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Original Article

Future doctors and anaphylaxis: What do they know? what should we do?

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Abstract

Aim: Anaphylaxis is a severe, potentially life-threatening systemic hypersensitivity reaction. Previous studies reveal that there are many potential deficiencies in the knowledge of doctors regarding the diagnosis and management of anaphylaxis in different health-care settings.The main purpose of this study was to assess the knowledge of 4th-6th-year medical students regarding the diagnosis and management of anaphylaxis.

Material and Methods: The study was designed as a cross-sectional survey. The total number of 4th-, 5th-, and 6th-grade medical students at Trakya University Medical School was 651, and 172 (26%) agreed to participate in the study. The participants were asked to answer the questionnaire forms were including the questions assessing students' knowledge about the diagnosis and management of anaphylaxis, before and after a training session about anaphylaxis.

Results: Awareness of students about symptoms indicating anaphylaxis other than cutaneous and respiratory symptoms was between 40% and 77% in the initial test. Although the majority of participants (94%) chose epinephrine as the first-line drug for the treatment of anaphylaxis, correct answers about dosage, concentration, and the route for administration of epinephrine were low when compared with the final test ($p < 0.001$ for each item). While 14% stated they felt they could diagnose and treat anaphylaxis in the initial test, this increased 83% after the training ($p < 0.001$).

Conclusion: The study revealed that, knowledge of medical students relating diagnosis and treatment of anaphylaxis is unsatisfactory. Much more attention is needed in medical-school education concerning anaphylaxis management to prevent anaphylaxis-related mortalities in the future.

Keywords: Anaphylaxis; medical student; diagnosis; epinephrine; medical education.

INTRODUCTION

Anaphylaxis is a severe, potentially life-threatening systemic hypersensitivity reaction. The lifetime prevalence of anaphylaxis has recently been reported as being between 0.3 and 5.1% (1). Approximately 2–10 times more than previously reported, and hospitalization rates due to anaphylaxis are increasing steadily (2,3).

The diagnosis of anaphylaxis depends on recognizing characteristic symptoms and signs that occur minutes to hours after exposure to a known or potential trigger. Under-diagnosis of anaphylaxis is common (3). Previous studies reveal that there are many potential deficiencies in the knowledge of doctors regarding the diagnosis and management of anaphylaxis in different health-care settings, even among allergy/immunology specialist (4-10). Fatal outcomes have been associated with a delay/failure in the diagnosis of anaphylaxis or administration of epinephrine (11).

In Turkey, after medical school, almost all graduates work as general practitioners in hospitals until they enter a residency program in their specialty of interest. Being first-contact care providers, general practitioners can encounter any type of emergency, and they thus have a pivotal role in the management of anaphylaxis.

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The main purpose of this study was to assess the knowledge of 4th-6th-year medical students regarding the diagnosis and management of anaphylaxis and also to evaluate the improvement in their knowledge and attitudes in diagnosing and managing of anaphylaxis following a comprehensive training session.

MATERIAL and METHODS

The study was designed as a cross-sectional survey, which took place at the Congress Center of Trakya University, in a single session in October 2017 and was approved by Trakya University's ethical committee (decision number: TUTF-BAEK 2017/151) An announcement about the study was made via posters and the webpage of the medical school two weeks before hand. Medical students in their 4th,5th, or 6th year (interns) were invited (with no compulsion) to participate. Verbal informed consent was obtained from them. Two pediatric allergy fellows (initial test) distributed questionnaire forms assessing students' knowledge of the diagnosis and management of anaphylaxis. Participants were asked to respond to the questions without disclosing their identity. After completing the questionnaire, the initial test forms were collected, and then a pediatric-allergy specialist conducted a comprehensive training session. The session included the definition, pathophysiology, symptoms, principles of diagnosis, and the management of anaphylaxis, according to current guidelines (3,12).
Final tests, which featured the same questions as the initial test, were distributed soon after completing the training session. Six of the participants did not take the final test and so were excluded from the study.
The questions, designed following anaphylaxis guidelines (3,12) featured multiple-choice answers. Two questions concerned demographic data, while the rest were related to the diagnosis and management of anaphylaxis. The questionnaire forms were numbered and then marked as "A" for the initial test and "B" for the final test.

