ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Evaluation of The Patients Brought to The Emergency Service by Helicopter Ambulance by REMS and NACA Score

Acil Servise Helikopter Ambulans İle Getirilen Hastaların REMS ve NACA Skoruna Göre Değerlendirilmesi

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ABSTRACT

Aim: Air ambulances are used to save patients and deliver first aid where it is hard or impossible to access by land under favorable weather conditions. Air ambulances are indispensable in modern health care services. Air ambulance services are invaluable in terms of being fast and reliable and providing early response to the patients in need as well as being costly. In this study, the aim is to demonstrate availability and efficiency of REMS score as well as NACA score that are frequently used in making a decision on using air ambulance services.

Material and Methods: In this study, 77 patients that were dispatched to the emergency service of our hospital by air ambulance between January 2014 – December 2016 as a case or from other health centers were evaluated retrospectively. The data were statistically analysed after they were uploaded to the program SPSS (Statistical Package for The Social Scienses) 23.0.

Results: While median NACA value is 6 in the exitus cases, it is 2 in the surviving cases; there is a statistically significant difference in the median NACA values between the two groups (p<0,001). While median REMS value is 17.5 in the exitus cases, it is 3 in the surviving cases; there is a statistically significant difference in the median REMS values between the two groups (p<0,001).

Conclusion: Use of REMS score together with NACA score in evaluation of patients prior to helicopter ambulance service enables the health personnel to make more efficient and accurate decisions.

Keywords: Helicopter Emergency Health Service; Helicopter Ambulance, REMS Score; NACA Score

ÖZ

Amaç: Kara yolu ile ulaşımın zor veya imkânsız olduğu durumlarda uygun hava koşullarında hastaların kurtarılması ve ilk yardımın ulaştırılması için hava yolu ambulansları kullanılmaktadır. Modern sağlık hizmetlerinde hava ambulansları vazgeçilmezdir. Hava ambulansları; hızlı, güvenilir ve ihtiyacı olan hastalara erken müdahele açısından çok kıymetli olmakla birlikte maliyeti yüksek bir hizmettir. Bizim bu çalışmada amacımız hava ambulansı hizmetine karar verilirken sık kullanılan NACA skorlamasının yanında daha objektif kriterlerin kullanıldığı REMS skorunun da kullanılabilirliğini ve etkinliğini göstermektir.

Gereç ve Yöntemler: Çalışmamızda Hastanemiz Acil Servisine Ocak 2014 –Aralık 2016 yılları arasında hava ambulansı ile vaka olarak veya diğer sağlık merkezlerinden sevkli getirilen 77 hasta retrospektif olarak incelenmiştir. Veriler SPSS (Statistical Package For The Social Scienses) 23.0 programına yüklenerek istatistiksel analizleri yapıldı.

Bulgular: Ölen hastalarla yaşayan hastaların ortanca NACA değerleri arasında istatistiksel olarak anlamlı fark vardır (p<0,001). Ölenlerde ortanca değer 6 iken yaşayanlarda 2 olarak elde edilmiştir. Çalışmamızda REMS skorları ortanca değeri de ölenlerle yaşayanlara göre istatistiksel olarak anlamlı farklılık tespit edilmiştir. (p<0,001). Ölenlerde ortanca değer 17.5 iken yaşayanlarda 3 olarak elde edilmiştir

Sonuç: Helikopter Ambulans hizmeti öncesi hastaların değerlendirilmesinde NACA skorlaması ile birlikte REMS skorunun da kullanılması; Sağlık personelinin daha etkin ve doğru karar vermesini sağlayacaktır.

Anahtar Kelimeler: Helikopter Acil Sağlık Hizmeti, Helikopter Ambulansı, REMS Skoru, NACA Skoru

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Introduction

It is commonly known that the elapsed time while taking a patient from the scene to hospital is crucial. The cases in Turkey are given advanced health services by well-equipped ambulances and well-trained paramedics under the control of 112 (number of emergency call) command center and minimal complications are aimed in doing so (1).

Air ambulances are used to save patients and deliver first aid where it is hard or impossible to access by land under favorable weather conditions. In addition, air ambulances may also be used to carry the organs to be transplanted to hospitals. Air ambulances are indispensable in modern health services. Transportation of patients by air ambulance dates back to 1800's (1). Air ambulance industry has grown significantly in the last 30 years in the world and it is considered to be beneficial in increasing survival and recovery rates of trauma cases and other patients in critical condition particularly in rural areas (2). Presence of this service plays an essential role particularly in rural areas where accessible advanced health centers and medical experts are absent (3).

