Analysis of Factors Influencing Length of Stay in Hospital among Burns Patients, Pertaining to Blood Transfusion- A Cross-sectional Study

JEYARAJ RAVISHANKAR[1], POTHIPILLAI ARUMUGAM[2], M CHITRA[3], MUNUSAMY SRIDEVI[4]

ABSTRACT

Introduction: Blood transfusion is an independent risk factor for death and perioperative infection in trauma patients. Hospital Length Of Stay (LOS) is an indicator of morbidity and can be used to assess wound healing in burns patients.

Aim: To analyse the factors influencing hospital length of stay in burns patients, with relevance to blood transfusion.

Materials and Methods: This was a cross-sectional study on burns patients admitted at burns ward, Government Kilpauk Medical College, Tamil Nadu, India, between September 2014 to August 2015. Patients with age more than 16 years with 15-40% Total Burnt Surface Area (TBSA) and had survived treatment were included after obtaining informed consent. Age, Acute Physiology and Chronic Health Evaluation (APACHE II) score, blood component transfusion, storage age of red cells, surgical procedures and wound infection were studied. Results were analysed using Chi-square test, Analysis of Variance (ANOVA) and Pearson correlation.

Results: Of the 122 burns patients studied, mean age was 35.38±12.93 years, 54.09% were males, mean LOS was 22.39±1.23 days, mean TBSA was 26.11±0.40%, mean APACHE II score was 5.02±0.06, 85 (69.67%) patients had received red blood cell transfusion, 59 (48.36%) underwent surgical procedures and 103 (84.43%) developed culture proven wound infections. APACHE II score at admission (r-value=0.260, p-value=0.004), blood transfusions (r-value=0.504, p-value <0.0001), surgical procedures (r-value=0.614, p-value <0.0001) and wound infections (r-value=0.468, p-value <0.0001), were the factors which significantly increased length of hospital stay. Age of the patient (r-value=0.102, p-value=0.265) and storage age of red blood cells (p-value=0.193) did not influence length of stay in burns patients.

Conclusion: Minimising wound infection by proper wound care and medications and rational use of blood components help in early healing of burns wound with reduced hospital stay.

INTRODUCTION

Burn injuries are a major public health problem due to its high mortality, morbidity and disability among young and middle aged adults. It may be accidental, suicidal or homicidal. Every 1% increase in Total Burnt Surface Area (TBSA) is significantly associated with 6% increase in risk of mortality [1,2]. As mortality in burns is decreasing due to early interventions; quality of life and functional status are recently being examined as parameters of burn care, of which hospital Length Of Stay (LOS) data are easy to collect and measure. The LOS data provide an indirect indication of morbidity and clinical complications, as well as cost of care [3].

Factors contributing to prolonged length of stay in hospital are delay in hospitalisation, elderly age and severity of burns, flame burns and requirement of blood transfusions [4-6]. Simple models like Acute Physiology and Chronic Health Evaluation (APACHE II) scores are still relevant in developing countries, like India, and shows good discriminating ability between survivors and non survivors [7]. In trauma patients, blood transfusion is an independent risk factor for death, perioperative infection, multiple organ failure and admission to Intensive Care Unit (ICU). It has been well documented that blood transfusion within 24 hours of admission is an independent predictor of mortality and ICU length of stay [8].

The harm from Red Blood Cell (RBC) transfusion has been attributed to the ageing of blood and loss of normal RBC function due to storage lesion which leads to worsening microcirculation and nitric oxide bioavailability [8-10]. Pettila V et al., observed that older RBC are associated with increased mortality in critically ill patients [11]. But a

review from the American Association of Blood Banks (AABB) technical manual and a Cochrane review did not find any association between clinical outcomes and different durations of blood storage [12,13].

While large TBSA burn injury patients benefit from surgery, smaller burn injuries rest on a balance between risks and benefits [6]. Immediate colonisation of burn wounds occur with patient's normal skin flora with subsequent wound infection by gram negative flora [1,14]. The impaired immune system is unable to eradicate microbes and blood transfusion complicates this scenario by Transfusion Related Immunomodulation (TRIM), independent of injury severity [1,15,16]. Hence, reducing transfusions can help benefit patient care [17,18]. Even though, Fresh Frozen Plasma (FFP) is advantageous in early fluid management in burn injury due to the presence of albumin and fibronectin, it is also associated with TRIM and its complications [19,20].

