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DOES DIRECT HEALTHCARE COSTS CONTINUE TO BE A PROBLEM IN THE BURN CENTER DUE TO MANY COMPONENTS?

ÇOKLU BİLEŞENİNDEN DOLAYI DİREKT SAĞLIK MALİYETLERİ YANIK MERKEZİNDE SORUN OLMAYA DEVAM EDİYOR MU?

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SUMMARY

Introduction: *Although it is not possible to calculate the patient's harm to the work life and economy due to burns, knowing the direct health costs in the burns center is important in determining which patient groups are high-budgeted and preparing the budget for the next years. In this study, we aimed to evaluate the relationship between age, total burn surface area (TBSA) and length of hospital stay(LOS) with cost in 2018, the highest invoice cost in the last five years.*

Material and Method: *A retrospective study was conducted from January 2018 to December 2018 that included 177 patients with a history of a burn injury.*

Results*: There was a prdominance of males. Median age was 39,2 years old. The total median cost per person was 6.428 TL and the daily cost was 377 TL. There was no statistically significant relationship between between age and cost (p = 0.061). There was a statistically significant relationship between TBSA burns and cost (p = 0.000). The average LOS was 17 days. Burning percentage had a significant effect on LOS (p = 0.000). The amount of days spent in the hospital was found to be significantly associated with cost (p = 0.000).*

Conclusion: *In our series, burn costs were found to be very low, and we think that the main factor in this result is the development of burn centers' specialized treatment algorithms.*

ÖZ

Giriş: *Yanığa bağlı olarak hastasının iş hayatı ve ekonomiye olan zararının hesap edilmesi tam olarak mümkün olmamakla birlikte, yanık merkezinde direkt sağlık masraflarının bilinmesi, hangi hasta gruplarının yüksek bütçeli olduğunun belirlenerek gelecek yılların bütçesinin hazırlanmasında önem taşımaktadır.*

Gereç ve Yöntem: *Bizde bu çalışmada son 5 yıl içerisinde fatura maliyeti en yüksek olan 2018 yılında yaş, toplam vücut yanık alanı ve hastanede kalış süresinin maliyet ile ilişkisini değerlendirmeyi amaçladık.*

Bulgular: *Bu çalışma 177 olguyu içermekte olup, kişi başı ortalama toplam maliyet 6.428 TL, günlük maliyet 377 TL'dir. Yaş ve maliyet arasında istatistiksel olarak anlamlı bir ilişki yoktu (p = 0.061). Toplam vücut alanı yanıkları ile maliyet arasında istatistiksel olarak anlamlı bir ilişki vardı (p = 0.000). Hastanede kalış ortalama 17 gündü. Toplam yanık alanı hastanede kalış üzerinde anlamlı bir etkiye sahipti (p = 0.000). Hastanede geçirilen gün sayısı maliyetle anlamlı düzeyde ilişkili olduğu bulundu (p = 0.000).*

Sonuç: *Bizim serimizde yanık maliyetleri oldukça düşük bulunmuş olup, bu sonuçta başlıca etkenin özelleşmiş yanık merkezlerinin tedavi algoritmalarını geliştirmesi olduğunu düşünmekteyiz.*

INTRODUCTION

There is a consensus among the physicians dealing with burn care that the cost of burn treatment is expansive, and the treatment process applied in the burn centers is a challenging situation even for the economies of developed countries. At the high cost of burn treatment; in addition to hospitalization expenses, it is important to evaluate it with losses from prolonged post-discharge care and work - losts(1). In the studies, it was classified as *direct healthcare costs* due to hospitalization, *direct non-healthcare costs* due to the patient's commuting to health institutions and/or informal caring by caregivers, *indirect costs* due to maintenance in the life process, temporary or permanent disability, reduction of working time, loss of workforce and early retirement (2,3). Although it is not possible to calculate the effect of the patient to work life and economy due to the burns, knowing the cost of treatment at the burn center is important in the preparation of the budget of the next years in the countries where the health expenses are provided by the social security system.

In this study, we evaluated the relationship between age, Total Burn Surface Area (TBSA) and length of hospital stay (LOS) with *direct healthcare cost* in 2018, which the year with the highest invoice cost.

