Acil Tıp Hekimlerinin Hava Ambulansı ile Kritik Hasta Nakli Konusundaki Bilgilerinin Değerlendirilmesi

Evaluation of The Knowledge Level on Aeromedical Transfer of The Critically Ill Patients Among Emergency Medicine Physicians

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ÖZ

GİRİŞ ve AMAÇ: *Kritik durumdaki hastalar, gerekli bakım sağlanması için hava ambulansları ile nakil gerektirebilecek hayati tehlike oluşturan yaralanmalara veya hastalıklara sahiptir. Ancak bu hastaların nakli ek riskler oluşturmaktadır. Bu nedenle, kritik hastaların nakil sırasındaki yönetimi çok önemlidir. Bu çalışma, acil tıp asistanları ve uzmanlarının havadan hasta transferi konusundaki bilgi düzeylerini karşılaştırmayı ve hava tıbbi nakil konusunda daha önceki deneyimlerinin ve eğitim almalarının katılımcıların bilgi düzeylerine etkisini belirlemeyi amaçlamıştır.*

YÖNTEM ve GEREÇLER: *Bu çalışma, Şubat 2021 ile Mart 2021 arasında gerçekleştirilen web tabanlı ileriye dönük bir anket çalışmasıydı. Üç bölümden oluşan anketin, ilk bölümünde yazılı bilgilendirilmiş onam, ikinci bölüm yaş, cinsiyet, hekimin akademik derecesi, havadan hasta transferi ile ilgili önceki eğitimi ve havadan hasta nakli ile ilgili önceki deneyimleri içeriyordu. Üçüncü bölüm, katılımcıların havadan tıbbi hasta transferi konusundaki bilgi düzeylerini anlamaya ayrılan sorulardan oluşturuldu.*

BULGULAR: *Çalışmaya 77 acil servis hekimi katıldı. Bunların 38'i (%49,4) asistan, 39'u (%50,6) uzmandı. Asistanlar ve uzmanlar arasında endotrakeal kaf basıncının doğru cevap oranları arasında anlamlı farklılık bulunmaktaydı [sırasıyla 3/38 (%7,9), 14/39 (%35,9)] (p<0,05), diğer soru cevaplarında katılımcılar arasında anlamlı farklılık görülmedi.*

TARTIŞMA ve SONUÇ: *Bulgularımız hekimlerin bu spesifik tıbbi alanda eğitim ve öğretiminin yeterli olmadığını göstermektedir. Daha fazla randomize kontrollü çalışmaların yapılması, doktorların havadan hasta transferi konusundaki bilgi düzeylerini değerlendirebilmek için gereklidir.*

Anahtar Kelimeler: *havadan tıbbi nakil, acil tıp, kritik bakım*

ABSTRACT

INTRODUCTION: *Critically ill patients have life-threatening injuries or illnesses that might require transportation for adequate care. However, transport of these patients poses additional risks for these patients. Therefore, prehospital management of these patients is crucial. The study aimed to compare the knowledge level of the emergency medicine residents and specialists on aeromedical patient transfer and to determine the effects of previous experience and previous education in aeromedical transfer on the knowledge level of the participants.*

METHODS: *This was a prospective web-based survey study conducted between February 2021 to March 2021. The survey consisted of three parts. The first part was for the written informed consent, the second part included age, sex, the academic degree of the physician, previous education on aeromedical patient transfer, and previous experience of aeromedical patient transfer. The third part was dedicated understanding the knowledge level of the participants on aeromedical patient transfer.*

RESULTS*: Seventy-seven emergency physicians participated in the study. Thirty-eight (49.4%) of them were residents and 39 (50.6%) of them were specialists. The right answer rates of the endotracheal cuff pressure was significantly different between the residents and specialists [3/38 (7.9%), 14/39 (35.9%), respectively] (p<0.05) while other topics had not significant difference between participants.*