Aircrafts are split into two as fixed wing aircrafts and helicopters. Both of them have advantages and disadvantages compared to each other (4). Air ambulance service came into operation in Turkey with 2 helicopters within the structure of the Ministry of Health in 2008. There are still 17 helicopter ambulances in total in Turkey; Ankara have 2 of them and other provinces each have 1 (Istanbul, Malatya, Çanakkale, Bursa, Izmir, Antalya, Afyon, Adana, Kayseri, Konya, Diyarbakır, Van, Erzurum, Trabzon and Samsun) (5).

A number of scoring systems were developed to calculate mortality risks in life-threatening conditions and diseases such as, multiple trauma, pulmonary embolism. Health personnel can evaluate the condition of a patient objectively thanks to these scoring systems and estimate the clinical condition, mortality and morbidity risk of the patient universally (6).

The REMS (Rapid Emergency Medicine Score) score is seen as a prehospital measure of disease severity and as an assessment tool to monitor clinical change (7). The NACA (The National Advisory Committee on Aeronautics Scale) severity score has gained wide-spread acceptance as a means of describing diseaseor injury severity in patients treated by emergency medical services. The NACA score was one of the earliest severity scoring systems in trauma and was primarily used for scoring 24 h after admission in hospital. Because of this, the NACA score was not applied for pre-hospital purposes. In 1980, Tryba et al. modified the NACA score to include both surgical and medical conditions at the time of handover from emergency medical services to hospital and thus made thescore suitable for severity assessment by pre-hospital services (8). The study analysed REMS and NACA scoring systems.

Air ambulance services are invaluable in terms of being fast and reliable and providing early response to the patients in need as well as being costly. Unfavorable weather conditions, in particular, affect provision of the service negatively. In addition, this service requires high security and a lot of well-trained personnel. Considering such situations, it is obvious that this service needs to be provided to patients appropriately.

The study investigated whether the patients that were brought to the emergency service of our hospital by helicopter ambulance were evaluated by REMS and NACA scores and dispatched to the hospital by accurate indications and also availability and efficiency of NACA and REMS scores that are commonly used in helicopter ambulance service.

Material and Methods

This retrospective and cross-sectional study analysed 77 patients that were dispatched to OMU (Ondokuz Mayıs University) Medical Faculty, Emergency Clinic by air ambulance between the dates January 2014–December 2016. The study analysed the age, gender, admission date, airline security evaluation, form of trauma in traumatic patients, REMS score, NACA score, whether emergency response is required, change in cases by seasons, service of admission, mortality, length of hospital stay from the files of patients that were brought to the hospital by air ambulance on the specified dates and the hospital information system and then statistical comparison was made for the data. The United Nations classified the ages of children, young and middle-aged persons and elder persons as 0-18, 18-40, 40-65, and 65+. Ethics committee approval no. B.30.2.ODM.0.20.08/599, resolution number 2016/391 of the study was obtained from Ethics Committee of Ondokuz Mayıs University, Medical Faculty.

REMS Score

REMS is adapted from Acute Physiology and Chronic Health Evaluation (APACHE) that is used for intensive care units. Body temperature, mean arterial pressure, heart rate, respiration rate, oxygen saturation, Glasgow coma score and age are graded on a scale from 0 to 4 in REMS scoring. Different values are used for age (7). (Table. 1)

NACA Score

NACA score is an eight-level scoring system that is commonly used to determine the severity of an injury or disease. Mortality risk of a patient increases as the score increases (8). (Table. 2)

We entered the data to the program Microsoft Office 2016 Excel and uploaded them to the program SPSS (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) Then, we analysed the data statistically. Conformity of the

SCORE	Body Temperature	MAP*	Heart Rate	Respiration Rate	O2 Saturation	GKS	Age
+4	>40.9	>159	>179	>49	<55	<5	
+3	39-40.9	130-159	140-179	35-49	55-60	5-7	
+2		110-129	110-139			8-10	
+1	38.5-38.9			25-34	61-70	11-13	
0	36-38.4	70-109	70-109	12-24	>70	>13	<45
+1	34.35.9			10-11			45-54
+2	32-33,9	50-69	55-69				55-64
+3	30-31.9		40-54				65-74
+4	<30	<49	<39	<5			>74

*Mean Arterial Pressure

Table 1. REMS Scoring System by Clinical Findings and Age (7)

Number of Patients	In-Hospital Mortality Rate	NACA Scores of Patients	NACA Score	NACA Score Definition
57	0 (0%)	0-1-2	0	No disease
			1	No care needed by doctor.
			2	Doctor intervention is required but hospital stay is not needed.
1	0 (0%)	3		No life-threatening conditions but hospital stay is needed.
			3	Conditions that may lead to disorder in vital findings.
6	3 (50%)	4		Life-threatening condition.
			4	
3	3 (100%)	5	5	Patients that are successfully stabilized through resuscitation after disease/injury
11	6 (54%)	6	6	Terminal diseases or fatal injuries.
0	0 (0%)	7	7	

Table 2. NACA Scoring System (8) And NACA Score and Mortality Rate of The Patients Taken to The Emergency Service

data to normal distribution was analysed by using Shapiro Wilk. Comparison of the data that don't conform to normal distribution was made by Mann Whitney U test. The correlation between variables were analysed by using Spearman correlation analysis. Quantitative data were presented as median (min-max); qualitative data are presented as frequency (percent). Significance level was considered as p<0,05.

