Annals of Plastic and Reconstructive Surgery

Research Article
Published: 14 Nov, 2022

# The Impact of Surgeons on the Outcome of Burn Patients and Its Comparison with Years of Experience and Social Popularity

*Fatemi MJ[1,2]*, Saberi M[3], Naderi S[1,2], Bagheri T[1], Taghavi S[1] and Niazi M[1]*

[1]Burn Research Center, Iran University of Medical Sciences, Iran

[2]Department of Plastic and Reconstructive Surgery, Hazrat Fatemeh Hospital, School of Medicine, Iran University of Medical Sciences, Iran

[3]Department of Community Medicine, Baqiyatallah University of Medical Sciences, Iran

## Abstract

LA50 is a reliable measure for evaluating quality of care in burn centers. Age and severity of burns are the most important factors affecting LA50. In this study, we evaluated the impact of burn surgeons on LA50 in a tertiary burn center. During a one-year period, we collected data including age, gender, cause of burn, Total Burned Body Surface Area (TBSA), presence or absence of inhalation injury and comorbidity, surgeon in charge of the treatment and outcome (discharge or death), in all patients who were admitted to the hospital. Totally, 2,581 data from patients were analyzed. The mean age of patients was 33.01 ± 21.60. The inhalation injury and comorbidity had significant impact on LA50. Also, different surgeons had significantly different LA50. Factors such as older age, more sever burn, inhalation injury and comorbidity entail low LA50, and whereas treated by different surgeons are features considered as significant factors for having a different outcome and LA50 in burn centers.

**Keywords: Burns; Burn surgeons; Burn surgeon's experience; Patients' outcome; LA50; Mortality**

OPEN ACCESS

***Correspondence:***
*Mohammad Javad Fatemi, Department of Plastic and Reconstructive Surgery, Hazrat Fatemeh Hospital and Burn Research Center, Iran University of Medical Sciences, Tehran, Iran, E-mail: mjfatemi41@gmail.com/ Fatemidokht.mj@iums.ac.ir*

**Received Date**: *21 Oct 2022*
**Accepted Date:** *08 Nov 2022*
**Published Date:** *14 Nov 2022*

***Citation:***
*Fatemi MJ, Saberi M, Naderi S, Bagheri T, Taghavi S, Niazi M. The Impact of Surgeons on the Outcome of Burn Patients and Its Comparison with Years of Experience and Social Popularity. Ann Plast Reconstr Surg. 2022; 6(4): 1100.*



## Introduction

Mortality is the best outcome measure which provides objective data about quality of care in burn centers [1-3]. LA50, defined as the TBSA burn at which 50% of patients will die, is a popular tool for evaluation of standards of medical care [4-6]. Regular measurement of LA50 indicates whether burn center' medical care has improved or not and clarify the extent of the required changes [6,7]. Although burn mortality rate is still a demonstrator of resuscitation efficiency and medical care quality, LA50 can be a better indicator in predicting the quality of medical care due to the fact that it relies on a more comprehensive set of variables [5,7]. There are several studies discussing the factors that have an effect on LA50. Based on general agreements, it is completely clear that two factors of age and burn severity [depth and extent] have been the main factors related to the outcome in multiple studies [1,5,7-16]. There are also other factors that may have some correlations with the outcome [7]. Multivariate analyses have proved the role of other factors such as depth [4,8-10], inhalation injury [1,4,6-8,11-15,17,18], associated diseases [1,7,8,14,19], gender [5,8,9,16,19,20], suicidal intent [7], early grafting [5], sepsis [1], associated trauma [1,7,21,22], lactate level [23], fire flammable fabrics [4,9,24], low platelet level and base deficit [12]. Among all of these, the experience of surgeon and medical team and important role of them in systematic treatment have been ignored. However, here one question remains that whether surgeon's expertise and knowledge can be considered as a reasonable factor in patients' outcomes and LA50?

In this study we evaluated a one-year LA50 of a 120-bed tertiary burn center and the factors that have an impact on this indicator with focusing on the surgeon's role. In order to conduct the study, we calculated LA50 of each surgeon individually, then compared them with one another.

## Materials and Methods

This study was conducted during a one-year [2018] evaluation in Motahari Burn Hospital, Iran University of Medical Sciences, in Tehran. We included all patients who were admitted to our center during this period and were followed up clinically until either death or discharge. Any patient who left the hospital before the complete clearance of the outcome, were excluded from study. This

study was done under the ethical principles of Helsinki Declaration of Bioethics and also Ethics Committee of Iran University of Medical Sciences.