DISCUSSION AND CONCLUSION*: Education and training of the physicians on this highly specific medical specialty is not sufficient in our findings. Further randomized controlled simulation studies should investigate the knowledge level of the physicians on aeromedical patient transfer.*

Keywords: *aeromedical transport, critical care, emergency medicine*

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INTRODUCTION

Critically ill patients have life-threatening injuries or illnesses that might require transportation for adequate care. However, the transport of these patients poses additional risks for these patients. Therefore, prehospital management of these patients is crucial (1,2). Effective patient triage is an essential part of the prehospital management systems. The suitability of the patient for the aeromedical transfer can be decided according to the patient's situation (3). Anatomic abnormalities (Patients requiring critical interventions), physiologic abnormalities (unstable vital signs), and situational problems (mechanism of injury) may lead to field triage of these patients (4,5). If the patient does not have one of these abnormalities, a ground ambulance should be activated. If the patient has one of these abnormalities, the decision for the type of ambulance, should be made according to the transportation time. In addition to prehospital triage, during aeromedical transportation the pressure falls with high altitude may require significantly different approaches for the management of the patients. For instance, since the increase in the cuff pressure depending on the high altitude may cause tracheal ischemia, endotracheal cuff pressure should be monitored elaborately (6). Therefore, appropriately trained emergency physicians should be able to manage the aeromedical patient transfers during both prehospital triage and transportation processes (7).
Since aeromedical patient transfer is expensive and requires meticulous planning, the decision of the transfer should be taken on cautiously (8). Thus, the indications of the aeromedical transfer, which is different from the indications for ground ambulance patient transfer, should be known by the emergency physicians. In addition, prehospital management of pediatric patients for aeromedical transfer is more complex, resulting in over triage (4,9). Thus, appropriate prehospital management of both adults and pediatric patients is warranted to prevent jeopardizing the patients and unnecessary costs.

Aeromedical transportation has been widely used in developed countries for the expeditious transfer of trauma patients (10,11). In Australia, the first civilian aeromedical patient transfer system was established in 1928. In Turkey, air ambulances have been used since 2008. Ever since four fixed-wing and nineteen rotary-wing aircrafts have been used for the transport of the patients. Training and education of the physicians should begin concurrently with the usage of the aeromedical patient transfer. Continuous education and training of the physicians on this highly specific medical specialty increase the prehospital skills of the physicians tailored to the challenges of the setting. Although aeromedical transportation has begun to be used, there is no regular training program for emergency physicians in the field of aviation medicine (12). Accordingly, determining the knowledge level of emergency physicians on aeromedical transportation may reveal the requirements for training programs.

The study aimed to compare the knowledge level of the emergency medicine residents and specialists on aeromedical patient transfer and determine the effects of previous experience and previous education in aeromedical transfer on the knowledge level of the participants.

METHODS

Study Design and Settings

This was a prospective web-based survey study. The study was approved by the local ethics committee (2021/20). Written informed consent was obtained from all participants by ticking the checkbox on the first page of the survey. The study was conducted between February 2021 to March 2021.

The survey consisted of three parts. The first part was for the written informed consent, the second part included age, sex, the academic degree of the physician, previous education on aeromedical patient transfer, and previous experience of aeromedical patient transfer. The third part was dedicated to understanding the knowledge level of the participants on aeromedical patient transfer. The first question was asked to determine the knowledge level on triage of the patients before an aeromedical transfer. The second question was about the transfer of the critically ill patients. The third question was about the stabilization of the patient before an aeromedical transfer. The last question was about the complications of the aeromedical transfer of the pediatric patients which may develop specifically in this age group. The questionnaire used in the study has been presented in table 1.