The present study was undertaken to study the factors influencing hospital LOS in burns patients with respect to blood transfusions. The secondary objective was to study if blood stored for less than seven days reduced LOS in burns patients.

MATERIALS AND METHODS

This was a cross-sectional study conducted in patients admitted and treated in Burns Ward/ Burns ICU at Government Kilpauk Medical College Hospital, Chennai, Tamil Nadu, India. The patients admitted and treated between September 2014 to August 2015, who fulfilled the inclusion criteria (purposive sampling) were included in the study. The study was approved by Institutional Ethics Committee of

The Tamil Nadu Dr. M.G.R. Medical University (ECMGR0309034). Informed consent was obtained from patients/patient's relatives for willingness to participate in the study.

Inclusion criteria: All the patients with age >16 years, TBSA of 15-40% and patients who survived the treatment were included in the study.

Exclusion criteria: Burns patients who were treated previously and admitted later for reconstructive surgeries and patients who were not willing to participate in the study were excluded from the study.

Study Procedure

The factors studied were age of the patient, APACHE II score at admission, blood component transfusion, storage age of red cells, influence of transfusion on wound infection and surgical procedures performed on patients [21]. Blood components transfused were non leukofiltered and non irradiated. The age of RBC unit was determined by subtracting the date of collection from the date of transfusion [11].

STATISTICAL ANALYSIS

Data entry and analysis were done using Statistical Package for Social Sciences (SPSS) software version 21.0 (IBM, New York, USA). Statistical analysis were done using Chi-square test (χ^2) for categorical variables, analysis of variance and Pearson correlation (r) to find correlation. The p-value <0.05 was considered significant.

RESULTS

A total of 143 patients were followed from date of admission and 21 patients died during treatment. Data from 122 patients, who recovered successfully, were analysed. The mean age of the patients was 35.38±12.93 years; 66 (54.09%) were males. The mean length of hospital stay for all patients was 22.39±12.08 days (range was 6-63 days). While 121 patients received at least one blood component transfusion, a total of 85 patients had received red blood cell transfusion.

The age of the patient, TBSA and haemoglobin level at admission did not significantly influence LOS, while APACHE II score at admission did influence LOS [Table/Fig-1]. As the number of blood

transfusions increased, there was significant prolongation of LOS (r-value=0.495, p-value <0.05).

The mean LOS of patient transfused with RBC was 26.39 days while those who did not receive RBC transfusion was 13.19 days (r-value=0.504, p-value <0.0001). The mean LOS in patients receiving RBC units stored for ≤14 days was 22.03±9.15 days while mean LOS in patients who received RBC units stored for >14 days was 23.04±10.89 days (p-value=0.727) [Table/Fig-2]. The mean LOS in patients receiving RBC units stored for ≤7 days was 19.6±13.1 days while mean LOS in patients who received RBC units stored for >7 days was 23.33±5.93 days (p-value=0.193) [Table/Fig-2]. Fresh frozen plasma transfusions in the burns patient and LOS were negatively correlated (r-value=-0.422, p-value=0.001) and that the mean length of stay for patients transfused with FFP (n=114/122) (22.03±11.37 days) was significantly shorter than those who were not transfused (n=8/122) (27.37±20.13 days).

Patients who received RBCs stored for	Length of stay (in days)	Pearson correlation (r-value)	p-value
≤14 days (n=26/85)	22.03±9.15	0.051	0.727
>14 days (n=23/85)	23.04±10.89		
≤7 days (n=8/85)	19.13±8.32	0.169	0.189
>7 days (n=52/85)	24.31±10.54		

[Table/Fig-2]: Difference in mean LOS between patients receiving RBCs stored for Variable time intervals (Remaining patients had received multiple RBC units stored for both durations).
r-value: Pearson correlation; p-value: Chi-square test, p-value<0.05 was considered as significant

Culture-proven wound infections developed in 103 (84.42%) patients. The most common microbes grown in cultures from the burn injury site are given in [Table/Fig-3]. The mean LOS for burns patients with culture-proven wound infection (24.8±11.5 days) was significantly longer than those patients without wound infection (9.3±3.2 days). Mean LOS of burns patients who had received red cell transfusion and developed wound infection was higher than patients who developed wound infection but did not receive blood transfusions (p-value=0.039) [Table/Fig-4].

