Social Support Correlates with Survival in Patients with Massive Burn Injury

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Large burn size, inhalation injury, age, and associated trauma increase the rate of mortality after burns. However, not all patients with large burns and significant risk factors die. In this study, we wanted to determine other presenting factors that might indicate a survival benefit for burn patients with large burns. We reviewed charts of 36 patients with burns ≥60% TBSA that were aggressively resuscitated at the University of Washington Burn Center from 1990 to 2000 to determine whether survivors of large burns exhibit presenting variables that predict survival. Patients who had comfort care measures initiated at admission were excluded from this analysis. Survivors (n = 16) and nonsurvivors (n = 20) had no significant differences in age, total burn size, inhalation injury, or need for escharotomy. Full-thickness burn size was significantly smaller for survivors (58%) than for nonsurvivors (73%; *P* = .02). Survivors (81%) were more likely than nonsurvivors to have social support (35%; *P* = .007). A full-thickness burn ≥80 % TBSA was the only variable uniformly associated with mortality, suggesting that patients who survive large burns have a partial-thickness component that heals without surgery. The difference in degree of social support was one unique distinction that may impact patient survival and is worth further investigation.
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More than 1 million burn injuries occur annually in the United States.[1] Whereas most are minor, 60,000 to 80,000 people require admission to a hospital because of major burn-related injuries, and 5,000 of these patients die each year.[1] Predictors of mortality have been well recognized to include large %TBSA burn, increasing age, and inhalation injury. Survival rates for patients treated in burn centers have markedly improved during the past 20 years as the result of early excision and grafting and improved critical care management.[2] The key to improving treatment of massively burned patients includes appropriate early resuscitation, aggressive treatment of pulmonary injury, and a better understanding of the physiological responses to severe burns. In spite of these improved approaches, patients that are aggressively treated for large (≥60% TBSA) burns still have a high mortality rate. We wanted to determine whether survivors of large burns exhibit presenting variables that predict survival. In addition to the traditional medical variables, we also wanted to examine the importance of psychosocial variables, specifically social support.[3]

METHODS

We retrospectively reviewed the medical records of patients with ≥60% TBSA burn who were aggressively resuscitated and had early excision and grafting between January 1990 and December 2000 at the University of Washington Burn Center. This review was performed in accordance with and approved by the University of Washington Institutional Review Board. The decision to provide comfort care to patients with large, deep burns, advanced age, limited donor sites, significant comorbidity, and associated injuries is an attending burn surgeon decision made on an individual case basis; patients treated with comfort care were excluded from this analysis.

The identified patients were categorized into two

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groups: survivors and nonsurvivors. Demographic, therapeutic, and outcome data included age, weight, %TBSA burn and %TBSA full-thickness burn, length of intensive care unit (ICU) stay, length of hospital stay, comorbidity, inhalation injury, use of plasmapheresis, escharotomy, infection, wound coverage with a manufactured dermal template (Integra™, Integra LifeSciences, Plainsboro, NJ), and the presence of social support systems. Patients who had a history of being in an enclosed space, of having high levels of carboxyhemoglobin, and having carbonaceous-sputum were considered to have an inhalation injury.

Social support was determined by whether or not a patient had family or friends present during their ICU stay. Because this study was retrospective, a qualitative analysis of the social support could not be conducted. It is important to note that the number of visitors or social support persons available has not been found in previous studies to be as important as the quality of social support that the patient perceives.[3] For example, having multiple friends and family present who do not get along, who demand a lot of attention, and who generally are inappropriate may create more stress for the patient and may not be beneficial. However, one caring friend who provides appropriate support can be extremely important.

Statistical Analysis

We used the two-sample Wilcoxon rank-sum (Mann–Whitney *U* test) test to evaluate potential differences in continuous variables, age, weight, %TBSA burn, %TBSA full-thickness burn, length of ICU and hospital stay between survivors and nonsurvivors. Whereas results from this test describe differences in median values, data are expressed as mean ± SD. We used Fisher's two-tailed unpaired exact probability test to test for potential differences between survivors and nonsurvivors in the categorical predictors, incidence of inhalation injury, plasmapheresis, escharotomy, infection, wound coverage with Integra and social support. Results from this test are expressed as an odds ratio and 95% confidence interval. All tests were two-tailed, and a *P* value of less than .05 was considered to indicate statistical significance. Multiple logistic regression was used to examine predictors for survival. Covariates were considered in a multivariate regression model in which univariate *P* values were less than .1. Statistical analyses were performed using Stata, version 6.0 software (StataCorp, College Station, TX).