Table 1. The questionnaire used in the survey

Q1. Which of the following patients is not suitable for air ambulance transport?
a. Traumatic cardiac arrest patients
b. Suffocated patients
c. High risk pregnant patients
d. Patients with inhalation burns
e. All of the above
Q2. Which of the following statements are correct for intubated patients' air transport process? **I. Endotracheal tube cuff pressure in airplane ambulances in high altitude flights must be monitored.** **II. Endotracheal tube cuff pressure in helicopter ambulance flights must be monitored.** **III. Since the cabin pressure is adjusted according to altitude in air transport, endotracheal tube cuff pressure monitoring is not required.** **a. I and II** **b. I only** **c. II only** **d. III only** **e. None of the above**
Q3. For patients with pneumothorax, tube thoracostomy should be performed prior to transport with helicopter ambulances. **a. Right** **b. False** **c. The patient should be intubated** **d. No idea**
Q4. Which of the following complications may occur more frequently in pediatric patients than adults during air transport? **a. Motion sickness** **b. Aspiration of stomach contents** **c. Effects of acceleration/deceleration forces** **d. Hypoxia** **e. No idea**

Correct answers have been marked in bold font

The survey was adapted to the web-based application (Google forms) and sent to the participants using the WhatsApp application in on android version 10 mobile device.

Outcome measures

The primary outcome of the study was a comparison of the knowledge level of the emergency medicine residents and specialists on the aeromedical transfer of the patients.

Secondary outcomes were to determine the effects of previous experience and previous education on aeromedical transfer on the knowledge level of the participants.

Primary data analysis

Statistical analyses were performed using SPSS version 22 (SPSS, Inc., Chicago, IL). The normality of the distribution of data was examined by the Kolmogorov-Smirnov test. Descriptive statistics were presented as the percentages for categorical variables. Categorical variables in independent groups were analyzed with the chi-square test. Fisher's exact test was used when more than 20% of cells have expected frequencies less than five. P values less than 0.05 were considered statistically significant.

RESULTS

Seventy-seven emergency physicians participated in the study. Thirty-eight (49.4%) were residents and 39 (50.6%) were specialists. The demographic characteristics of the participants have been presented in table 2.

The right answer rates of the second question, which was about the transfer of the critically ill patients significantly different between the residents and specialists [3/38 (7.9%), 14/39 (35.9%), respectively] ($p<0.05$). When the right answer rates of the other three questions were compared, there were no significant differences between the residents and specialists (Table 3).

The right answer rates of the four questions did not differ with or without the previous experience of aeromedical transfer (Table 3). None of the patients have previous education on aeromedical patient transfer.

Table 2. Demographic data of the participants

	Residents (n=38)	Specialists (n=39)
Age (%)		
Age <30	28 (73.7%)	2 (5.1%)
Age 30-35	10 (26.3%)	20 (51.3%)
Age >35	0 (0%)	17 (43.6%)
Gender (%)		
Female	15 (39.5%)	7 (17.9%)
Male	23 (60.5%)	32 (82.1%)
Previous experience (%)		
Experienced	3 (7.9%)	8 (20.5%)
None	35 (92.1%)	31 (79.5%)

Table 3. The right and wrong answer rates of the four questions according to the age, sex, academic degree, previous experience and education on aeromedical patient transfer

	Question 1 (n=77)		Question 2 (n=77)		Question 3 (n=77)		Question 4 (n=77)	
	Right	**Wrong**	**Right**	**Wrong**	**Right**	**Wrong**	**Right**	**Wrong**
Age (%)								
<31	18(60)	12(40)	5(16.7)	25(83.3)	18(60)	12(40)	9(30)	21(70)
31-35	16(53.3)	14(46.7)	6(20)	24(80)	19(63.3)	11(36.7)	7(23.3)	23(76.7)
>36	10(58.8)	7(41.2)	6(35.3)	11(64.7)	14(82.4)	3(17.6)	8(47.1)	9(52.9)
p	0.539		0.315		0.271		0.237	
Sex (%)								
Male	33(60)	22(40)	15(27.3)	40(72.7)	33(60)	22(40)	16(29.1)	39(70.9)
Female	9(40.9)	13(59.1)	2(9.1)	20(90.9)	18(81.8)	4(18.2)	8(36.4)	14(63.6)
p	0.129		0.128		0.067		0.534	
Degree (%)								
Resident	21(55.3)	17(44.7)	3(7.9)	35(92.1)	24(63.2)	14(36.8)	11(28.9)	27(71.1)
Specialist	21(53.8)	18(46.2)	14(35.9)	25(64.1)	27(69.2)	12(30.8)	13(33.3)	26(66.7)
p	0.901		0.003		0.573		0.678	
Experience (%)								
Yes	9(81.8)	2(18.2)	5(45.5)	6(54.5)	6(54.5)	5(45.5)	4(36.4)	7(63.6)
None	33(50)	33(50)	12(18.2)	54(81.8)	45(68.2)	21(31.8)	20(30.3)	46(69.7)
p	0.05		0.058		0.493		0.712	