MATERIAL AND METHODS

A retrospective study was conducted in the Burn Center of Izmir Bozyaka Education and Research Hospital, between January 2018 and December 2018. Our institution is the referral center for our province. Our burn center has 12 beds, of which 4 are intensive care bed. The burn center does not accept child patients. Burn patiens, under the age of 18 and those who applied for the second admission were excluded from the study. The demographic and clinical records of the patients were retrospectively reviewed from the Probel™ data recording system. We recorded age, TBSA, duration of hospitalization and invoices. The patients were grouped as over 60 years and under. Body burn area was calculated according to the rule of nines. The burn area was divided into the groups as below 20%, 21-30% , 31-40%, 41-50% and over 51%. The patients were started with fluid therapy with Evans formula and dressing treatment was applied. Then, it was debritted within 24-48 hours and repeated with an interval of 48 hours. Dressing was applied daily with sedation. Burn cover was used in patients with 2nd and 3rd degree burns. The expenses reflected directly to the hospital cost between hospitalization and discharge were evaluated. The cost was subdivided and then the total invoice was calculated for each patient. Surgical interventions were excluded in the subgroups of Vaccine, serum and drugs, Blood and blood products, Medical equipment, Radiology expenses, Laboratory expenses, Polyclinic fees, Accompanying fees, Bed fees and Other fees (consultation, physical therapy, etc.) and then the total was taken.

Initiatives such as eschatomy, fasiatomy, debridement, graft application, amputation, and invasive procedures performed by the anesthesia group were taken into the surgical procedures group. Tetanus vs vaccines, serums such as crystalloid or colloid, TPN products and medications were taken in vaccine, serum and drugs group. Dressing material and burnt covers were calculated in the medical material group. Portability scope and ultrasound procedures were taken as radiology expenses. Biochemistry, hemogram and blood gas tests were calculated in laboratory expenses. The salaries paid to physicians, nurses and personnel in the total invoice are not included because they are paid through the salary and performance system. The average exchange rate for 2018 is 4.8 TL = 1 USD and the dollar is converted into TL.

Data of all patients were recorded using Statistical Package for Social Sciences-SPSS software for Windows version; 24,0 Chicago, Il. Data were analyzed using student's t-test for quantitative parameters and. Categorical variables are expressed as percentages. Mann-Whitney, Anova and Kruskal-Wallis tests were used for comparison of two or more then two groups. A *p*-value of <0.05 was considered to be statistically significant.

RESULTS

Overall, 177 patiens were studied. The total costs were 693.964 TL (2015), 772.722 TL (2016), and 681.350 TL (2017), while 1.138.887 TL in 2018. When sub-groups are analyzed in total invoice in

2018, surgical interventions; 303. 932 TL, serum and drugs; 192.791 TL, blood and blood products; 13.528 TL, medical equipment; 117.538 TL, Radiology expenses; 2.303 TL, Laboratory expenses; 63.136 tl., Outpatient fees; 2.622 TL, attendant fees; 901 TL, ward fees; 228.577 TL. and other fees (consultation, physiotherapy etc.) 213.550 TL. was found. Total median cost was 6.428 TL per person (174-246.112 TL) and daily cost was 377 TL. In cases over 60 years old, the cost per person was 2.843 TL, and the daily cost was 249 TL.

Among 177 patients, 51 were women and remaining 126 patients were men. Median age was 39,2 years old, ranging from 17 to 81 years old. One hundred fifty nine (89,8%) patients were under the age of 60 and 18(10,1%) patients were above the age of 60. There was no significant statistical correlation between the age and cost with Student t-test and Mann-Whitney U test (p=0.452) (Table 1). The mean TBSA was 18,6% (ranged between 1% and 70%), and the majority of patients presented TBSA of below 20% burns. There was significant statistical association between TBSA burns and cost (Anova, Kruskal- Wallis, p=0.000) (Table 2, Figure 1). The avarage LOS was 17 days. The mean LOS in <20% TBSA burns was 12.6 days, 21-30% burns was 16,7 days, 31-40% TBSA burns was 25,5 days, 41-50% TBSA burns was 26,3 days and >51% TBSA burns was 53,6 days. The burn percentage area had a significant influence on the LOS (Anova, Kruskal- Wallis, p=0.000). The amount of days spent in the hospital was found to be significantly related to the cost (Anova, p=0.000) (Figure 2).

Table 1. There was no significant statistical correlation between the age and cost with Student t-test (p=0.061) and Mann-Whitney U test .

