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Knowledge Levels of Pediatric Assistants on Anaphylaxis Management and Adrenaline Autoinjector Application Skills: Pretraining and Posttraining Evaluation

Pediatri Asistanlarının Anafilaksi Yönetimi ve Adrenalin Otoenjektör Uygulama Becerileri Konusundaki Bilgi Düzeyleri: Eğitim Öncesi ve Eğitim Sonrası Değerlendirme

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Abstract

Aim: The study aimed to evaluate the knowledge levels of pediatric residents about the treatment of anaphylaxis and the correct application skill of adrenaline auto-injector (AAI) and to determine the contribution of short-term training to this level.

Material and Method: A questionnaire form was distributed to evaluate the basic information about the anaphylaxis treatment. And, all participants were asked to demonstrate the use of AAI using demo devices and mannequins. This assessment was considered a 'Pre-Test'. At the end of the training, the steps of AAI use were re-evaluated. The data coming from this re-evaluation were recorded as 'Post-Test'.

Results: A total of 110 pediatric residents were included in our study. Most of the participants (94.6%) correctly knew that the first drug to be administered in the treatment of anaphylaxis was adrenaline. And also, 99.4% of the participants knew that adrenaline treatment should be administered intramuscularly. When asked where to apply adrenaline, 94.6 of the participants gave the correct answer. When the AAI application technique is evaluated with the pretest; It was observed that frequent mistakes were made in some steps. With the Post-Test applied after the training almost all the participants were able to complete the steps flawlessly

Conclusion: It is important to increase the knowledge level, identify faulty steps, if any, and repeat the training of physicians who are obliged to supervise the AAI application technique of patients during outpatient follow-ups.

Keywords: Anaphylaxis, adrenaline auto-injector, treatment

Öz

Amaç: Çalışma, pediatri asistanlarının anafilaksi tedavisine ilişkin bilgi düzeylerini ve adrenalin otoenjektörünü (AOE) doğru uygulama becerisini değerlendirmek ve kısa süreli eğitimlerin bu düzeye katkısını belirlemek amacıyla yapılmıştır.

Gereç ve Yöntem: Anafilaksi tedavisi ile ilgili temel bilgileri değerlendirmek için bir anket formu dağıtıldı. Ve tüm katılımcılardan demo cihazları ve mankenler kullanarak AOE kullanımını göstermeleri istendi. Bu değerlendirme bir 'Ön Test' olarak kabul edildi. Eğitim sonunda AOE kullanım adımları yeniden değerlendirildi. Bu yeniden değerlendirme sonucunda elde edilen veriler "Son Test" olarak kaydedilmiştir.

Bulgular: Çalışmamıza toplam 110 pediatri asistanı dahil edildi. Katılımcıların çoğu (%94.6) anafilaksi tedavisinde uygulanacak ilk ilacın adrenalin olduğunu doğru olarak biliyordu. Ayrıca katılımcıların %99,4'ü adrenalin tedavisinin kas içine verilmesi gerektiğini biliyordu. Adrenalinin nereye uygulanacağı sorulduğunda, katılımcıların 94,6'sı doğru cevap vermiştir. AOE uygulama tekniği ön test ile değerlendirildiğinde; Bazı adımlarda sık sık hatalar yapıldığı gözlemlendi. Eğitim sonrasında uygulanan Son Test ile hemen hemen tüm katılımcılar adımları kusursuz bir şekilde tamamlayabilmiştir.

Sonuç: Hastaların poliklinik takiplerinde AOE uygulama tekniğini denetlemekle yükümlü hekimlerin bilgi düzeyinin artırılması, varsa hatalı adımların belirlenmesi ve eğitimlerinin tekrarlanması önemlidir.