Variable	Mean±SD	r-value (against LOS)	p-value
Age (in years)	35.38±12.93	0.102	0.265
Total burnt surface area (%)	26.11±0.40	0.049	0.590
Haemoglobin at admission (gm%)	12.53±2.49	0.014	0.881
APACHE II score at admission	5.02±0.06	0.260	0.004
LOS in males (n=66)	22.60±12.17 days	0.019	0.346
LOS in females (n=56/122)	22.14±12.08 days		
LOS in patients who received red blood cell transfusion (n=85)	26.39±11.91 days	0.504	<0.0001
LOS in patients who did not receive red blood cell transfusion (n=37)	13.19±5.92 days		
LOS in patients who received FFP transfusions (n=114)	22.03±11.37 days	-0.422	0.001
LOS in patients who did not receive FFP transfusions (n=8)	27.37±20.13 days		
LOS in patients who developed culture proven wound infection (n=103)	24.8±11.5 days	0.468	<0.0001
LOS in patients who did not develop culture proven wound infection (n=19)	9.3±3.2 days		
LOS in patients who underwent surgical procedures (n=59)	30.02±14.93 days	0.614	<0.0001
Length of stay in patients who were treated conservatively (n=63)	15.24±8.33 days		

[Table/Fig-1]: Mean value of variables tested and the correlation with LOS.
r-value: Pearson correlation; p-value: Chi-square test; p-value <0.05 was considered as significant

S. No.	Duration of burn injury	Organism cultured	Percentage
1.	Less than 48 hours (72 culture positive among 93 patients tested)	*Staphylococcus aureus*	44.44% (n=32/72)
		Klebsiella pneumoniae	26.39% (n=19/72)
		Pseudomonas aeruginosa	9.72% (n=7/72)
		Acinetobacter	5.55% (n=4/72)
		Coagulase negative *Staphylococcus*	13.89% (n=10/72)
2.	3-7 days (54 culture positive among 65 patients tested)	*Klebsiella pneumoniae*	40.74% (n=22/54)
		Staphylococcus aureus	37.04% (n=20/54)
		Pseudomonas aeruginosa	12.96% (n=7/54)
		Enterococcus spp.	3.70% (n=2/54)
		Coagulase negative *Staphylococcus*	5.55% (n=3/54)
3.	8-14 days (31 culture positive among 40 patients tested)	*Klebsiella pneumoniae*	41.93% (n=13/31)
		Staphylococcus aureus	29.03% (n=9/31)
		Pseudomonas aeruginosa	16.12% (n=5/31)
		Acinetobacter	3.22% (n=1/31)
		Coagulase negative *Staphylococcus*	6.45% (n=2/31)
		Proteus spp.	3.22% (n=1/31)
4.	>14 days (30 culture positive among 42 patients tested)	*Staphylococcus aureus*	46.67% (n=14/30)
		Klebsiella pneumoniae	20.00% (n=6/30)
		Pseudomonas aeruginosa	16.67% (n=5/30)
		Coagulase negative *Staphylococcus*	6.67% (n=2/30)
		Proteus spp.	10.00% (n=3/30)

[Table/Fig-3]: Microbes cultured from burn sites based on duration of hospitalisation.

RBC transfusion status	Length of stay (Days)		p-value (Chi-square test)
	Total number of patients	Mean±SD	
Burns patients transfused with red blood cells (n=85)	Patients who developed wound infection (n=78)	27.76±11.9	0.003
	Patients who did not develop wound infection (n=7)	11.14±4.37	
Burns patients not transfused with red blood cells (n=37)	Patients who developed wound infection (n=25)	15.6±5.73	0.002
	Patients who did not develop wound infection (n=12)	8.17±1.59	

[Table/Fig-4]: Difference in mean LOS in transfused burns patients who developed/did not wound infection.
p-value <0.05 was considered as significant

A total of 59 patients underwent surgical procedures, while 63 were treated conservatively. Escharatomy was the most common surgery (n=59) while 28 patients had eschar removal and split skin grafting. Six patients underwent amputation. The mean LOS of patients who underwent surgical procedures was 30.02±14.93 days, while patients who were treated conservatively had a mean LOS of 15.24±8.33 days (p-value <0.05). Mean LOS of burns patients who underwent surgical procedures and had received RBC transfusion was significantly higher than patients who had surgical procedures but did not receive blood transfusions (p-value <0.05) [Table/Fig-5].