Age	n=177	Mean rank	Sum of ranks
<60	159	89,97	14306,00
>60	18	80,39	1447,00
Mann Whitney U	1276.000		
Wilcoxon W	1447.000		
Z	-.752		
Asymp sig(2-tailed)	.542		

Table 2. Summary table of between TBSA and total/day cost.

TBSA %	n (%)	Mean cost/day -TL	Total cost -TL
<20%	117(66,1%)	286,4	380.701,00
21-30%	27(15,2%)	279,8	134.348,00
31-40%	17(9,6%)	397,0	162.509,00
41-50%	12(6,7%)	370,0	147.159,00
>50%	4(2,2%)	1.273,0	273.868,00
p-value			0.000[a]

[a]P-value of the Kruskal- Wallis

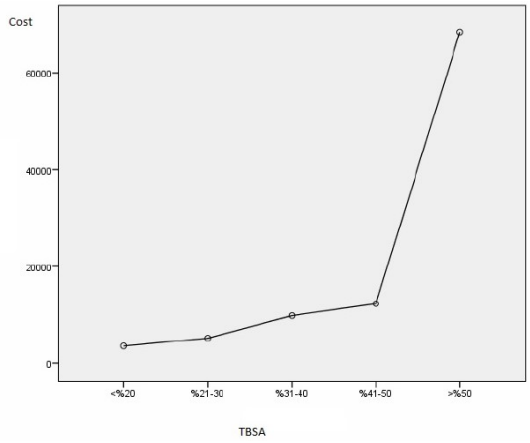

Figure1. Total patients costs according to %TBSA. There was significant statistical relationship between TBSA burns and cost.
TBSA: total burn surface area

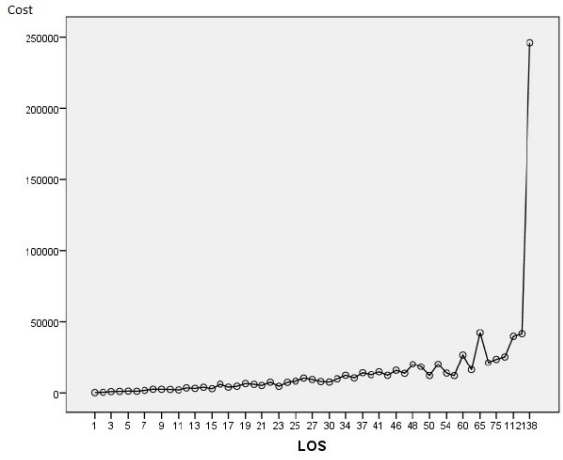

Figure2. Relationship was found to be significantly between TBSA burns and cost.
TBSA: total burn surface area

DISCUSSION

Burn is not only devastating to the patient, but it is important with its direct and indirect effects in family, social and business environments. The patient groups to be treated in burn centers are arranged with guides and are basically serious burn cases (4). Burn centers, undertaking all the treatment of the patient from resuscitation to rehabilitation, are units that increase the quality of life while reducing mortality. Care of burn patients is one of the most expensive treatments in health services due to its long hospital stay, expensive materials and qualified specialists. Treatment of burn patients is important in calculating the share to be separated from the budged of countries. Clinical studies mostly do not differentiate between ICU and non-ICU costs, but it is in the form of calculating over total costs (2). In the 1990s, the mean total cost of hospitalization per patient was between 181.000 TL and 220 .000 TL and the main daily cost was 3.100 TL was calculated with a TBSA of more than 30% (5). In 2008, the daily cost was found to be 2.289TL and it was stated that this was less than half of the intensive care cost (1). In many studies, salaries and treatment costs were evaluated in the same expense category. In studies, a significant part of the cost is salaries and has been reported between 37% and 59% (1,6). However, we analyzed the separate fee proportion between the expense items.