Anahtar Kelimeler: Anafilaksi, adrenalin oto-enjektör, tedavi

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INTRODUCTION

Anaphylaxis is an acute, potentially life-threatening systemic hypersensitivity reaction. Emergency treatment of a pediatric patient experiencing anaphylaxis should include rapid evaluation of the need for support of the airway, respiratory and circulatory systems, as well as adrenaline treatment in the appropriate dose and application site.[1,2]

In long-term follow-up, it is recommended to prescribe an adrenaline auto-injector (AAI) due to the unpredictability of when anaphylaxis will develop in individuals who experience anaphylaxis and/or are at high risk of anaphylaxis.[3] Patients and/or their caregivers (parents, caregivers, kindergarten, and school staff) should be trained on how to recognize anaphylaxis when it develops, and how to implement the first intervention with AAI.[4] The AAI usage technique and application steps should be explained by healthcare professionals both in practice and in writing with demo devices. At this stage, it is important that trainers are trained to provide standard training on the correct use steps of AAI and to make suggestions.[5]

Pediatric residents play an important role in the first intervention and follow-up of patients diagnosed with anaphylaxis. The study aimed to evaluate the knowledge levels of pediatric residents in a tertiary pediatric hospital about the treatment of anaphylaxis and the correct application skill of AAI and to determine the contribution of short-term training to this level.

MATERIAL AND METHOD

The study was conducted in Ankara City Hospital Pediatric Allergy and Immunology Clinic. The approval of the Ankara City Hospital Clinical Research Ethics Committee (decision number E2-22-2002) was obtained for our study. The study was carried out in accordance with the principles of the Declaration of Helsinki.

Data Collection Steps

A total of 110 pediatric residents who actively worked and stated that they were willing to participate in the study were included in our study. The demographic characteristics of the physicians, such as age and gender, as well as the active working time in pediatric health and diseases, pediatric allergy and immunology, and pediatric emergency outpatient clinics, were recorded. Moreover, it was questioned whether they had previously received training on AAI application principles, provided training on AAI to any patient, and found their knowledge level sufficient. In addition, a questionnaire form was distributed to evaluate the basic information about the anaphylaxis treatment, such as the adrenaline application site, the appropriate adrenaline dose, and the dosage information of the commercially available AAI preparation.

Evaluation of Adrenaline Auto-injector Application Skill

An eight-step checklist including the steps recommended by the manufacturer company (Penepin®, Vem Pharmaceuticals, Ankara, Turkey) and organized in accordance with our clinical experience was created to control the correct application principles of AAIs used in anaphylaxis emergency response. The checklist used in the evaluation of the AAI usage technique is shown in **Table 1**.

Table 1. Check-list including the application steps of the adrenaline auto-injector device

Step 1) Adrenaline auto-injector is removed from the box
Step 2) The protection cover on the lower side is removed by pulling it down strongly
Step 3) The trigger is turned in the direction of the arrow
Step 4) The auto-injector is stuck in the upper outer side of the thigh
Step 5) Press the trigger mechanism with the thumb and a click is heard
Step 6) Counts to 10 with the trigger pressed
Step 7) After the auto-injector is applied, the application area is lightly massaged for 10 seconds
Step 8) The patient is kept in the lying position throughout the application

All participants were asked to demonstrate the use of AAI using demo devices and mannequins. Meanwhile, the steps were always scored as true and false by the same pediatric allergy and immunology specialist (ZŞE). This assessment was considered a 'Pre-Test'. Then, 'AAI usage training' was given to the participants in groups of up to 10 people, where all application steps were shown practically through demo devices by the same expert. At the end of the training, the steps of AAI use were re-evaluated. The data coming from this re-evaluation were recorded as 'Post-Test'.

RESULTS

Characteristics of the Participants

A total of 110 pediatric residents working in the pediatrics clinic were included in our study. The mean age was calculated as 28.2±2.4 years (IQR; 26.7-30 years). Eighty-two (74.5%) of the participants were female. The mean working time in the pediatric clinic was 20.3±13.1 months. Approximately 40% were in the first year of their education. Fifty-six (50.9%) worked actively in the outpatient clinic, and 71 (64.5%) worked actively in the pediatric emergency department at any time during the assistantship period. Thirty-one (28.2%) participants were present in the pediatric allergy and immunology outpatient clinic as an observer for at least one month. All participants stated that they encountered anaphylaxis at least once during working hours in the inpatient service, outpatient clinic, or emergency department and took an active role in its treatment.

