to a regional, verified burn center. Ann Plast Surg 2003;51:173–6. Crossref
23. Lund CC, Browder NC. The estimation of areas of burns. Surg Gynecol Obstet 1944;79:352–8.
24. Moore FD. The body-weight burn budget. Basic fluid therapy for the early burn. Surg Clin North Am 1970;50:1249–65.
25. Collis N, Smith G, Fenton OM. Accuracy of burn size estimation and subsequent fluid resuscitation prior to arrival at the Yorkshire Regional Burns Unit. A three year retrospective study. Burns 1999;25:345–51.
26. Chipp E, Warner RM, McGill DJ, Moiemen NS. Air ambulance transfer of adult patients to a UK regional burns centre: Who needs to fly? Burns 2010;36:1201–7. Crossref
27. Günay K, Taviloğlu K, Şad O, Eskioğlu E, Ertekin C. Acute Electrıcal Burns: 6 Year Experıence. Ulus Travma Acil Cerrahi Derg 1995;1:97–101.

ORİJİNAL ÇALIŞMA - *ÖZET*

Transfer edilen çocuk yanık hastalarındaki yanlış uygulamaların değerlendirilmesi

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AMAÇ: Yanıklar çocuklarda ölüme en çok neden olabilen travmalardan biridir. Bu yüzden, uygun acil müdahale komplikasyonları önlemek ve başarılı tedavi sağlamak için gereklidir. Bu çalışmada, yanık hastalarının acil müdahale çalışmaları değerlendirildi ve ülkemizdeki sevk endikasyonları gözden geçirildi.
GEREÇ VE YÖNTEM: Hastanemize Ocak 2009 ile Aralık 2013 tarihleri arasında diğer şehirlerden sevk edilmiş olan 187 hastanın dosyaları değerlendirildi. Demografiler, sevk araçları, intravenöz sıvı tedavileri, solunum durumları, idrar çıkışları ve cerrahi komplikasyonlar değerlendirildi.
BULGULAR: Transfer kriterlerine göre sadece 15 hasta (8%) uygun koşullarda sevk edilmiştir. Yüz yetmiş iki hasta (%92) için ise, en az bir transfer hatası ile sevk edildiği anlaşılmıştır.
TARTIŞMA: Gelişmekte olan ülkelerde; yanlış müdahaleler, hatalı tedaviler, gereksiz sedasyon ile solunum problemleri ve transport hataları mevcuttur. Ülkemizde, sevk edilecek hastaların protokolleri tanımlanmıştır ancak etkili tedavi için eğitim ve geri bildirim eksikliği vardır.
Anahtar sözcükler: Çocuklar; korunma; terapi, yanıklar.

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