Results

In analysis of the patients by age groups, the rate of people under the age of 18 was found 32.5% (n:25) while the people between the ages 19-39 were 22.1% (n:17); the people between the ages 40-64 were 28.6% (n:22); the people aged 65 years and older were 16.9% (n:13). The study found that 72.7% of the patients (n:56) were male and 27.3% of the patients (n:21) were female. Average age was 38 in males and 19 in females. In males, the youngest patient was 1 year old while the oldest one was 85 years old. In females, the youngest patient was 2 years old while the oldest one was 90 years old.

Peak time of the hospital is August, and the rate of the patients arriving at hospital in August to the total number of patients was found 22.1%. June and September follows August in comparison of the patients arriving at hospital; the rate of patients arriving at hospital in these months was found 15.6%. The rate of patients arriving at hospital in summer is 59.7% (n:46) while it is 23.4% (n:18) in autumn, 14.3% (n:11) in spring, and 2.6% (n:2) in winter.

In our study mortality was found to be 100% in patients with a REMS score of 24-26, while mortality was 0% in patients with a REMS score of 0-2. (Table 3)

Mortality Rate According To Literature (7)	REMS Score	The Number Of Patients In The Study (n)	The Mortality Rate In The Study (%)
0%	0-2	29	0 (0%)
1%	3-5	21	1 (4.7%)
3%	6-9	5	1 (20%)
4%	10-11	4	0 (0%)
10%	12-13	1	0 (0%)
17%	14-15	8	2 (25%)
38%	16-17	3	2 (66%)
45%	18-19	3	3 (100%)
56%	20-21	0	0 (0%)
66%	22-23	0	0 (0%)
100%	24-26	3	3 (100%)

Table 3. Mortality Rates by REMS Score (7) And REMS Score and Mortality Rates Of The Patients Taken To The Emergency Service

72.7% of the patients (n:56) arrived at hospital due to trauma. 14.2% of them (n:11) were dispatched to the hospital due to myocardial infarction. (Table 4)

Reason	Number	Percent
Trauma	56	72.7
Myocardial Infarction	11	14.2
SAH	2	2.6
Postpartum Hemorrhage	2	2.6
Complete AV Block	1	1.3
CO Intox	1	1.3
Intraparenchymal Hemorrhage	1	1.3
Cerebellar Hemorrhage	1	1.3
Status	1	1.3
Foreign Body Aspiration	1	1.3

Table 4. Pre-Diagnosis of The Patients Brought to The Hospital by Helicopter Ambulance

Median value in NACA scoring was found 2 for the patients and this value varies between 1 and 6. Median value in REMS scoring was found 3.5. While minimum value of REMS score was found 0, maximum value was found 27.

While the rate of patients in emergency monitoring was 9% (n:7), the rate of patients in intensive care unit was 48.1% (n:37); the rate of urgent operation patients was 26% (n:20); the rate of patients dispatched to another hospital was 2.6% (n:2); the rate of hospitalized patients was 37.7% (n:29); the rate of patients discharged from the emergency service was 10.4% (n:8); and the mortality rate was 15.6% (n:12). There is a statistically significant difference between median NACA values of exitus and surviving cases (p<0,001). Median value was 6 in exitus cases while it was 2 in surviving cases. (Table 5) In this study, there is a statistically significant difference between median values in REMS scores of the exitus and surviving cases (p<0,001). Median value was 17.5 in the exitus cases, while it was 3 in the surviving cases. (Table 5)

	NACA	REMS
Result		
Ex	6 (5 – 6)	17.5 (3 – 27)
Survived	2 (1 – 6)	3 (0 – 16)
Test Statistics	U=20	U=53.5
p	<0,001	<0,001

Table 5. Effect Of NACA-REMS Scores of The Patients Brought to The Emergency Service on Mortality Calculation

Discussion

The need for emergency health services increase each passing day along with advancing technology and growing population. In the increasingly socialized and globalized world, people now travel a lot more and they are occupied in nature sports more. Therefore, the need for rendering health service to hard-to-reach areas increases more and more. Thus, emergency health service aims to take patients to hospitals in the fastest and safest way possible. Also, alternative means of transportation are used for patients in addition to land transport.