RBC transfusion status	Length of stay (in days)		p-value (Chi-square test)
	Total number of patients	Mean±SD	
Burns patients who were transfused with red blood cells (n=85)	Patients who underwent surgery (n=54)	31.15±10.99	<0.05
	Patients treated conservatively (n=31)	18.09±8.45	
Burns patients who were not transfused with red blood cells (n=37)	Patients who underwent surgery (n=5)	17.8±11.12	<0.05
	Patients treated conservatively (n=32)	12.47±4.57	

[Table/Fig-5]: Difference in mean LOS between transfused burns patients who underwent surgery or were treated conservatively.

DISCUSSION

With better accessibility to tertiary care with Emergency Medical Services (EMS) vehicles and long strides in burns injury care, more burns victims are surviving and so quality of life parameters are taking prominence over mortality parameters. Length of hospitalisation is one of the easily monitored and accessible parameters, which gives a better view on burns care and patient survival. When multivariate analysis is performed, exclusion of non survivors from analysis can help identify prognostic factors for hospital length of stay [20]. Thus, this study included data only from patients who were successfully discharged from hospital after treatment and deaths were excluded.

The mean LOS of burns patients in the present study (n=122) was 22.39±12.08 days, with a range between 6-63 days. The study by Gupta AK et al., showed a higher mean length of stay of 57 days while Bain J et al., showed a lower mean length of stay [2,22].

The mean age of burns patients in the present study was (35.38±12.93 years) with a range between 16-81 years. This was similar to the study by Gupta AK et al., but Hashmi M and Kamal R, showed a lesser mean age while Lu RP et al., showed a higher mean age of burns patients [22-24]. Burns were more common in males (54%) in the present study which was similar to studies by Gupta AK et al., but other studies by Bain J et al., and Chakraborty S et al., showed burns to be more common in females [2,22,25].

In the present study, age of burns patient did not influence LOS. This was similar to the result obtained by Posluszny JA Jr et al., who did not find correlation between age and LOS [18]. But in contrast, the studies by Hussain A and Dunn KW, and Edgar DW et al.,

showed that advancing age was a significant factor for prolonged LOS [3,4].

In the present study, total burnt surface area was taken as 15-40% because, below 15% TBSA burns, hospitalisations are rarely necessary and in burns above 40%, mortality risk is higher [5,26]. Hussain A and Dunn KW, in their review have shown that percentage of TBSA was a better predictor of hospital LOS [3]. As the present study results show, the restricted TBSA of 15-40% did not significantly correlate to LOS. Hence, the confounding factor of TBSA burns was overcome and the significance of other factors on LOS was absolute.

The APACHE II score which was developed as a mortality predictor also doubles up as a morbidity predictor. As the percentage of TBSA has been restricted in the present study, the APACHE II score obtained was low (maximum score 15). Still APACHE II score showed a positive correlation to LOS which was statistically significant.

In the present study, it was observed that there was significant prolongation of mean hospital LOS in transfused burns patients when compared to non transfused burns patients, irrespective of storage age of red cells (26.39 vs 13.19 days). The results were similar to those obtained by Neamţu MC et al., (31.3 vs 10.8 days), Vincent JL et al., (7.2 vs 2.6 ICU days) and Palmieri TL et al., (48.8 vs 13.5 days) [10,17,27].

In the present study, the mean LOS was significantly shorter for patients transfused with FFP when compared to those patients who were not transfused with FFP. This result was in contrast to the study by Sarani B et al., who showed that LOS was prolonged in critically ill patients who were transfused with FFP [20]. This finding should not be interpreted as FFP was beneficial for burns, but rather it signifies the beneficial effect of colloids in the late fluid management of burns.

Many observational studies and clinical trials have tried to prove the deleterious effects of increasing storage age of red cells but none have given conclusive results. While Pettila V et al., showed increased mortality in the critically ill patients transfused with older RBC; AABB technical manual and the Cochrane review 2015 have not found any clear differences in clinical outcomes between fresher and older RBC [11-13]. The present study did not find any significant prolongation of mean hospital LOS among two groups (RBCs stored for less than 14 days vs. RBCs stored for more than 14 days).

This study also evaluated if RBCs stored for less than seven days had any significant advantage over RBCs stored for more than seven days. This is a practice followed by clinicians who order fresh blood for transfusion in critically ill patients. There was no significant reduction in LOS in patients receiving RBCs stored for less than seven days (p=0.193). But there was significant prolongation of mean hospital LOS in transfused burns patients as the number of blood transfusions increased (r-value=0.504, p-value <0.0001). This was similar to the results by Palmieri TL et al. who found that burns patients who received fewer blood transfusions had a better survival [27].