DISCUSSION

Prehospital management of the patients for aeromedical transfer may be challenging for emergency medicine physicians in Turkey because of the lack of expertise and training in this medical specialty. Although emergency physicians have not been assigned to manage the patients in civilian aircrafts, they might be designated for managing the patients in rotary-wing aircrafts during cross-border operations. On the other hand, there is a lack of evidence about the knowledge and expertise levels of emergency physicians on the aeromedical transfer of patients. Therefore, even though there is no formal training in residency, an emergency specialist might be required to participate in air transports.

Additionally, it is uncertain if there is a difference between the knowledge level of residents and specialists. To the best of our knowledge, this is the first study that compares the knowledge level of the emergency medicine residents and specialists on the aeromedical transfer of patients. Emergency specialists are very skilled and expertized physicians; therefore, it could be easier for them to decide to manage the patients during aeromedical transfer. However, our study results showed no statistical association between the academic degree of the physicians and right answer rates, except the second question. Right answer rates were also similar between the participants with or without previous experience of aeromedical transfer. This indicates a training for this subject in residency would improve physicians' knowledge level on aeromedical transport.

Appropriate use of aeromedical transfer systems for the right patient and the right time is the critical component of prehospital patient management (13). Emergency physicians should know which patients will not likely benefit from the aeromedical transfer which comprises unrestrained, violent patients, patients already in cardiac arrest, patients likely to die during the transport (8). The results of this study showed that the knowledge level on triage of the patients before an aeromedical transfer did not differ between residents and specialists. The lack of training for the aeromedical transfer of the patients in the curriculum of the emergency medicine residency might have led to this finding of the study. Although the experience of the specialists on the management of patients in the emergency department is more than residents, more education and training are needed in this specific field to make a difference in the knowledge level. This might reduce the rates of under-triage and over-triage of the critical care patients, which may decrease the burden of the emergency departments and provide rapid access of these patients to the most appropriate center (14).

The second question was about the endotracheal tube cuff monitorization of critically ill patients during the aeromedical transport of the patient. The results of this question differed significantly between the residents and specialists. This difference might be attributable to the familiarity of the specialist to Boyle's law from diving disorders and high-altitude disorders, which states that at a constant temperature, the volume of a gas is inversely proportional with pressure. Management of the patients' airways is an integral part of critical care, and its management during aeromedical transport requires utmost importance. This disparity between answers of the second question indicates implementation of airway management during air transport required in the formal training.

The third question was about stabilization of the patient before the aeromedical transfer which comprises performing tube thoracostomy to the patient with pneumothorax. During aeromedical transport, since the volume of the gas increases with altitude, even patients with small pneumothorax might evolve into a tension pneumothorax, the gas in penetrating injuries as brain, the eye may cause life-threatening injuries. Thus, the emergency physician should be able to recognize and manage these complications.

The last question was about the aspiration of gastric contents which is a complication that may develop specifically in the pediatric age group during aeromedical transport. Considering that children have a smaller gastric capacity, they are more vulnerable to altitude. Thus, pediatric patients are at considerable risk of aspiration of gastric contents. Pediatric patients might need special care during air transport and knowledge of the physicians would have an impact on healthcare.