RESULTS

Thirty-six patients (9 women, 27 men) with ≥60% TBSA burn who were resuscitated fully and had early excision and grafting were included in this study. Sixteen patients survived (44%), and 20 patients did not survive (56%). The etiology of burns among survivors included 13 flame burns, 2 flash burns, and 1 chemical burn; the nonsurvivors included 14 flame burns, 4 scald burns, 1 chemical burn, and 1 combined electrical/flame burn.

No statistically significant differences in age ($P = .054$), weight ($P = .085$), or burn size ($P = .34$) were identified between survivors and nonsurvivors, as shown in Table 1. The median size of a full-thickness burn was significantly smaller for survivors (58% TBSA) than for nonsurvivors (73% TBSA; $P = .02$). All patients with a full-thickness burn ≥80% TBSA (n = 8) died. As expected, survivors had significantly longer stays in the ICU ($P = .01$) and hospital ($P < .001$; Table 1). Interestingly, in this study, no patients with burns greater than 60%TBSA who were older than 40 years (n = 8) survived; however, all patients older than 40 had ≥60% TBSA full-thickness burn, suggesting that burn size, rather than age, contributed to their mortality risk.

Increased rates of comorbidity and inhalation in-

Table 1. Demographic characteristics of survivors and nonsurvivors

Characteristics	Survivors	Nonsurvivors	*P* Value
Age (year)	24 ± 8 (range, 10–39)	34 ± 22 (range, 4–73)	.054
Weight (kg)	80 ± 27	62 ± 33	.09
% TBSA burn	71 ± 8%	74 ± 10%	.34
% TBSA full-thickness burns	58 ± 19%	73 ± 12%	.02*
ICU stay (days)	42 ± 28	25 ± 42	.01*
LOS (days)	78 ± 42	25 ± 42	<.001*

ICU, intensive care unit; LOS, length of stay.

Demographic characteristics of the survivors and nonsurvivors group show that the only admission finding that differs in nonsurvivors is the size of the full-thickness burn. Data represent mean values ± SD. Asterisks indicate statistically significant differences.

* *P* value calculated using two-sample Wilcoxon rank-sum (Mann–Whitney *U*) test.

jury in the nonsurvivor group were not statistically significant (P = .2 and P = .7, respectively). Other interventions that might affect survival in these patients did not have a significant difference in this analysis. Of four patients who underwent plasmapheresis, one died and three survived; as such, plasmapheresis was not associated with survival (P = .2). Likewise, escharotomy was performed as often in survivors (37%) as nonsurvivors (35%) and was not associated with survival (P = 1.0). Integra wound coverage after burn excision became available after 1997; seven patients reviewed were treated with Integra; three survived and four died, but the difference did not reach statistical significance (P = 1.0; Table 2).

One important difference in our analysis was a greater presence of social support for survivors (81% had some social support) compared with nonsurvivors (35% had social support; P = .007). In a multivariate logistic regression model controlling for demographic variables (age and weight) and for variables found to have P values less than 0.1 on univariate analysis, no single variable was found to be a significant predictor of survival.

DISCUSSION

According to prediction formulas reported by Zawacki et al[4] and Ryan et al,[5] all patients in this cohort were at high risk of dying. We wanted to determine whether there were differences between those that survived and those that did not survive. The only differences that we identified were size of full-thickness burn and presence of social support.

A recent report revealed a 5% decline in burn-related deaths in the United States during the last 20 years.[1] The outcomes of improved burn care have rendered mortality a moving target because patients who would previously have died now frequently survive.[6] Sheridan et al[7] reported that most children, even those younger than 2 years of age, should survive after a massive burn. Several authors have attempted to develop predictive models for mortality in burn patients.[8–10] However, no published studies have reported how to predict which patients with large burns will survive.

Previous literature has documented age, total burn size, deep burn size, and inhalation injury effects on rates of mortality.[11–13] In this study of fully resuscitated patients with burns larger than 60% TBSA, age, weight, total burn size could not be associated with survival. Whereas difference in age between survivors and nonsurvivors only approached significance in this cohort group, all patients older than 40 years old died, suggesting that age older 40 is not consistent with survival. There was no difference in total burn size in our cohort, but survivors had significantly smaller full-thickness burn size than nonsurvivors; because all patients with ≥80% TBSA full-thickness burn died, the extent of full-thickness burn may be one criterion to determine which patients are likely to survive if all other parameters are equal.