In the present study, many (n=103/122) burn patients had culture positive wound infections, of which *Staphylococcus* species were the most common organism cultured in the first week of admission. From second week of admission onwards, gram negative organisms including *Klebsiella* species and *Pseudomonas* species were cultured more frequently. These results are similar to the other studies by Church D et al. and Khaliq MF et al., who showed gram positive organisms in the first 48 hours by colonisation from skin flora and gram negative organisms after five to seven days of burn injury by colonisation from enteral flora [1,14].

In the present study, wound infection showed a significant association with prolonged stay in hospital. In contrast, Khaliq MF et al., reported that colonisation of wounds by micro-organisms did

not prolong hospital stay [14]. It was also noted that patients who received blood transfusions showed an increased the risk of wound infection and thus prolonged LOS, which was similar to the results by Palmieri TL et al., (Spearman's rank correlation=0.647, p-value <0.001) [27].

In the present study, patients who underwent surgical procedures received more blood transfusions than those treated conservatively. These results were similar to the findings by Posluszny JA Jr et al., who showed that transfusions significantly correlated with number of operative procedures [18]. Such patients undergoing surgical procedures had prolonged LOS, as expected, when compared to those patients treated conservatively. These results are similar to those obtained in the study by Hussain A and Dunn KW, and Gupta AK et al., [3,22].

Thus, the factors significantly influencing hospital LOS of burn patients in the present study include APACHE II score at admission, blood transfusions, surgical procedures and wound infections.

Limitation(s)
Burn patients with total burnt surface area more than 40% were not included in this study.

CONCLUSION(S)
The present study highlights some of the factors significantly influencing hospital length of stay of burns patients. A quick APACHE II score check at admission, minimising wound infection by proper wound care and medications, rational use of blood components and judicious surgical procedures go a long way in early wound healing of burns wound with reduced hospital stay. Fresh red blood cells did not help in reducing length of stay in the present patient population. So, blood transfusion services should not be unnecessarily burdened with request for fresher blood components.

