Original Research Article

Efficiency of the Critical Care Unit Usage in the Emergency Department

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ABSTRACT

Aim: The aim of this study is evaluating demographic characteristics of patients who applied emergency medicine clinic and followed in critical care unit and compare the tests intended the critical care unit and patient outcomes with literature data, finally evaluate the effectiveness of use of the critical care unit.

Methods and materials: Our study planned to analyze the patient who applied the emergency medicine clinic and followed in the critical care unit between August 1 2015-July 31 2016 from the archival records of patient data. Data like; age, gender, owned social security, disease in the back ground, the laboratory and radiologic tests intended from patient, consultations, patients outcome, the services they hospitalized, costs of emergency service were recorded. In the descriptive statistics of data; mean, standard deviation, median, minimum, maximum frequency and ratio values are used. The distribution of values was measured with Kolmogorov Smirnov test. In the analysis of quantitative data Mann Whitney U test was used, Qualitative data were analyzed by the Chi-square test. SPSS 22.0 programme was used in the analysis.

Results: There were 8254 patients; included in the study. The average age of the patients was 49,43 (±19,43). 3656 patients in the study (%44,29) were female and 4598 (%55,71) male. Hypertension was the most common comorbid disease. Cardiology was the department from which most of the consultations were wanted and by which most of the patients were hospitalized. Cranial CT was the most advanced radiologic examination. In the critical care unit 155 patients died and cardiac problems were the most frequent cause of death (%61,95). The average amount per patient files was $ 51, 6. The effect of age on the amount of files was statistically significant (p <0.01).

Conclusion: Our critical care unit; is understood to be a cost effective unit; considering the average cost per patient and the effect of the transaction on patient outcomes.

Key words: Critical care, cost effective, emergency department

INTRODUCTION

Critical patients' care is an important and a growing field in emergency medical service, which involves a difficult, stressful, and costly expertise practice. The process starts previous to the admission to the hospital and continues in emergency service and critical care units meticulously during the illness. The process also requires an experienced medical team and special equipment. [1]

The present study aims to explore some important descriptive information regarding patients delivered to critical care units at emergency services. Specifically, the study has been conducted to identify this patient-group's demographic information, the examinations/tests required in the

critical care units, the endpoints of the patients, the average cost, and the efficiency of the use of critical care units.

MATERIALS AND METHODS

The present study was carried out to retrospectively at Adana Numune Training and Research Hospital Emergency Medicine Clinic between 8th. 01, 2015 and 31st. 07, 2016 and was initiated following the approval received from the Board of Scientific Research Evaluation.

The study was conducted with the inclusion of 8254 patients whose complete files could be obtained. The patients whose files could not be reached were not included in the sample. The data for the study was gathered from the hospital's data processing system, patients ID cards, and the registry of patients at the critical care unit. The data was analyzed in terms of the patients' ages, gender, their social security, illness history, the laboratory and the radiology examinations asked from them, the consultations asked for, their endpoints at the emergency service, the case of hospitalization in general services or intensive care units, and the cost of the total services they received. The data, then, was recorded on patient entrance form that was developed by the researchers.

STATISTICAL ANALYSIS

The data was analyzed descriptively calculating mean, standard deviation, median, the lowest and the highest frequency and ratio values. The filing variable was analyzed utilizing Kolmogorov Smirnov Test. The statistical difference between the filing of the patients below the age of 65 and the ones above 65, on the other hand, was analyzed using Mann-Whitney U Test, which is a non-parametric test used to calculate statistical difference between two independent groups. The qualitative variables were analyzed using Pearson Ki-Squire Test with p=0.05 significance point. The analyses were conducted through SPSS 20.0 statistical program. [2]

RESULTS

The data was gathered from 8254 patients in total. Of the participating patients, 3656 (44.29 %) were female and 4598 (55.71%) were male. The average age of the patients was 49.43 ±19.48 (min 12-max 103), which was 48.32 for male patients and 50.83 for females.