Although these variables may not have predicted survival in our cohort, our sample size of 36 patients was small and the lack of significance could represent a type 2 error. Power calculations to determine the number of patients needed to detect a significant difference between survivors and nonsurvivors predicts that sample sizes of 44 (age), 48 (weight), 157 (total burn TBSA), and 21 (full-thickness burn TBSA) are needed for an 80% chance of detecting a significant difference at the 5% level. Therefore, our data do not refute previous estimates for probability of survival.

The most interesting finding in this study is the increased social support identified for survivors com-

Table 2. Incidence of associated injury, comorbidity, inhalation injury, plasmapheresis, escharotomy, infection, Integra™ wound coverage, and social support

Characteristic	Survivors (%)	Nonsurvivors (%)	*P* Value	OR (95% CI)
Associated injury	0 (0)	3 (15)	0.2	0.2 (0–1.5)
Comorbidity	0 (0)	3 (15)	0.2	0.2 (0–1.5)
Inhalation injury	3 (18)	6 (30)	0.7	0.54 (0.1–2.4)
Plasmapheresis	4 (25)	3 (15)	0.15	6.3 (0.8–63.6)
Escharotomy	6 (37)	7 (35)	1	1.1 (0.3–4.2)
Infection	11 (68)	15 (75)	0.72	0.7 (0.2–3.0)
Integra™ wound coverage	3 (18)	4 (20)	1	1.3 (0.3–5.9)
Social support	13 (81)	7 (35)	0.007*	8.1 (1.8–35.6)

Incidence of associated injury, comorbidity, inhalation injury, plasmapheresis, escharotomy, infection, Integra™ wound coverage, and social support are presented as total numbers with percentages of each group (survivors and nonsurvivors) in parentheses. Results are presented as odds ratios (ORs) with 95% confidence interval (CI). Asterisks indicate statistically significant differences. Presence of social support was the only parameter that was significant between the two groups. *P* value and odds ratio with 95% confidence interval was calculated using Fisher's two-tailed unpaired exact probability test.

pared with nonsurvivors. We found no difference in the level of support received by local patients and those that were transferred to the Burn Center from a long distance. The role of social support also has been documented in human immunodeficiency virus and breast cancer research, where strong links have been reported between stress and immune function. Social support serves as a moderator between these variables and can lengthen the life span.[14–18] Furthermore, the impact of stress on wound healing includes observations that stress leads to lowered levels of interleukin 1 alpha and interleukin 8, which are critical in responses to injury. Deficits in these cytokines early in wound repair can have adverse consequences.[19]

In the burn literature, the importance of social support in long term adjustment (postdischarge) has been well established.[20–22] However, it is reasonable to hypothesize that the presence of positive, familiar friends and family may be important during early recovery from a large burn injury. The impact of family and friends on patient outcome in the ICU has not been well studied.[23,24] Given the recent findings on the role of stress and wound healing, an important goal of ICU management should be to minimize patient stress levels resulting from an unfamiliar setting, high pain levels, uncertainty of prognosis, and mental status changes. Evidence is accumulating that the quality of support is important, whether from friends and family or from staff.[25] A useful strategy to decrease stress during the critical phase of recovery is to offer appropriate social support through family and friends[22] who can provide reassurance in an otherwise-alien environment. It is important for all members of the multidisciplinary burn team to be involved with the family during this stage of recovery by providing education, information, and support. A patient may notice unhealthy cues from family with high levels of anxiety and stress and may behave accordingly. Therefore, it is essential to help family members convey a sense of hope and calmness that will encourage the patient to reflect these emotions.

Social workers, psychologists, and spiritual care staff can assist family members by addressing basic needs, such as housing while their family member is hospitalized, encouraging self-care (ie, regular meals, sleep), and giving them a safe place to express their own fears and anxiety. Members of the multidisciplinary team should continue to monitor the patient and family members throughout the recovery process from the ICU, to the acute floor to discharge and for follow-up clinic visits. For patients that do not have friends or family present, it may be crucial that the multidisciplinary burn team provide as much positive support as possible and to find other ways to decrease stress in this environment. The importance of social support in the later stages of recovery (ie, the rehabilitation phase and postdischarge) has been established.[22,26,27] We believe our data suggest the importance of social support as early as the resuscitative stage.

CONCLUSIONS

Our data indicate that among patients with large burns, full-thickness burn size was one variable that predicted survival and a ≥80% TBSA full-thickness burn was uniformly fatal. Furthermore, survivors may have benefited from increased presence of relatives and friends during the hospitalization, suggesting that social support was a unique distinction that may impact patient survival.

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