Statistical analysis

The data were presented both as numbers and as percentages. The results were analyzed using the SPSS, version15.0, database (SPSS, Chicago, Illinois). Comparisons were made to determine the effect of training on the knowledge levels of the medical students. The results were compared using Mc Nemar's test; $p< 0.05$ considered as statistically significant.

RESULTS

The total number of 4th-, 5th-, and 6th-grade medical students at Trakya University Medical School was 651, and 172(26%) agreed to participate in the study. Of these, 42(24%) students were 4th grade, 67(39%) 5th grade, and 63(37%) 6th grade.117 (68%) of the participants were female and 55(32%) were male).

More than 95% of the participants were aware of urticaria/angioedema and shortness of breath as symptoms of anaphylaxis, as revealed in the initial test. However, correct answers for other symptoms (such as hypotension, collapse, gastrointestinal findings, itching in the throat, coughing, itching in the palms/soles, impending doom, and loss of consciousness) indicating anaphylaxis were between 40% and 77% in the initial test. In the final test, there was a significant increase in the ratio of correct answers to these questions ($p<0.001$, for each item) (Table 1).

Although the majority of participants (94%) chose epinephrine as the first-line drug for the treatment of anaphylaxis in the initial test, correct answers about dosage, concentration, and the preferred route for administration of epinephrine were low when compared with the final test ($p<0.001$ for each item). Only 26% of participants knew previously that there are no absolute contraindications to the administration of epinephrine in the treatment of anaphylactic shock.

Most participants had no knowledge of the commercial drug used as an auto-injector in the treatment of anaphylaxis (Table 2). However, in the final test, there was a significant increase in the ratio of correct answers to the questions related to absolute contraindications for epinephrine administration and the question about an epinephrine auto-injector ($p<0.001$).

While 14% stated they felt they could diagnose and treat anaphylaxis in the initial test, this increased 83% after the training ($p<0.001$)(Figure 1).

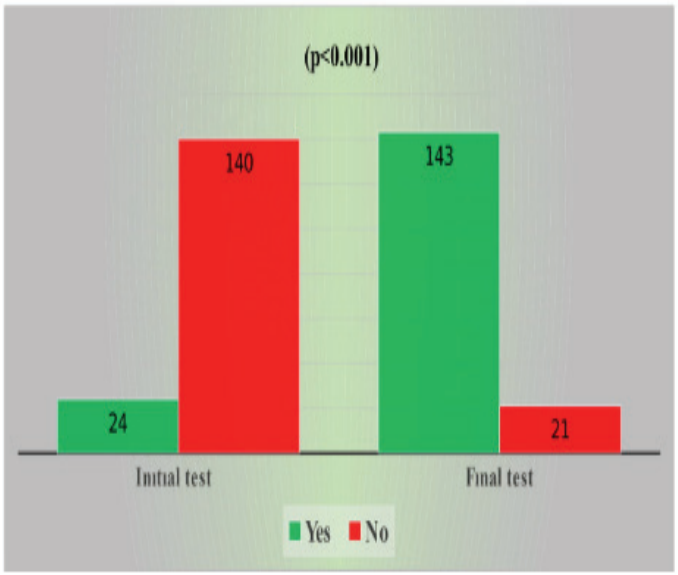

Figure 1.The percent of students who feel ready him/her self to diagnosing and management of patient with anaphylaxis.

DISCUSSION

Our initial test results indicated that the knowledge level of our medical students was unsatisfactory regarding the diagnosis and management of anaphylaxis. Many studies have been published evaluating physicians' and various health-care professionals' knowledge of anaphylaxis

Table 1. Correct answers of medical students to questions related with the diagnosis of anaphylaxis

Question (True answers)	Initialtest n(%)	Final test n(%)	p
Which sign/symptoms may be indicative of anaphylaxis?			
Urticaria/angioedema	164 (95)	170 (99)	0.125
Shortness of breath	166 (97)	199 (98)	1
Abdominal cramps	69 (40)	165 (96)	<0.001
Itching in throat	108 (63)	164 (95)	<0.001
Hypotension	131 (76)	169 (98)	<0.001
Cough	111 (65)	164 (95)	<0.001
Itching in palms/soles	120 (70)	168 (98)	<0.001
Impending doom	133 (77)	163 (95)	<0.001
Loss of consciousness	127 (74)	160 (93)	<0.001
Collapse	88 (51)	154 (90)	<0.001
Which one can be seen as a Complication of anaphylaxis? (Myocardial infarction)	38 (22)	133 (77)	<0.001
Which one can be used for diagnosis of anaphylaxis? (Serum triptase)	9 (5)	149 (87)	<0.001
Which statement is wrong about diagnosis of anaphylaxis? (Only generalized urticaria after exposure a likely allergen)	81(47)	143(83)	<0.001