Many studies around the world demonstrate that helicopter ambulance service decreases mortality rate if it is used in the right place at the right time (9). There are many disputes over the criteria for use of helicopter ambulance health service which is expensive (10). Emergency call center decides to activate helicopter ambulance system depending on the criteria such as cases, severity of accidents, number of casualties, and distance of scenes of accident to hospitals along with the specified rules. Unnecessary use of helicopter ambulance system leads to overconsumption of cash resources. For the helicopter ambulance system to be cost-effective, activation of the system must be examined and investigated in detail at every stage.

In a study conducted by Diaz et al., 1075 patients were carried by helicopter ambulance in 3 years and 7854 patients were carried by ground ambulance (11). The rate of patients transported by air ambulance was found 12%. Brown et al. found in their study on comparison of the traumatic patients transported by ground ambulance and air ambulance that 16% of the patients were transported by helicopter and 84% of the patients were transported by ground ambulance (12). In this study, there were 14,112 patients brought to our hospital by emergency medical services the period of 2 years between the dates 1.1.2014 -31.12.2016. Of these patients, 77 (0.54%) were brought to the hospital by helicopter ambulance.

Gosteli et al. found in their study on 616 patients transported by helicopter ambulance that 70.94% of the patients are male, 29.06% of the patients are female (13). Pasquier et al. found in their study in France that the ratio of male/female is 2:1 in 921 cases that were transported by helicopter ambulance (14). Andruszkow et al. found in their study on 42,788 patients that the rate of male patients is

72.4%. In this study, we found that 27% of the patients (n:21) that were transported by helicopter ambulance are female and 73% (n:56) are male (15). This study is in accordance with literature, in that males predominate the total number of patients; this is probably because males are exposed to trauma more. Besides, the rate of patients that were transported to the hospital by helicopter ambulance was 59.7% in summer in this study while the rate was 2.6% in winter. There wasn't any transfer of patient by helicopter ambulance in December, January, and February. August was found to be peak time of transfer of patient at the rate of 22.1%. Accordingly, we think that there are many cases of traumas particularly related to agricultural works in summer. In addition, it is obvious that helicopter ambulance transportation is adversely affected by unfavorable weather conditions in our region and the fact that days last shorter in winter months.

Lairet et al. reported in their study in 2013 that 425 (65%) of 656 patients that were transported to hospitals by helicopter ambulance were trauma patients; 231 (35%) were patients with other medical conditions (16). Young-Hoon Yoon et al. reported in their study in 2011 that 28 (68%) of the 41 patients that were transported to hospitals by helicopter ambulance were traumatic patients and 13 (32%) were patients with other medical conditions (17). In this study, 72.7% of the patients (n:56) that were transported to hospital by helicopter ambulance were traumatic patients and 27.3% (n:21) were patients with other medical conditions. The study found that most of the traumatic patients consist of blunt trauma cases. The study is in accordance with literature in this respect.

There is a statistically significant difference between median NACA values of the exitus and surviving cases ($p<0,001$). Median value was found to be 6 in the exitus cases while it was 2 in the surviving cases. The study found statistically significant difference between median values in REMS scores of the exitus and surviving cases ($p<0,001$). Median value was 17.5 in the exitus cases while it was 3 in the surviving cases. (Table 5) These findings suggest that triage can be performed more accurately in the field by using REMS score comprising vital findings and GCS as well as NACA score in transportation of patients by helicopter ambulance; thus more accurate decisions can be made on the use of air ambulance. In addition, REMS score is a scoring system that paramedics, nurses and doctors may calculate easily and quickly in the field and it contains more objective findings compared to NACA score. Therefore, REMS scoring must absolutely be used as well as NACA scoring if air ambulance system is going to be used for a patient.

Besides, 10% of the patients that were transported to the hospital by helicopter ambulance in this study were discharged after they were evaluated in emergency service and their consultation and monitoring were completed. This rate suggests that more objective criteria are required in deciding to transport a patient by helicopter ambulance. Use of REMS and NACA scores together may be good option in this regard.

Limitations

In this study, we couldn't find the data such as time of arrival of air ambulance to the scene after decision was made to dispatch it, time of arrival to the hospital, distance of scenes to the hospital and cost of the cases for technical reasons. This is one of the limitations of the study. We think that there is a need for further studies on the use of air ambulance services cost-efficiently and on larger patient populations.

Conclusion

The study found a significant correlation between NACA and REMS scores and mortality rate of the patients transported to the hospital by helicopter ambulance. In addition, the findings of our study showed that unnecessary use of air ambulances can be minimized when REMS and NACA scores are used in patients transported by helicopter ambulance. We think that REMS score which is more objective should be used together with NACA score in air ambulance systems.

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Authors' Contribution: All authors contrubuted for conception, design of the study, data collection, data analysis, and assembly. The manuscript was written and approved by all authors.

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