We collected data including age, gender, cause of burn [scald, flame, contact burn, chemical and electrical], Total Body Surface Area [TBSA] of burn determined by surgeon responsible of treatment team, presence or absence of inhalation injury [diagnosed by history plus clinical symptoms], comorbidity [Myocardial infarct, congestive heart failure, peripheral vascular disease, dementia, cerebrovascular disease, chronic lung disease, connective tissue disease, GI ulcer, chronic liver disease, diabetes and cancer], and outcome [discharge or death]. The size of burn in injured area, reported as percentage of TBSA, was estimated based on the Lund and Browder chart. All data were entered into an online database and then analyzed using SPSS software [SPSS Inc., Chicago, Illinois, USA] version 20. Descriptive values are presented as frequency, percentage and mean ± SD. Calculation of LA50 was performed by Probit analysis. Multiple logistic regression model analysis with 95% confidence intervals was conducted to identify the mortality risk factors. P-value of less than 0.05 was considered statistically significant.

We calculated LA50 in different groups with respect to age, sex, different TBSA of burn, with and without inhalation injuries and comorbidities. There were 8 surgeons in Motahari hospital who treated burn patients. One of them had only three patients during this one-year period, therefore LA50 was calculated among 7 surgeons. Also, this study was not a crossover trial and each patient was treated by a separate surgeon. Also, surgeons were ranked based on the years of experience and social popularity to evaluate the impact of these factors on the results of each surgeon. The ranking method according to the years of experience was conducted in a burn center [recruitment file] and also social popularity in terms of questioning 50 nurses from the operating room or burn wards and 100 patients during the period of the study.

Social popularity of each surgeon was evaluated by four questions about knowledge, experience, psychological support, and providing clarification about the procedure of treatment. Each item was scored from 1 to 4 (poor, fair, good, and excellent). For all these four variables, each surgeon was scored from minimum 4 to maximum 16. Eventually, all of them were categorized based on the total score. Our method is not a validated tool and we designed and used it for our study.

## Results

In this study, 2,592 patients were admitted during the study period in hospital. Among them, 11 patients had missing data; so were excluded from the study. Therefore, only 2,581 patients were analyzed. The mean age of patients was 33.01 ± 21.60. Frequency of male and female patients were 67.2% [1734 patients] and 32.8% [847 patients] respectively. The TBSA estimated by burn surgeon was 16.28 ± 18.973. Among these patients, 236 cases [9.2%] were the case of inhalation injury, and 430 cases [16.7%] with comorbidity. The main cause of burn was first flame and second scald burn (Table 1). The mortality and survival rate, based on the treatment of each surgeon are presented in Table 2.

Based on our results, the overall LA50 of hospital was calculated 57.43%. The LA50 of inhalation injury group was 52.77%, and LA50 of the group without inhalation injury was 59.42%. The difference was significant (P=0.000) with the odds ratio of 0.391.

The LA50 in groups with comorbidity and without comorbidity was calculated 50.36% and 58.59% respectively. There was a significant difference between two groups (P=0.010) with the odds ratio of 0.426.

In case of gender, the estimated LA50 was 59.26% in male and 50.89% in female patients. There was no significant difference (P=0.056) and the odds ratio was also estimated 1.683.

Aging has significant effects on mortality meaning that with an increase in age, mortality also increases. The odds ratio for each year of increase in age was 1.026 (P=0.000).

The LA50 of groups in terms of causes of burn are as follow [from high to low]: Electrical burn [72.93%], contact burn [62.54%], scald [57.65%], flame [57.31%], and chemical burn [45.61%]. The odd ratio was 1.178, but the difference was not significant (P=0.313).

The last variable in calculating LA50 was the role of each surgeon. The numbers are categorized from the highest to the lowest: No 1: 63.96%, No 2: 62.76%, No 3: 60. 36%, No 4: 58.95%, No 5: 53.77%, No 6: 52.71%, and No 7: 49.87%. P value was P=0.003, which showed that the difference is significant. The odds ratio was 0.832.

According to Table 3, surgeons treated patients with different burn percentage. According to the results of this study, thus the difference between them was significant (P=0.000). However, the surgeon with the best LA50 treated patients with more severe burns, the average percentage of burns in his patients was significantly different from two surgeons, while it was not statistically significant with four other surgeons.

In the case of inhalation burns, there was a significant difference between patients of different surgeons, and in this regard, the first-ranked surgeon and the third-ranked surgeon with the best results had the highest number of patients with inhalation burns. The difference with other surgeons was also significant (P=0.001) (Table 4).

In the case of comorbidity, there was a significant difference between surgeons and most of the patients with certain underlying medical conditions in the group of the second-ranked surgeon (P=0.006) (Table 5).