Twenty-nine (26.4%) of the participants stated that they received training on using AAI at least once during their assistantship. The training was mostly given by pediatric allergy and immunology specialists (75.8%). The ratio of those who reported that they had previously given verbal or

practical training on the use of AAI to any patient was 17.2%. Most of the participants (85.5%) stated that they did not find their knowledge of AAI use techniques and patient education sufficient.

Most of the participants (94.6%) correctly knew that the first drug to be administered in the treatment of anaphylaxis was adrenaline. And also, 99.4% of the participants had knowledge that adrenaline treatment should be administered intramuscularly. When asked where to apply adrenaline, 94.6 of the participants gave the correct answer. The data on the characteristics of the participants are summarized in **Table 2**.

Table 2. Characteristics of the participants.

Characteristics of the participants	N, (%)
Age (year), (mean±SD)	28.2±2.4 (IQR;26.7-30)
Gender	
Female	82 (74.5)
Resident duration (month)	
Mean±SD	20.3±13.1
0-12 month	43 (39.1)
12-24 month	22 (20)
24-36 month	29 (26.3)
36-48 month	16 (14.6)
Rotated departments	
Child health and diseases out-patient clinic	56 (50.9)
Pediatric Allergy and Immunology out-patient clinic	31 (28.2)
Pediatric emergency outpatient clinic	71(64.5)
Have you received any training on the principles of adrenaline auto-injector application before?	
Yes	29 (26.4)
From whom did you receive the training?	
Pediatric Allergy and Immunology specialist	22 (75.8)
Child health and diseases specialist	5 (17.2)
Senior doctors	2 (7)
Have you given any training to patients on the principles of adrenaline auto-injector application before?	
Yes	19 (17.2)
Have you ever been prescribed an adrenaline auto-injector?	
Yes	8 (7.2)
Do you find your level of knowledge about adrenaline auto-injector usage techniques and patient education sufficient in the treatment of anaphylaxis?	
Yes	16 (14.5)
What is the first drug to be administered in the treatment of anaphylaxis?	
Antihistamine	2 (1.8)
Methylprednisolone	4(3.6)
Adrenaline	104 (94.6)
How should adrenaline treatment be administered in anaphylaxis?	-
Intravenous	1(0.9)
Subcutaneous	109 (99.1)
Intramuscular	
Where is the recommended application site for adrenaline?	
Deltoid muscle	5(4.5)
Vastus lateralis	104(94.6)
Gluteus maximus	1 (0.9)
What is the appropriate dose of adrenaline used in the treatment of anaphylaxis?	
True	92 (83.6)
What forms of adrenaline auto-injector can be applied in childhood?	
True	32 (29.1)
What form of auto-injector should be prescribed to a child whose body weight is 30 kg?	
True	41 (37.3)

Evaluation of the Adrenaline Auto-Injector Application Technique

When the adrenaline auto-injector application technique is evaluated with the pretest; the most common mistakes were in steps 'The patient is kept in the lying position throughout the application', 'The protection cover on the lower side is removed by pulling it down strongly', 'The trigger is turned in the direction of the arrow', 'Counts to 10 with the trigger pressed', and 'After the auto-injector is applied, the application area is lightly massaged for 10 seconds'. With the Post-Test applied after the training almost all the participants were able to complete the steps flawlessly. The correct application rates of the participants able to follow the mandatory steps in the Pre-Test and Post-Test applications are shown in **Figure 1**.

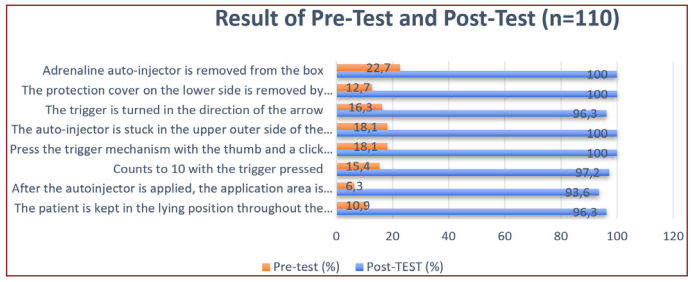

Figure 1. Results of Pre-Test and Post-Test

DISCUSSION

The study aimed to evaluate the knowledge levels of pediatric residents, who are frequently involved in the treatment of childhood anaphylaxis, on emergency intervention and AAI application techniques for anaphylaxis. In our study, it was observed that pediatric residents had sufficient knowledge about the need to administer adrenaline during the first intervention of anaphylaxis, the route of administration, and its application site. It was found that there were deficiencies in knowledge of adrenaline auto-injector application skills from the results of the Pre-Test applied before the training.