Considering comorbid illnesses of the patients who registered to the emergency service, 34.4 % of them were diagnosed with hypertension, 29.8 % had cardiovascular diseases (CVS), 15.2 % were diagnosed with pulmonary diseases (chronic obstructive respiratory disease or asthma) 12.2 % had renal diseases, 11.1 % had diabetes mellitus, 6.8 % had hematologic diseases, and 1.9 % were diagnosed with malignancy (Figure 1).
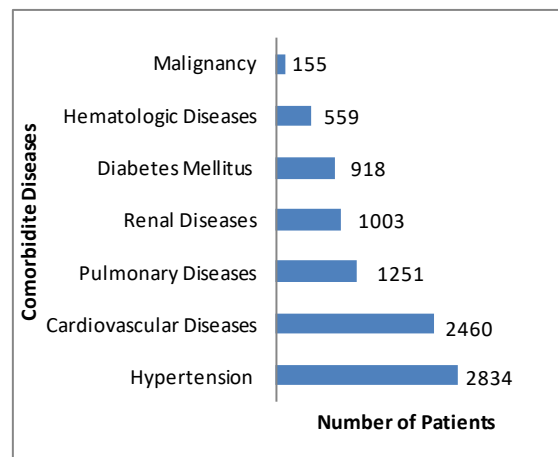

Figure 1. Patients comorbidity diseases

Regarding the laboratory examinations asked for, the most frequent test was complete blood count (CBC) (96.2 %). The other tests were biochemical tests (Glucose, BUN, creatinine, ALT, AST, Na, K, Ca, Cl) (for 7826 – 94.8 % of the patients); coagulation parameters (aPTT, PTZ, INR) (for 5826 – 70.5 % of the patients); cardiac markers examination (CK-MB, Troponin T) (for 5463 – 66.1 % of the patients); blood gas analysis (for 3384 – 40.9 % of the patients); urine analysis (for 2269 – 27.4 % of the patients); B-Hcg (for 900 – 10.9 % of the patients); D-Dimer (for

752 – 9.1 % of the patients); and BNP (for 703 – 8.5 % of the patients) (Figure 2).
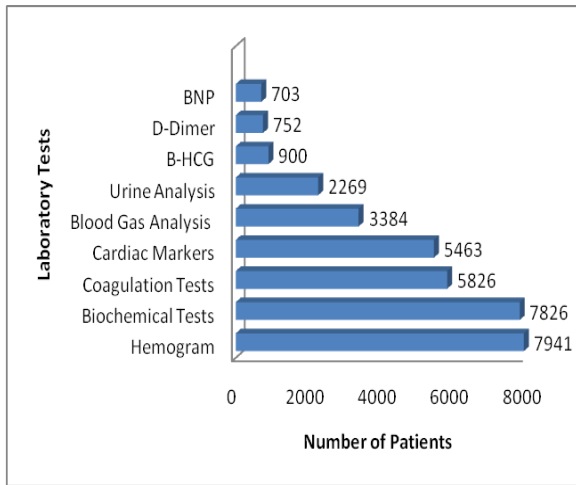

Figure 2. Laboratory tests required from patients
B-HCG: B-Human chorionic gonadotropin
BNP: Brain natriuretic peptide

The most frequently asked radiological imaging methods are displayed in Figure 3. Among the patients who were examined with x-ray graphy, 2107 (54.23 %) were in-patient; 1588 (40.87 %) were discharged from hospital; 171 (4.40 %) of them were sent to other medical institutions;

and 19 (0.48 %) of them were exitus (Figure 4). According to the results, direct graphy was asked from 47.1 % of the total patients, 39.4 % of the patient released; 57.1 % of the in-patients; 12.3 % of the patients who were exitus; and from 45.6 % of the patients sent to other institutions.
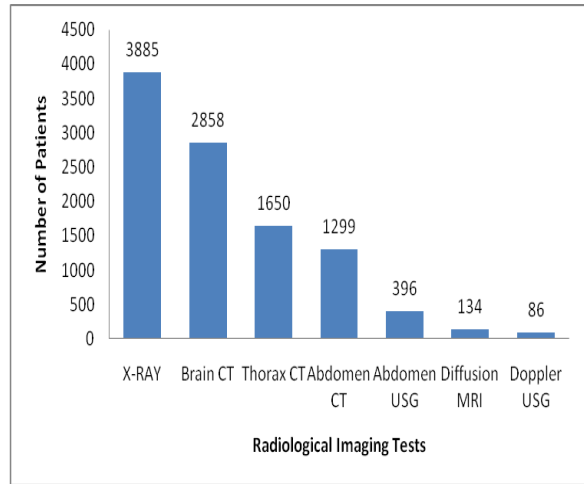