In a study from Brazil with 72% male and total body burn area of 29%, *direct healthcare costs* were subdivided into clinical support, medicines and blood products, medical procedures, burn-specific procedures and hospital fees. The highest expense consisted of medicines and blood products, and the cost of invoice was found to be higher in patients who died. In this study, total cost was found to be 187.200 TL (7). In a review of 156 studies conducted in high-income countries, the significant difference between cost was found on the day of hospitalization and the length of stay in the intensive care unit. In this study, an average of 211.000 TL is spent annually for burn patients, whereas it is found to be 16.800 TL in low and middle income countries (2). In a study based on drug and fluid treatments, laboratory and radiological tests, and physiotherapy, the daily cost of the burn patient was 3.360 TL, and 3.345TL in the non-burn control patient. As it is seen that there is no cost difference between burn and non-burn patients, however the cost changes when 6.772 TL, which is the doctor and nurse fee, are added. There was no difference between drug and fluid treatments and laboratory costs. Radiology costs were higher than the control group. Burn dressing was found to be 576 TL / day. The authors did not find any difference between the average daily cost of burn patients in the ICU and the cost of ICU of non-burn patients (8). The existence of different treatment protocols is important in the formation of these cost differences between countries. However, basically, age, burn percentage, and length of hospital stay are known to be the major factors affecting cost.

When the relationship between age and the cost is examined in the studies, it is seen that the 643 TL per day cost in the average age was 23 years old group and 5.384 TL per day in the 42 years old group. According to the studies, age has a strong effect on hospital costs (7,9,10). In our study, we did not find different costs in patients under 60 years old and over and it was found similar to the calculations we made without age group. The treatment cost was reported to be high due to delays in wound healing and comorbidities in elderly patients. In a study conducted in Japan, it is stated that the severity of burns and hospital costs are parallel, and mechanical ventilation, early escaratomy, grafting and treatment with expensive materials are the result of inter-institutional treatment differences (11). In the sample of twenty people, 29.932 TL was found in the percentage of burns and 17.649 TL cost per day. In the same study, if the body burn area was between 10% and 19.9, the cost was found to be 39.671 TL. The authors have identified the burn area as the most important determinant of the cost, since they showed that the cost increased 3 times if the TBSA exceeds to 30% (12). In the study conducted in our country, the percentage and severity of burns were found to be significant factors in high cost (13). In a similar study, authors showed that the cost of treatment increased with the height of TBSA and a tendency to increased costs asssociated with 40-50% TBSA (14) . In a study involving 109 cases from our country, it was stated that 24.105 TL was spent per case during an average of 26 days of hospitalization, and this

cost is stated to be one-eighty of the expenditures of the Western countries, and the reason for this was low ward, care and surgery costs (3). In a study of 34 cases carried out in a military hospital in our country, it was found that the major part of the total cost was ICU, blood and blood products and drugs, and the cost per capita was 73.200 TL. In this study, expenses in ICU constituted 12-16% of all expenses (15).

While in the high-income countries, one-day expenditure per patient in the burn center is 12.960 TL, while the average of all disease types in public hospitals is 2.918 TL. Due to the limited resources in low-income countries, burn patients are less expensive than developed countries. In patients treated in the ICU, the width of the body burn area and flame burns require more costly treatment, and the cost for 1% burn is over 19.200 TL. Although the LOS is the most costly item of burn care, drug and burn care materials are the highest cost of the ICU (2). Since 40% of the invoice belongs to the first three days of hospitalization, efforts to reduce the length of hospital stay could not be found to be effective (16-18). The effect of early hospitalization is considered the most important factor in reducing costs, therefore, decreasing the LOS. Despite this situation, the daily cost is quite high in paediatric burns treated in intensive care unit (19-20). It was stated in the two representative scenario studies related to the LOS that the LOS did not provide a significant reduction in expenses. In this study, when the costs were separated as fixed or variable, it was shown that they accounted for 58% of the fixed costs and the reduction in these expenses was not possible in practical application (16,17). According to this approach, it is more important to reduce costs in early hospitalization than total hospitalization time. In small area burns, the cause of LOS prolongation has been found as comorbid diseases or complications (21). Previous cost studies have noted grafts and artificial dressing materials as the expensive components of burn care. However, those who have been operated by early excision and grafting cause a decrease in the total cost of hospitalization (22). In our study, although surgical procedures constitute one-thirtd of the invoice, the cost per patient was found to be quite low.

Burn care costs are difficult to quantify completely because of the complex and individual nature of burn treatment. Burn units/centers are places with high costs and the hospital infrastructure should cover this cost. The comprehensive burn care is possible at a cost much lower than found in other centers. The limitation of such studies is that they are single center data, and the treatment protocols differ between the units. For this reason, it is important to establish the burn centers and keep the rate of burn specialists / patients high to provide professional care. In conclusion, in order to be able to reimburse the inpatient, it is necessary to classify in terms of diagnosis, resource use and treatment costs in similar clusters.

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