REFERENCES
[1] Church D, Elsayed S, Reid O, Winston B, Lindsay R. Burn wound infections. Clin Microbiol Rev. 2006;19(2):403-34.
[2] Bain J, Lal S, Baghel VS, Yedalwar V, Gupta R, Singh AK. Decadorial of a burn center in Central India. J Nat Sci Biol Med. 2014;5(1):116-22.
[3] Hussain A, Dunn KW. Predicting length of stay in thermal burns: A systematic review of prognostic factors. Burns 2013;39(7):1331-40.
[4] Edgar DW, Homer L, Phillips M, Gurfinkel R, Rea S, Wood FM. The influence of advancing age on quality of life and rate of recovery after treatment for burn. Burns. 2013;39(6):1067-72.
[5] Gul A, Alam SI, Sharif G. Mortality in above 40% thermal burns patients. Journal of Surgery Pakistan (International). 2011;16(4):174-78.
[6] Lim J, Liew S, Chan H, Jackson T, Burrows S, Edgar DW, et al. Is the length of time in acute burn surgery associated with poorer outcomes? Burns. 2014;40(2):235-40.
[7] Piacentini E, Ferrer C. Scoring prognostic system: To predict or not to predict. Minerva Anestesiol. 2012;78:149-50.
[8] Malone DL, Dunne J, Tracy JK, Putnam AT, Scalea TM, Napolitano LM. Blood transfusion, independent of shock severity, is associated with worse outcome in trauma. J Trauma. 2003;54(5):898-05; discussion 905-07.
[9] Dejam A, Malley BE, Feng M, Cismondi F, Park S, Samani S, et al. The effect of age and clinical circumstances on the outcome of red blood cell transfusion in critically ill patients. Crit Care. 2014;18(4):487.
[10] Neamţu MC, Pârvu A, Pârvănescu H, Neamţu LR, Vrabete M. Could stored blood transfusions (SBT) alter the mechanisms implied in wound healing, in burned patients? Rom J Morphol Embryol. 2011;52(2):599-04.
[11] Pettilä V, Westbrook AJ, Nichol AD, Bailey MJ, Wood EM, Syres G, et al. Blood observational study investigators for anzics clinical trials group. Age of red blood cells and mortality in the critically ill. Crit Care. 2011;15(2):R116.
[12] Fung MK, Grossman BJ, Hillyer CD, Westhoff CM. Chapter 20 Hemotherapy decisions. AABB Technical Manual. 18th Edition. 2014; p503.
[13] Brunskill SJ, Wilkinson KL, Doree C, Trivella M, Stanworth S. Transfusion of fresher versus older red blood cells for all conditions. Cochrane Database Syst Rev. 2015;(5):CD010801.
[14] Khaliq MF, Noorani MM, Siddiqui UA, Al Ibran E, Rao MH. Factors associated with duration of hospitalization and outcome in burns patients: A cross sectional study from Government Tertiary Hospital in Karachi, Pakistan. Burns. 2013;39(1):150-54.
[15] Muszynski JA, Spinella PC, Cholette JM, Acker JP, Hall MW, Juffermans NP, et al.; Pediatric Critical Care Blood Research Network (Blood Net). Transfusion-related immunomodulation: Review of the literature and implications for pediatric critical illness. Transfusion. 2017;57(1):195-06.
[16] Carson JL, Stanworth SJ, Roubinian N, Fergusson DA, Triulzi D, Doree C, et al. Transfusion thresholds and other strategies for guiding allogeneic red blood cell transfusion. Cochrane Database Syst Rev. 2016;10(10):CD002042. Update in: Cochrane Database Syst Rev. 2021;12:CD002042.
[17] Vincent JL, Baron JF, Reinhart K, Gattinoni L, Thijs L, Webb A, et al.; ABC (Anemia and Blood Transfusion in Critical Care) Investigators. Anemia and blood transfusion in critically ill patients. JAMA. 2002;288(12):1499-07.
[18] Posluszny JA Jr, Conrad P, Halerz M, Shankar R, Gamelli RL. Classifying transfusions related to the anemia of critical illness in burn patients. J Trauma. 2011;71(1):26-31.
[19] Rudmann SV. Textbook of Blood banking and Transfusion medicine. Second edition. Elsevier Saunders. 2006; Pp. 465-67.
[20] Sarani B, Dunkman WJ, Dean L, Sonnad S, Rohrbach JI, Gracias VH. Transfusion of fresh frozen plasma in critically ill surgical patients is associated with an increased risk of infection. Crit Care Med. 2008;36(4):1114-18.
[21] Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: A severity of disease classification system. Crit Care Med. 1985;13(10):818-29.
[22] Gupta AK, Uppal S, Garg R, Gupta A, Pal R. A clinico-epidemiologic study of 892 patients with burn injuries at a tertiary care hospital in Punjab, India. J Emerg Trauma Shock. 2011;4(1):07-11.
[23] Hashmi M, Kamal R. Management of patients in a dedicated burns intensive care unit (BICU) in a developing country. Burns. 2013;39:493-500.
[24] Lu RP, Lin FC, Ortiz-Pujols SM, Adams SD, Whinna HC, Cairns BA, et al. Blood utilization in patients with burn injury and association with clinical outcomes (CME). Transfusion. 2013;53(10):2212-21; quiz 2211.
[25] Chakraborty S, Bisoi S, Chattopadhyay D, Mishra R, Bhattacharya N, Biswas B. A study on demographic and clinical profile of burn patients in an Apex Institute of West Bengal. Indian J Public Health. 2010;54(1):27-29.
[26] The Clinical Use of Blood in Medicine, Obstetrics, Paediatrics, Surgery & Anaesthesia, Trauma & Burns. WHO document WHO/BTS/99. 2-337p.
[27] Palmieri TL, Caruso DM, Foster KN, Cairns BA, Peck MD, Gamelli RL, et al.; American Burn Association Burn Multicenter Trials Group. Effect of blood transfusion on outcome after major burn injury: A multicnter study. Crit Care Med. 2006;34(6):1602-07.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Immunohaematology and Blood Transfusion, Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India.
2. Professor, Department of Transfusion Medicine, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India.
3. Assistant Professor, Department of Immunohaematology and Blood Transfusion, Government Kilpauk Medical College, Chennai, Tamil Nadu, India.
4. Assistant Professor, Department of Immunohaematology and Blood Transfusion, Government Stanley Medical College, Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Munusamy Sridevi,
Assistant Professor, Department of Immunohematology and Blood Transfusion,
Government Stanley Medical College, Chennai, Tamil Nadu, India.
E-mail: msridevi1973@gmail.com