Figure 3. Radiological imaging tests required from patients
CT: Computer Tomography
MRI: Magnetic resonance imaging
USG: Ultrasonography
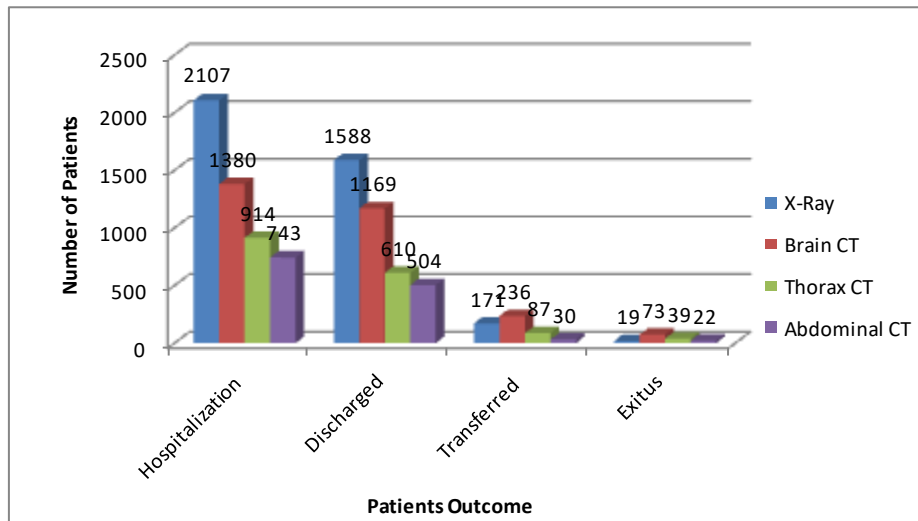X-RAY: Direct graphy

Figure 4. Patients outcome which is desired radiological imaging tests

Among the patients who were required to have brain CT, 1380 (47.83 %) of them were hospitalized, 1169 (40.51 %) of them were discharged from the service, 236 (8.18 %) were sent to other health institutions, and 73 (2.53 %) patients were exitus. (Figure 4). Brain CT was asked for

34.6 % of all the patients, 62.9 % of the patients sent to other institutions, 47.1 % of the patients who died, 37.4 % of the ones who were hospitalized, and 29.0 % of the patients released from the hospital.

When the patients asked to get thorax CT were analyzed, it was found that

914 (55.39 %) of them of them were hospitalized, 610 (36.96 %) of them were released from the service, 87 (5.27 %) were sent to other health institutions, and 39 (2.36 %) patients died while in the emergency service. (Figure 4). Thorax CT was asked for 20 % of the all patients, 23.2 % of the patients sent to other institutions, 25.2 % of the patients who were exitus, 24.8 % of the ones who were hospitalized, and 15.1 % of the patients released from the hospital. When the relationship between thorax CT examination request and being hospitalized or released was analyzed statistically using Pearson Ki-Square test, a statistically significant relationship was revealed between these two variables (p<0,001).

As for the patients who were requested abdomen CT, the results show that 743 (57.19 %) of them were hospitalized, 504 (38.79 %) of them were released from the service, 30 (2.30 %) patients were sent to other health institutions, and 22 (1.69 %) patients died in the emergency service. (Figure 4). Abdomen CT was asked for 15.7 % of the total patients, 8 % of the patients sent to other institutions, 14.2 % of the patients who were exitus, 20.1 % of the ones who were hospitalized, and 12.5 % of the patients released from the hospital. Another statistically significant relationship was found between abdomen CT examination request and being hospitalized or released according to Pearson Ki-Square test results (p<0,001).