The ranking of surgeons with respect to years of experience is 2, 3, 1, 6, 5, 4, and 7. The ranking is not the same as LA50 ranking but the 3 tops in both are the same and have considerable relation, visually.

The ranking of surgeons with respect to social popularity is 3, 1, 5, 4, 6, 7, and 2 respectively. This ranking is not the same as LA50 and the relation is weaker than the years of experience.

## Discussion

The mortality of burns is decreasing all around the world. Improved survival rates following major acute burns have been attributed in part to more specialized and experienced surgical and intensive therapy teams, the development of standardized initial assessment and transfer protocols, the increased use of early tangential wound excision and grafting, improved antimicrobial therapies, an improved range of skin substitutes and biological dressings, and the use of specialized critical care facilities and nutritional support protocols [1,9,22,25,26].

Improvement is better in young and middle age patients. The reason is more early excision and graft in these groups versus old ages and the greater probability of comorbidities. Also, withdrawal from treatment is more common in older age [25,26].

**Table 1**: Types of burn and the frequency of each variable.

| Variable | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| **Scald** | 921 | 35.7 | 35.7 | 35.7 |
| **Flame** | 1133 | 43.9 | 43.9 | 79.7 |
| **Electrical** | 139 | 5.4 | 5.4 | 85.1 |
| **Contact** | 291 | 11.3 | 11.3 | 96.4 |
| **Chemical** | 94 | 3.6 | 3.6 | 100 |
| **Total** | 2578 | 99.9 | 100 | |
| **Missing** | 3 | 0.1 | | |
| **Total** | **2581** | **100** | | |

**Table 2:** The percentage of survived and dead patients for each surgeon.

| Surgeon's Name | Patients (count) | | | Patients (%) | | |
|---|---|---|---|---|---|---|
| | survived | dead | Total | survived | dead | Total |
| **5** | 488 | 33 | 521 | 93.70% | 6.30% | 100% |
| **7** | 308 | 36 | 344 | 89.50% | 10.50% | 100% |
| **3** | 248 | 23 | 271 | 91.50% | 8.50% | 100% |
| **6** | 279 | 26 | 305 | 91.50% | 8.50% | 100% |
| **2** | 530 | 28 | 558 | 95.00% | 5.00% | 100% |
| **1** | 150 | 11 | 161 | 93.20% | 6.80% | 100% |
| **4** | 388 | 20 | 408 | 95.10% | 4.90% | 100% |
| **8** | 3 | 0 | 3 | 100% | 0.00% | 100% |
| **Total** | **2394** | **177** | **2571** | **93.10%** | **6.90%** | **100%** |

**Table 3:** Burn percentage of patients for each surgeon.

| Surgeon's Name | N | Burn Percentage | | | |
|---|---|---|---|---|---|
| | | Minimum | Maximum | Mean | Std. Deviation |
| 5 | 522 | 1 | 95 | 13.68 | 17.591 |
| 7 | 344 | 1 | 100 | 17.77 | 20.296 |
| 3 | 271 | 1 | 100 | 18.9 | 20.664 |
| 6 | 306 | 1 | 95 | 17.69 | 20.241 |
| 2 | 559 | 1 | 100 | 15.33 | 17.814 |
| 1 | 161 | 1 | 100 | 18.91 | 20.1 |
| 4 | 409 | 1 | 100 | 15.83 | 17.691 |

**Table 4:** Inhalation burn injury for each surgeon.

| Surgeon's Name | Inhalation (Count) | | Inhalation (%) | | Total | |
|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | Count | (%) |
| 5 | 46 | 470 | 8.90% | 91.10% | 516 | 100% |
| 7 | 26 | 313 | 7.70% | 92.30% | 339 | 100% |
| 3 | 39 | 230 | 14.50% | 85.50% | 269 | 100% |
| 6 | 29 | 277 | 9.50% | 90.50% | 306 | 100% |
| 2 | 37 | 519 | 6.70% | 93.30% | 556 | 100% |
| 1 | 25 | 135 | 15.60% | 84.40% | 160 | 100% |
| 4 | 34 | 374 | 8.30% | 91.70% | 408 | 100% |

In our study, we have the same results as other studies in indicating comorbidities that have a significant effect on the outcomes with an odds ratio of 0.426 [1,7,8,14,19]. The role of gender is the subject of controversy in different studies. In most cases, mortality is higher in female patients [9,11,16,20]. In some studies, gender has no effect on mortality [10,27], and in a few ones, mortality was higher in male patients [6]. Although, in our study, the mortality is higher in females and they die with less severe burns, the difference is not significant (P=0.056) [1].