Although there are various studies in the literature evaluating the AAI application skills of patients and their parents/caregivers, the studies evaluating the knowledge level of health professionals in the trainer position are limited.[6-8] In a systematic review evaluating 23 studies, the correct AAI application technique was found to be 37% among patients, 32% among parents/caregivers, and 21% among healthcare professionals. The authors emphasized that the low occurrence of the correct application technique in patients and parents/caregivers was worrisome but that the situation that should be of real concern should have the differences in the practices of trainers.[9] In another study involving 122 healthcare professionals consisting of emergency service specialists, family physicians, and pediatricians, only a quarter of the participants were able to show the AAI application steps flawlessly, and a new and sustainable education approach was found necessary in this regard.[10] In a study involving pediatricians, the ratio of those who were able to

apply at least one AAI device correctly was determined to be 18%. It was emphasized that the idea that explaining how to use AAI is the responsibility of the pharmacist may be one of the reasons for the low level of knowledge. In the same study, it was suggested to include this subject in continuous medical education.[11] The fact that the correct application rates in our study were found to be lower than the specified studies may be related to the fact that approximately half of the participants were in the first year of the assistant training process, and approximately 80% of them had not yet worked actively in allergy outpatient clinics. According to a study, the ability to use AAI increased 17 times when the trainer was an allergist.[12]

In this study, similar results were obtained form previous studies about which steps were applied most frequently incompletely or incorrectly during the application of AAI. Failing to position the patient appropriately and activate the device are the steps where both patients and healthcare professionals make mistakes frequently.[13,14] The probability of error can be reduced by considering this situation during training and explaining it in practice with demo devices.

In our study, training improved the ability to apply AAI correctly, but it was not possible to evaluate how long the effect of a single training session lasted since the application of the Post-Test took place immediately after the training. This can be seen as a limitation of our study. However, although more than 25% of the participants reported that they had previously received training on AAI application techniques, the fact that application errors were observed from some of them can be interpreted as the necessity of regular repetition of the training. According to a study involving 160 intern physicians, auto-injector use skills declined in the sixth month after the training and that application errors were lower in those who underwent skill reinforcement in the third month. The authors emphasized that regular training and skill reinforcement would be beneficial.[15] Similarly, there are studies indicating that one training for patients cannot guarantee the correct application and that it should be renewed in all control visits. In addition, it is emphasized that primary care physicians and pharmacists should be trained in addition to the physician following the patient.[16] According to another study in which the AAI correct application technique was supervised in the caregivers of pediatric patients experiencing anaphylaxis, the time passed since the last training was the most important parameter that negatively affected the ability to apply AAI correctly. The authors found a strong relationship between repeating the training every six months and being able to apply the AAI technique correctly.[14] The fact that we were able to evaluate a high number of pediatricians in a single center before and after the training by applying face-to-face training is the strength of our study and indicates the positive effect of even short-term training on the level of knowledge.

CONCLUSION

In our country, emergency treatment and long-term follow-up of pediatric patients experiencing anaphylaxis are mostly carried out by pediatric specialists. For this reason, we would like to draw attention to the importance of including anaphylaxis emergency intervention and AAI usage training in the special education process. Adrenaline is a life-saving treatment in anaphylaxis; however, its effectiveness depends largely on its correct application. For this reason, it is important to increase the knowledge level, identify faulty steps, if any, and repeat the training of physicians who are obliged to supervise the AAI application technique of patients during outpatient follow-ups. Periodic in-service training programs will both eliminate errors in implementation and increase awareness of AAI.

ETHICAL DECLARATIONS

Ethics Committee Approval: The approval of the Ankara City Hospital Clinical Research Ethics Committee (decision number E2-22-2002) was obtained for our study.
Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.
Referee Evaluation Process: Externally peer-reviewed.
Conflict of Interest Statement: The author has no conflicts of interest to declare.
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