When the endpoints of the patients at the emergency service were analyzed, the findings indicate that 4034 (48.87 %) patients were discharged from the emergency service, 3690 (44.71 %) were hospitalized, 375 (4.54 %) of them were transferred to other health institutions due to the lack of vacancy in the intensive care units of the hospital, and 155 (1.88 %) were while in the emergency service (Figure 5).
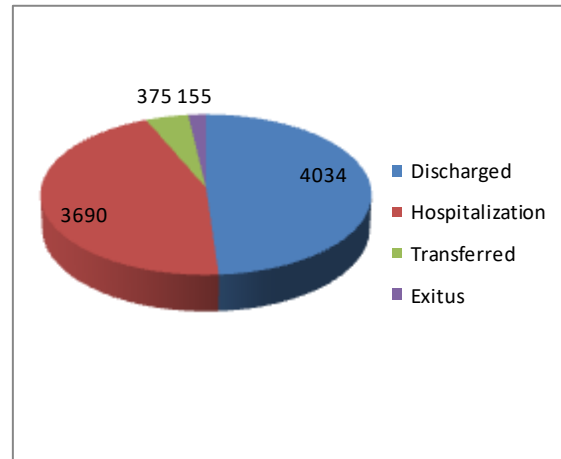

Figure 5. Patients outcome at emergency service

Regarding the consultations asked, the findings show that for 5271 (63.85 %) patients, 6792 consultations in total were asked. The number of consultations was 1366 (33.9 %) of the 4034 patients released, 3499 (94.8 %) of the 3690 patients who were hospitalized. As a result of the consultations required for 5271 patients, 3690 of them were hospitalized and 375 patients were sent to other health institutions since they needed intensive care and there were not any available beds in the hospital's intensive care units. In total, 4065 (77.12 %) patients who were sent for consultations were hospitalized.

Considering the distribution of the consultations in terms of departments, 4221 were from internal departments and 2570 (60.88 %) of these were hospitalized in these departments. The other consulted departments were: 1397 (16.92 %) cardiology, 628 (7.60 %) internal diseases, 570 (6.90 %) neurology, 476 (5.76 %) thoracic diseases, 410 (4.96 %) gastroenterology, 374 (4.53 %) nephrology, 154 (1.86 %) oncology, 150 (1.81 %) infectious diseases, 48 (0.58 %) hematology, 12 (0.14 %) psychiatry, and 2 (0.02 %) dermatology departments.

From surgical departments, 2571 consultations were asked in total and 1120 (43.56 %) of them were hospitalized in surgical departments. In respect to the departments, the number of the consultations was 638 (7.72 %) for brain

surgery department, 545 (6.60 %) for general surgery, 429 (5.19 %) for orthopedics, 383 (4.64 %) for thoracic surgery, 109 (1.32 %) for cardiovascular surgery, 109 (1.32 %) for otolaryngology, 102 (1.23 %) for gynecology, 88 (1.06 %) for urology, 69 (0.83 %) for ophthalmology, 38 (0.46 %) for plastic surgery, 36 (0.43 %) for anesthesia, and 25 (0.30 %) for burn units. When the relationship between the

request for consultation and the variable of being hospitalized or released was analyzed statistically using Pearson Chi-Square test, a statistically significant relationship was found (p<0.001).

Of the 3690 patients who were hospitalized, 980 of them were placed in intensive care units. The distribution of the intensive care units is presented in Figure 6.
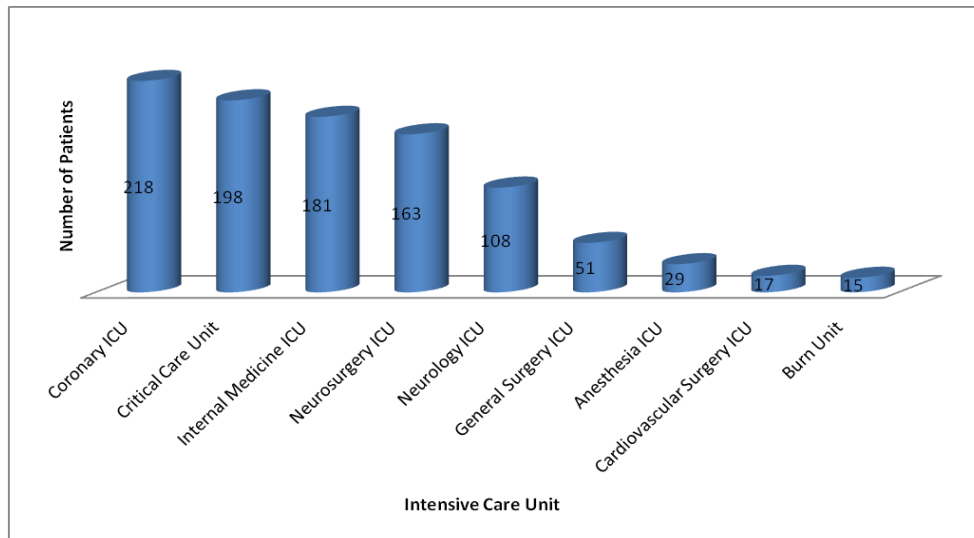