The main factor that we were concerned about in our study was the impact of surgeons, who are the head of the medical team. Based on our research, we did not find any other research considering this

**Table 5:** Underlying diseases for each surgeon.

| Surgeon's Name | Underlying Disease (Count) | | Underlying Disease (%) | | Total | |
|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | Count | (%) |
| 5 | 83 | 434 | 16.10% | 83.90% | 517 | 100% |
| 7 | 64 | 280 | 18.60% | 81.40% | 344 | 100% |
| 3 | 36 | 233 | 13.40% | 86.60% | 269 | 100% |
| 6 | 33 | 272 | 10.80% | 89.20% | 305 | 100% |
| 2 | 115 | 442 | 20.60% | 79.40% | 557 | 100% |
| 1 | 23 | 137 | 14.40% | 85.60% | 160 | 100% |
| 4 | 74 | 335 | 18.10% | 81.90% | 409 | 100% |

factor in their studies. Moreover, in some studies, it was pointed that one of the reasons for the improvement of the results of treatment and decrease in mortality rate is the knowledge and experience of the medical team [8]. Most of the time, patients, through getting information from other patients, hospital personnel, and staff about the surgeons, ask for a specific surgeon for their treatment whom they think has better knowledge and experience, without considering the fact that whether their decision is right.

There are 8 surgeons in our center among whom only one of them were excluded due to an involvement in treating only 3 patients. All conditions for the availability of surgical room were similar for each surgeon. Hospital personnel were also selected randomly and the head of the hospital did not have the highest LA50 among the surgeons.

Our study showed that different surgeons have different LA50 in their patients and the difference is significant with odds ratio of 0.832. Future studies needed to clarify the detail reasons of different LA50 in different surgeons. Patient's factors and surgeon's characteristics may have complex and combined effect in this result. Age of the patients, extent and depth of the wounds, comorbidity, inhalation injury, amount of blood transfusion, and duration of ICU stay and intubation are patient's factors. Knowledge, surgical expertise, correct judgment and decision and commitment in on time intervention are surgeon's factors.

When we arrange the surgeons in respect of years, they work in a burn center as on our results [1,4,5,7-9], there is a considerable relation between experience and better outcome, although they are not the same. When we arrange surgeons based on staff's suggestion and patients' preference, it is as follow: [1,3,5,7-9]. It showed that there is not any significant relationship between the outcome of surgeons and public belief. Therefore, we can conclude that, in a burn center with the same facility and staff, same infectious disease specialists, and ICU specialists and anesthesiologists, different surgeons can make significantly different results.

Our results showed that the surgeon with the best results was responsible for patients with more severe burns and also the highest rate of inhalation burns. Also, the second-ranked and third-ranked surgeons also had more patients in terms of inhalation burns or underlying conditions. It is necessary to clarify that the better results are due to the chosen treatment method by the surgeon or the characteristic of the disease and the patients.

This study has considerable limitations. The depth of the burn wounds was not included in the analysis, and the inhalation injuries were not confirmed by bronchoscopy evaluation. Also, the method of social popularity was not a validated technique.

## Conclusion

The most important factors that determined LA50 are age of the patient, severity of burn (extent and depth), presence of inhalation injury and comorbidity. Different surgeons have different results in LA50 which may be due to patient's factors or surgeon's characteristics and need further studies.