Table 2. Correct answers of students to questions that related with treatment and management of anaphylaxis

Question (True answers)	Initial test n(%)	Final test n(%)	p
Which is the name of drug should be first choice in the treatment of anaphylaxis? (Epinephrine)	162(94)	162 (94)	Not calculated
Which route of administriation should be first preffer route for epinephrine? (Intramuscular)			
Which is the proper dose and concentration of epinephrine for ıntramuscular administration? (1/1000-0.01 mg/kg)	19 (11)	169 (98)	<0.001
Which one is true about maximum single dose of epinephrine for children and adults? (0.3-0.5 mg)	32 (19)	165 (96)	<0.001
Which is true interval of re-administration of epinephrine? (5 minutes)	90 (52)	157 (91)	<0.001
Which one is a contraindication for administration of epinephrine in the treatmentof anaphylactic shock? (iscemic heart disease, hypertension, pregnancy, glocoma, oldage, using ACE inhibitors, shock,uncertain diagnose of anaphylaxis (None of them)	45 (26)	152 (88)	<0.001
Table 2 continued			
Do you know any commercial drug which have Standard doses and ready to use in the treatment of anaphylaxis?			
Yes	66 (38)	162 (94)	<0.001
Can you write it's name? (Any trademark)	48 (28)	154 (90)	<0.001

(4,8,13-21) in which medical students were included in some (22,24). In a study from Turkey, Baccioglu et al. compared the anaphylaxis knowledge of non-allergy specialists, general practitioners, medical students, nurses, and paramedics. However, there were no details about the medical students' year level, and most of the participants were nurses (18).

To our knowledge, the present study is the first in our country dealing only with medical students. Knowledge and attitudes of medical students are important because these people will go on to work in primary health-care settings after graduation. Our results indicate that most of the students knew about the relationship between skin findings and shortness of breath with anaphylaxis but not that anaphylaxis can occur without these symptoms. Hypotension, gastrointestinal findings, itching in the throat, coughing, itching in the palms/soles, impending doom, loss of consciousness, and collapse may be prominent symptoms and should be widely known to prevent under-diagnosis and under-treatment. Interestingly, results concerning awareness of these symptoms in previous studies featuring highly trained and experienced doctors are lower than our study (4,25).

We found that the vast majority of students (94%) correctly answered epinephrine as the first choice for treating anaphylaxis, a result that is higher than results in previous studies (including ones with medical students), but correct answers regarding dosage and concentration of epinephrine were significantly fewer than previously reported (18,22-24).

It has been shown that epinephrine is more effective when given by intramuscularly in the treatment of anaphylaxis (26). In our study's initial test, 56%of the students knew that intramuscular is the preferred route for epinephrine administration, a finding that is also higher than results from previous studies (13,14,17,18,21,22). Strikingly, another study comparing two district hospitals in England revealed that only 14.4% of senior and junior doctors had adequate knowledge regarding the dosage, route, and concentration of adrenaline (27). These results may be due to less consideration given to anaphylaxis guidelines in medical education in previous years.

In our initial test, 52% of participants were able to answer the interval of re-administration of epinephrine in the case of no response; however, in the final test, the correct ratio increased remarkably ($p<0.001$). In the study by Baccioglu et al, the interval of re-administration of epinephrine was correctly answered by 29.4% of the participants (18).

Although most health-care providers know that epinephrine should be the first drug to administer in the treatment of anaphylaxis, published reports on the emergency treatment of anaphylaxis indicate that epinephrine is actually only used in a minority of patients, even in those with cardiovascular symptoms (28-32). Unfortunately, most health-care providers think there are absolute contraindications to the administration of epinephrine in the treatment of anaphylactic shock due to its potential side effects (4,13). Similarly, in our initial test, only 26% of students knew there are no absolute contraindications to the administration of epinephrine; however, in the final test, 88% of the participants correctly answered the same question.