Figure 6. Patients distribution of intensive care unit (ICU)

The number of the patients who were hospitalized is 2710 out of 3690 total patients. Regarding the distribution of the departments in which the patients were placed, the findings reveal that 622 (22.95 %) patients were sent to cardiology department, 289 (10.66 %) to the department of gastroenterology, 285 (10.51 %) to internal diseases, 262 (9.66 %) to nephrology service, 220 (8.11 %) to brain surgery department, 215 (7.93 %) to general surgery service, 167 (6.16 %) to thoracic diseases, 141 (5.20 %) to thoracic surgery department, 140 (5.16 %) patients to orthopedics, 106 (3.91 %) to oncology, 77 (2.84 %) to neurology, 40 (1.47 %) to cardiothoracic surgery, 34 (1.25 %) to infectious diseases department, 27 (0.99 %) to urology service, 27 (0.99 %) to gynecology service, 23 (0.84 %) to hematology department, 16 (0.59 %) to plastic surgery department, 10 (0.36 %) to ophthalmology department, and 9 (0.33 %)

to otolaryngology service for hospitalization.

The number of the patients placed in general services and in intensive care units was 3690 in total. Among these, 583 (15.79 %) were exitus and 3107 (84.20 %) of them were discharged from the hospital. Of the 155 patients who were exitus in critical care unit, 95 (61.29 %) of them died of cardiac reasons, 14 (9.03 %) of them because of traffic accidents, 8 (5.16 %) of them died as a result of falling down from height, 7 (4.51 %) as a result of firearm injuries, 5 (3.22 %) of them died of COPD, 4 (2.58 %) of poisoning, 4 (2.58 %) because of cerebrovascular diseases, 4 (2.58 %) of chronic renal failure, 3 (1.93 %) of stab wounds, 3 (1.93 %) of malignity, 2 (1.29 %) of gastrointestinal bleeding, 2 (1.29 %) of drowning, 2 (1.29 %) of septicemic, 1 (0.64 %) of hanging suicide, and 1 (0.64 %) of the patients died because of electrical shock (Figure 7).
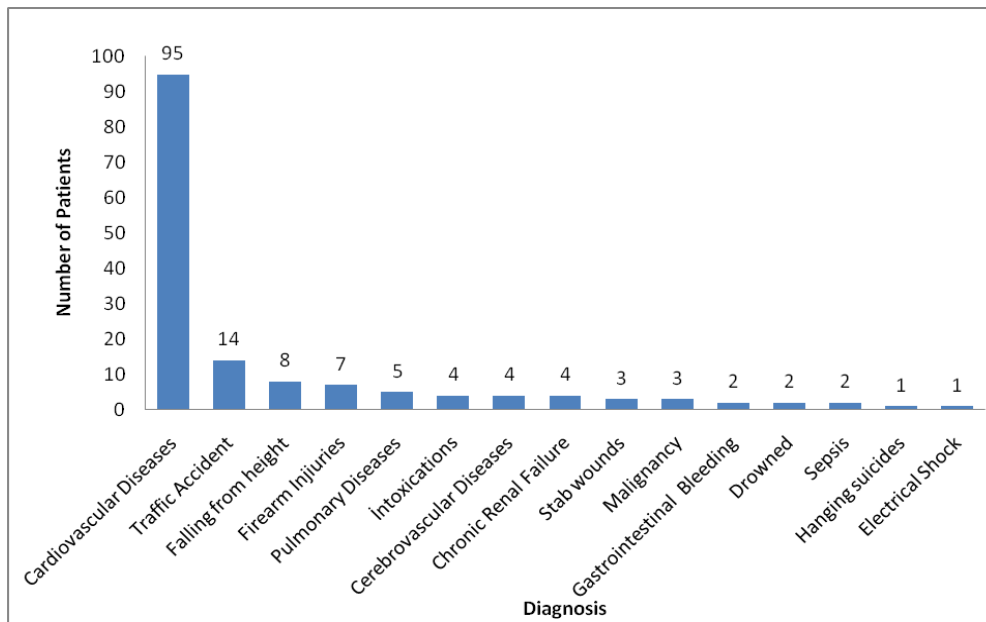
Figure 7. Exitus patients at critical care unit