## References


1. Jeevan R, Rashid A, Lymperopoulos NS, Wilkinson D, James MI. Mortality and treatment cost estimates for 1075 consecutive patients treated by a regional adult burn service over a five-year period: The Liverpool experience. Burns. 2014;40(2):214-22.
2. Sobouti B, Ansari I, Garahgheshlagh SN, Rahbar H, Rahbar A, Alizadeh-Navaei R, et al. Traumatic brain injury in child burn. World J Plast Surg. 2022;11(2):75-82.
3. Stefani K, Wagstaff MJD, Damkat I, Greenwood JE. Mortality data 2004–2019: An audit of the royal Adelaide hospital adult burn service. ANZ J Surg. 2021;91(1-2):77-82.
4. Bowser B, Caldwell FT, Baker JA, Walls RC. Statistical methods to predict morbidity and mortality: Self assessment techniques for burn units. Burns Incl Therm Inj. 1983;9(5):318-26.
5. Mobayen M, Farzan R, Dadashi A, Rimaz S, Aghebati R. Effect of early grafting on improvement of lethal area index (la50) in burn patients: A 7-year investigation in a burn referral centre in the North of Iran. Ann Burns Fire Disasters. 2017;30(3):189-92.
6. Shirani KZ, Pruitt BA, Mason AD. The influence of inhalation injury and pneumonia on burn mortality. Ann Surg. 1987;205(1):82-7.
7. Zawacki BE, Azen SP, Imbus SH, Chang YT. Multifactorial probit analysis of mortality in burned patients. Ann Surg. 1979;189(1):1-5.
8. Benito-Ruiz J, Navarro-Monzonis A, Baena-Montilla P, Mirabet-Ippolito V. An analysis of burn mortality: A report from a Spanish regional burn centre. Burns. 1991;17(3):201-4.
9. Anlatıcı R, Ozerdem OR, Dalay C, Kesiktaş E, Acartürk S, Seydaoglu G. A retrospective analysis of 1083 Turkish patients with serious burns. Burns. 2002;28(3):231-7.
10. Hager S, Foldenauer AC, Rennekampff HO, Deisz R, Kopp R, Tenenhaus M, et al. Interleukin-6 serum levels correlate with severity of burn injury but not with gender. J Burn Care Res. 2018;39(3):379-86.
11. Capek KD, Sousse LE, Hundeshagen G, Voigt CD, Suman OE, Finnerty CC. Contemporary Burn Survival. J Am Coll Surg. 2018;226(4):453-63.
12. 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(5):554-65.
13. Suzuki M, Aikawa N, Kobayashi K, Higuchi R. Prognostic implications of inhalation injury in burn patients in Tokyo. Burns. 2005;31(3):331-6.

14. Brusselaers N, Monstrey S, Vogelaers D, Hoste E, Blot S. Severe burn injury in Europe: A systematic review of the incidence, etiology, morbidity, and mortality. Crit Care. 2010;14(5):1-12.

15. Jie X, Baoren C. Mortality rates among 5321 patients with burns admitted to a burn unit in China: 1980–1998. Burns. 2003;29(3):239-45.

16. O'Keefe GE, Hunt JL, Purdue GF. An evaluation of risk factors for mortality after burn trauma and the identification of gender-dependent differences in outcomes. J Am Coll Surg. 2001;192(2):153-60.

17. Mann R, Heimbach D. Prognosis and treatment of burns. Wes J Med. 1996;165(4):215-20.

18. Galeiras R, Seoane-Quiroga L, Pertega-Diaz S. Prevalence and prognostic impact of inhalation injury among burn patients: A systematic review and meta-analysis. J Trauma Acute Care Surg. 2020;88(2):330-44.

19. Thombs BD, Singh VA, Halonen J, Diallo A, Milner SM. The effects of preexisting medical comorbidities on mortality and length of hospital stay in acute burn injury: Evidence from a national sample of 31,338 adult patients. Ann Surg. 2007;245(4):629-34.

20. Kerby JD, McGwin JrG, George RL, Cross JA, Chaudry IH, Rue LW. Sex differences in mortality after burn injury: Results of analysis of the National Burn Repository of the American Burn Association. J Burn Care Res. 2006;27(4):452-6.

21. Fazeli S, Karami-Matin R, Kakaei N, Pourghorban S, Safari-Faramani R, Safari-Faramani B. Predictive factors of mortality in burn patients. Trauma Mon. 2014;19(1):e14480.

22. Knowlin L, Stanford L, Moore D, Cairns B, Charles A. The measured effect magnitude of co-morbidities on burn injury mortality. Burns. 2016;42(7):1433-8.

23. Lavrentieva A, Voutsas V, Konoglou M, Karali V, Koukiasa P, Loridas N, et al. Determinants of outcome in burn ICU patients with septic shock. J Burn Care Res. 2017;38(1):e172-9.

24. Tegtmeyer LC, Herrnstadt GR, Maier SL, Thamm OC, Klinke M, Reinshagen K, et al. Retrospective analysis on thermal injuries in children–demographic, etiological and clinical data of German and Austrian pediatric hospitals 2006–2015–approaching the new German burn registry. Burns. 2018;44(1):150-7.

25. Jackson PC, Hardwicke J, Bamford A, Nightingale P, Wilson Y, Papini R, et al. Revised estimates of mortality from the Birmingham Burn Centre, 2001–2010: A continuing analysis over 65 years. Ann Surg. 2014;259(5):979-84.

26. McGwin G, Cross JM, Ford JW, Rue LW. Long-term trends in mortality according to age among adult burn patients. J Burn Care Rehabil. 2003;24(1):21-5.

27. Ederer IA, Hacker S, Sternat N, Waldmann A, Salameh O, Radtke C, et al. Gender has no influence on mortality after burn injuries: A 20-year single center study with 839 patients. Burns. 2019;45(1):205-12.