Only a minority of our students knew the "Epinephrine Auto-Injector" (EAI) trademark or any trademark of EAI. Other studies from Turkey have revealed that only 20.3% of different health-care providers have heard about EAI, and 80% of pediatricians working in Istanbul did not know about any EAI trademark or the amount of the drug in the auto-injectors (18,20). These results are noteworthy when considering that of those patients who have experienced more than one episode of anaphylaxis, 60% reported they did not receive any EAI products (33). Cohen et al (34) evaluated all kind of problems associated with epinephrine use in the treatment of anaphylaxis in a comprehensive study. They found many pitfalls at the point of education for indications and appropriate administration of epinephrine beside concern for systemic effects. It has utmost importance to get knowledge and skill about use of epinephrine during medical education to come through this problem.

Our study has limitations: first, while the total number of study participants was enough to draw conclusions, the sample size was relatively small. Second, since all the participants were from a single medical school in Turkey, this study may not apply to other medical schools in the country. Third, the survey instrument was not a standardized, validated survey. Although there may be disadvantages in applying a final test soon after training, in order to evaluate the impact of training on the same respondents, we decided to conduct the research thus.

CONCLUSION

Our study, despite its limitations, is the first study that examines the impact of training on knowledge and ability to manage anaphylaxis among medical students in Turkey. Although it is reassuring that most students were familiar with the term anaphylaxis and knew that epinephrine is the recommended first-line treatment, students' knowledge of atypical presentations was unsatisfactory, featuring gaps related to dosage, concentration, and route of administration. It is crucially important that medical students, whatever specialty they intend to choose, are ready to recognize and appropriately manage anaphylaxis because they will be the frontline physicians treating this common and life-threatening medical emergency. Therefore, we believe that much more attention is needed in medical-school education concerning anaphylaxis management to prevent anaphylaxis-related mortalities in the future.