Analyzing the filing costs of the patients, it is found that the cost is below 64.135 TL for 5 % of the patients, below 80.988 TL for 10 % of them, below 116.875 TL for 25 %, below 165.100 TL for 50 % of them, below 247.140 TL for 75 %, below 369.000 TL for 90 %, and below 442.066 TL for 95 % of the patients (Table 1). The average filing cost for the patients below the age of 65 is 194.10 TL while it is 202.56 TL for the ones above the age of 65. This difference in the average cost was analyzed statistically and a statistically significant difference was found between the average filing costs of the patients below and those above the age of 65 ($p<0,001$).

Table 1. The distribution of the file amount

FİLE AMOUNT ($)	THE DİSTRİBUTİON OF THE FİLE AMOUNT PERCENT (%)						
	%5	%10	%25	%50	%75	%90	%95
	16,5	20,8	30,1	42,5	63,6	95,1	113,9

DISCUSSION

According to the report by Turkish Institute of Statistics, in 2016, 282.859.972 patients in total received treatment at hospitals and 85.097.415 of these were treated at emergency services. [3] While the majority consisted of the patients who needed only ambulatory treatment, also called green area patients, [4] the number of the patients who were in need of difficult, stressful and costly treatment which required expertise was much lower; however, this group constituted the majority of the mortality and morbidity rates. [5] Critical illnesses can occur at any age level while it is more prevalent among old patients because of comorbid diseases. In 2015, people over the age of 65 constituted 8.2 % (6.495.239) of Turkey's population.

The increase in the rate of older population has led to an incline in the number of the old patients with critical illnesses who require hospitalizing in intensive care units. The literature in the field states that 46 % of the patients under treatment in intensive care units are over 65. [6] The average age of the participants in the present study is 46.43 and 25 % of them were over the age of 66. That the average age is 46.43 indicate that the participant group included not only old patients with chronic diseases but also younger patients with poisoning or traffic accident cases as well.

According to the Chronic Disease Report published by Ministry of Health, General Directorate of Medical Treatment Services, the most common chronic diseases are high blood pressure, diabetes, mellitus,

chronical obstructive respiratory diseases and cardiovascular diseases. [7] The findings of our study reveal the same illnesses to be the most frequent among the participants, namely high blood pressure (34.4 %), cardiovascular diseases (29.8 %), chronical obstructive respiratory diseases (15.2 %), and diabetes mellitus (11.1 %).

As the diagnostic research methods have been continuously improving and proliferating nowadays, it is becoming more challenging to decide for doctors, particularly for the ones working at emergency services, on which laboratory and imaging method would be the best choice for a specific case. Yet, there has been a significant decrease in the number of examinations and radiation exposure since medicine based on proof started to be regarded as the accepted application. [8] As the funding sources, and thus, the budget allocated for health services have been shrinking, the question of cost-effectivity has become more and more important. [9] Laboratory and radiological examinations are among the most commonly focused on issues for several reasons. First, they form more than 40 % of the financial burden in the evaluations for emergency-patients; [10,11] secondly emergency physicians are directly responsible for inputs evaluations; and finally, there have been quite a lot of studies revealing that the aforementioned methods are frequently used excessively. [12-14] The findings of our study indicate that computerized brain tomography (CBT) is the most used examination (34.6 %). The study conducted at Uludag University also states CBT as the most commonly required examination followed by USG. [15] The results of the present study, however, reveal that USG was at very low frequency level (4.8 %). That USG is not an official routine at off-hours is believed to be a contributing factor for this low level. [16] The findings of our study also indicate that there is a statistically significant between the patients' hospitalization and the brain, abdomen, and thorax tomography requests (p<0,001). That the majority of the patients who were sent

for CT examination based on their other examination results were hospitalized may imply that the examinations asked for were the exact ones.