Existing data suggest that expertise is beneficial for aeromedical transportation (15). In contrast to the literature, the results of this study showed that the previous experience of aeromedical transfer did not improve the knowledge level of the participants. This discrepancy might be attributable to the lack of education and training on aeromedical transportation. This study also showed that none of the emergency physicians had previous education on aeromedical patient transfer.

Limitations

This study has several limitations. First, this was a short survey study that evaluates the knowledge level with only one question for each subject. This study did not use a validated questionnaire; therefore, interpretation of the results should not be generalized. However, 53% of the questions replied wrong by emergency physicians that might show the requirement for education and training in this subject. Second, in this study, only the knowledge levels of the physicians have been evaluated. The

results would be more accurate if the knowledge levels had been evaluated by simulation studies. However, this is a preliminary study that reveals the requirement for the education and training on aeromedical patient transfer.

CONCLUSION

Education and training of the physicians on this highly specific medical specialty are not sufficient in our findings. Further randomized controlled simulation studies should investigate the knowledge level of the physicians on aeromedical patient transfer.

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REFERENCES

1. Wilson MH, Habig K, Wright C, Hughes A, Davies G, Imray CHE. Pre-hospital emergency medicine. The Lancet. 2015;386(10012):2526-34.
2. Yenice H, Köksal Ö, Armağan E, Köse A, Çetinkaya HB, Sığırlı D. The evaluation of patients transported to a university hospital emergency department with air ambulance. 2013;39(2):105-10.
3. Thomson DP, Thomas SH. Guidelines for air medical dispatch. Prehospital Emergency Care. 2003;7(2):265-71.
4. Thomas SH, Brown KM, Oliver ZJ, et al. An evidence-based guideline for the air medical transportation of prehospital trauma patients. Prehosp Emerg Care. 2014;18 Suppl 1:35-44.
5. Purtill MA, Benedict K, Hernandez-Boussard T, et al. Validation of a prehospital trauma triage tool: a 10-year perspective. J Trauma. 2008;65(6):1253-7.
6. Fan CM, Ko PC, Tsai KC, et al. Tracheal rupture complicating emergent endotracheal intubation. Am J Emerg Med. 2004;22(4):289–93.
7. Critical care transport standarts. https://nasemso.org/wp-content/uploads/ACCT-Standards-Version1-Oct2016.pdf. Accessed May 05, 2021.
8. Johnson D, Luscombe M. Aeromedical transfer of the critically ill patient. Journal of the Intensive Care Society. 2011;12(4):307-12.
9. Eckstein M, Jantos T, Kelly N, Cardillo A. Helicopter transport of pediatric trauma patients in an urban emergency medical services system: A critical analysis. J Trauma. 2002;53(2):340-4.
10. Ageron FX, Debaty G, Savary D, et al. Association of helicopter transportation and improved mortality for patients with major trauma in the northern French Alps trauma system: an observational study based on the TRENAU registry. Scand J Trauma Resusc Emerg Med. 2020;28(1):35.
11. Gray A, Gill S, Airey M, Williams R. Descriptive epidemiology of adult critical care transfers from the emergency department. Emerg Med J. 2003;20(3):242-6.
12. İnal MT, Memiş D. Aero medical transfer of critical patients and anesthesiology speciality. Turkiye Klinikleri J Anest Reanim. 2008;6(1):14-23
13. Mckee JL, Roberts DJ, van Wijngaarden-Stephens MH, et al. The right treatment at the right time in the right place: a population-based, before-and-after study of outcomes associated with implementation of an all-inclusive trauma system in

a large Canadian province. Ann Surg. 2015;261(3):558-64.

14. Taylor CB, Stevenson M, Jan S, Middleton PM, Fitzharris M, Myburgh JA. A systematic review of the costs and benefits of helicopter emergency medical services. Injury. 2010;41(1):10-20.

15. Galvagno SM. Comparative effectiveness of helicopter emergency medical services compared to ground emergency medical services. Crit Care. 2013;17(4):169.