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REFERENCES

1. Tejedor Alonso MA, Moro Moro M, Múgica García MV. Epidemiology of anaphylaxis. Clin Exp Allergy 2015;45:1027-39.
2. Lieberman P, Camargo CA Jr, Bohlke K, et al. Epidemiology of anaphylaxis: Findings of the American College of Allergy, Asthma and Immunology Epidemiology of Anaphylaxis Working Group. Ann Allergy Asthma Immunol 2006;97:596-602.
3. Simons FE, Ebisawa M, Sanchez-Borges M, et al. 2015 update of the evidence base: World Allergy Organization anaphylaxis guidelines. World Allergy Organ J 2015:28;8:32.
4. Altman AM, Camargo CA Jr, Simons FE, et al. Anaphylaxis in America: A national physician survey. J Allergy Clin Immunol 2015;135:830-3.
5. Fineman S, Dowling P, O'Rourke D. Allergists' self-reported adherence to anaphylaxis practice parameters and perceived barriers to care: an American College of Allergy, Asthma and Immunology member survey. Ann Allergy Asthma Immunol 2013;111:529-36.
6. Krugman SD, Chiaramonte DR, Matsui EC. Diagnosis and management of foodinduced anaphylaxis: a national survey of pediatricians. Pediatrics 2006;118:554-60.
7. Wang J, Sicherer SH, Nowak-Wegrzyn A. Primary care physicians' approach to food-induced anaphylaxis: a survey. J Allergy ClinImmunol 2004;114:689-91.
8. Grossman SL, Baumann BM, Garica Pena BM, et al. Anaphylaxis knowledge and practice preferences of pediatric emergency medicine physicians: a national survey. J Pediatr 2013;163:841-6.
9. Worm M, Hompes S, Vogel N, et al. Care of anaphylaxis among practising doctors. Allergy 2008;63:1562-3.
10. Cruz NV, Wilson BG, Fiocchi A, et al. America College of Allergy, Asthma and Immunology Adverse Reactions to Food Committee. Survey of physicians' approach to food allergy, part 1: prevalence and manifestations. Ann Allergy Asthma Immunol 2007;99:325-33.
11. Storey P, Fitzharris P. Adrenaline in anaphylaxis: over treatment in theory, under treatment in reality. Postgrad Med J 2015;91:1-2.
12. Muraro A, Roberts G, Worm M, et al. EAACI Food Allergy and Anaphylaxis Guidelines Group. Anaphylaxis: Allergy 2014;69:1026-45.
13. Jacobsen RC, Toy S, Bonham AJ, et al. Anaphylaxis knowledge among paramedics: results of a national survey. Prehosp Emerg Care 2012;16:527-34.
14. Colleti Junior J, de Carvalho WB. Anaphylaxis knowledge among pediatric intensivists in Brazil: a multicenter survey. J Intensive Care Med 2017;32:593-96.
15. Rutkowski K, Dua S, Nasser S. Anaphylaxis: current state of knowledge for the modern physician. Post grad Med J 2012;88:458-64.
16. Ibrahim I, Chew BL, Zaw WW, et al . Knowledge of anaphylaxis among emergency department staff. Asia Pacific Allergy 2014;4:164-71.
17. Erkoçoğlu M, Civelek E, Azkur D, et al. Knowledge and attitudes of primary care physicians regarding food allergy and anaphylaxis in Turkey. Allergol Immunopathol (Madr) 2013;41:292-7.
18. Baççioğlu A, YilmazelUçar E. Level of knowledge about anaphylaxis among health care providers. Tuberk Toraks 2013;61:140-6.
19. Kahveci R, Bostanci I, Dallar Y. The effect of an anaphylaxis guideline presentation on the knowledge level of residents. J Pak Med Assoc 2012;62:102-6.
20. Cetinkaya F, Zübarioğlu AU, Göktaş S. Pediatricians' knowledge about recent advances in anaphylaxis treatment in Istanbul, Turkey. Turk J Pediatr 2009;51:19-21.
21. Çetinkaya F, Sezgin G, Aslan OM. Dentists' knowledge about anaphylaxis caused by local anaesthetics. Allergol Immunopathol (Madr) 2011;39:228-31.
22. Drupad HS, Nagabushan H. Level of knowledge about anaphylaxis and its management among health care providers. Indian J Crit Care Med 2015;19:412-5
23. Prabhu SB, Yasmeen M. Treatment of anaphylaxis in adults: A questionnaire survey at S. Nijalingappa medical college hospital, Bagalkot, India. J Clin Diagn Res 2010;4:3474-9.
24. Adiga S, Nayak V, Bairy KL. Treatment of anaphylaxis in adults: a questionnaire survey. Online J Health Allied Sci 2008;7:6.
25. Thain S, Rubython J. Treatment of anaphylaxis in adults: results of a survey of doctors at Dunedin Hospital, New Zealand. N Z Med J 2007;120:2492.
26. Anchor J, Settipane RA. Appropriate use of epinephrine in anaphylaxis. Am J Emerg Med 2004;22:488-90.
27. Droste J, Narayan N. Anaphylaxis: Lack of hospital doctors' knowledge of adrenaline (epinephrine) administration in adults could endanger patients' safety. Eur Ann Allergy Clin Immunol 2012;44:122–7.
28. Rudders SA, Banerji A, Corel B, et al. Multicenter study of repeat epinephrine treatments for food-related anaphylaxis. Pediatrics 2010;125:711-8.
29. Gaeta TJ, Clark S, Pelletier AJ, et al. National study of US emergency department visits for acute allergic reactions, 1993 to 2004. Ann Allergy Asthma Immunol 2007;98:360-5.
30. Russell S, Monroe K, Losek JD. Anaphylaxis

management in the pediatric emergency department: opportunities for improvement. Pediatr Emerg Care 2010;26:71-6.
31. Clark S, Bock SA, Gaeta TJ, et al. Multicenter study of emergency department visits for food allergies. J Allergy Clin Immunol 2004;113:347-52.
32. Grabenhenrich L, Hompes S, Gough H, et al. Implementation of anaphylaxis management guidelines: a register-based study. PLoS One 2012;7:35778.
33. Wood RA, Camargo CA, Lieberman P, et al. Anaphylaxis in America: The prevalence and characteristics of anaphylaxis in the United States. J Allergy Clin Immunol 2013;133:461-7.
34. Cohen MB, Saunders SS, Wise SK, et al. Pitfalls in the use of epinephrine for anaphylaxis: patient and provider opportunities for improvement. Int Forum Allergy Rhinol 2017;7:276-86.