The results show that for 63.85 % of the participant patients, at least one consultation was requested while two or more consultations were asked for 19.02 % of them. Following the consultations, 51.13 % of the patients were hospitalized, sent to other medical institutions due to bed unavailability in intensive care unit, or died in the emergency service. The result indicates how efficiently and accurately consultation requests are used in our critical care unit. The relationship between hospitalization or discharge cases and consultation requests was analyzed utilizing Pearson Ki-Square test and a statistically significant result was found (p<0,001). According to the study conducted in 2014 in Hacettepe University, the departments which requested consultations the most were internal diseases, infection, and cardiology. [17] The results of our study show that consultations were most frequently asked at cardiology (16.92 %), neurosurgery (7.72 %), and internal diseases (7.60 %) departments. The lowest rate was found in dermatology (0.02 %) and psychiatry and (0.14 %).

It was reported that, out of 5981 of the patients who were admitted to the emergency service, 53.4 % of them discharged from the hospital, 23.2 % admitted to intensive care units, 16.2 % were admitted to various services, 1.1 % of them lost their lives in the emergency service, and 0.4 % were transferred to other health institutions. [18] According to the results of our study, 48.7 % were discharged from the emergency service, 32.82 % were admitted to the services, 11.87 % of them were taken under care in intensive care units, 4.54 % were sent to other institutions' intensive care units as there were no vacant places in our hospital, and finally 1.88 % of these patients died. The emergency treatment of the patients with critical illnesses admitted to the emergency service

starts at the critical care unit and the stabilization of the patients' health state is tried to be obtained at diagnosis stage. The majority of the patients are tracked and treated in critical care units and they are sent to general services without needing intensive care, which can be the reason for having a higher number of hospitalized patients in general service units than in intensive care units.

The number of hospitalized patients was higher for cardiology (22.95 %), gastroenterology (10.66 %), and internal diseases (10.51 %) services. Cardiology has the highest number of patients both for general services and for intensive care units, which indicates cardiac diseases are the most frequent cases among comorbid illnesses and the most commonly consulted. This finding clearly emphasizes the importance of cardiology in critical care services.

Hospitalization in intensive care units has the highest number for coronary intensive care unit (22.24 %), which is followed by critical intensive care with 20.20 %. Considering the high number of the patients followed in critical intensive care units points at the important role of the critical care unit in terms of the burden it removes from the hospital.

Studies reported that, in Europe, there are 1.15 beds in intensive care units for every 10.000 people, in America is 2.8 [19] and in 2015 at Turkey is 3.9 beds. [20,3] That 4.54 % of the all patients were sent to other health institutions because of the lack in the beds in our hospital indicates the inadequacy of the beds in our hospital. According to the Statement of Health Practices by Turkish Social Security Institution, intensive care units are paid $ 85, 8 for the first level, $ 188, 6 for the second level, and $ 348 for the third level treatments per day. [21] A study conducted shows that the one day cost of intensive care service is $ 354. [22] Another study reports the daily cost to be $ 174, 6. [23] The findings of our study, on the other hand, suggest that the average daily cost per filing

is $ 51, 6. The filing cost is below $ 113, 9 for 95 % of the patients. When considering the services provided in our critical care unit such as patient follow up by mechanic ventilators, emergency treatments for the patients in need of intensive care until they are ready to be placed in general service units, it could be claimed that the critical care unit provides a highly cost-effective service.

CONCLUSION

There has been a constant increase in the number of admissions to emergency services of patients with critical illnesses in our country owing to the growth in population, decrease in life expectancy, and higher availability levels of emergency services. Critical illness patients admitting to emergency services require all-purpose critical care units that can provide service to patients with various health complaints. In critical care units, patients do not only receive treatment during their diagnosis phase, but are also attended until their health course is stabilized, which eventually helps to reduce the rate of unnecessary use of intensive care units. The results regarding the impact of the practices conducted in critical care units on the patients' endpoints as well as the average cost of those practices per patient may suggest that critical care units are cost-effective units.

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