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ORIGINAL PAPER/*PRACA ORYGINALNA*

Assessment of the use of adrenaline auto-injectors among adult patients at risk of anaphylaxis

Ocena zastosowania autostrzykawek z adrenaliną wśród dorosłych pacjentów zagrożonych anafilaksją

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ABSTRACT

Introduction: Carriage and correct use of adrenaline auto-injectors (AAIs) by patients have been reported to be low.

Aim: To evaluate the carriage rate of the EpiPen® and the usage skills of the adult patients.

Material and methods: A total of 46 patients who had been previously prescribed EpiPen® were enrolled during a five-month period in our clinic. Data about the EpiPen® prescription indications and prescription date, the number of the device usage training sessions, the last training date, and the reasons for not carrying the device were obtained. Patients were practically evaluated with a trainer device.

Results: Among 46 patients, 20 (43%) were female, and the mean age of the patients was 45 ±13 years (min.–max.: 20–67). EpiPen® prescription indication included Hymenoptera venom allergy in 44 patients, food allergy in one patient, and idiopathic anaphylaxis in one patient. Twenty-nine (63%) patients reported that they kept the device with them always, whereas 17 (37%) reported they did not. The most frequently stated reason for not carrying an EpiPen® was the thought that it was unnecessary (n = 6, 35%). Of 29 patients, 11 (38%) correctly demonstrated all the steps of the trainer device. The most frequent mistake was failing to remove the cap (n = 15, 83%).

Conclusions: The significance of always carrying the device at all times should be emphasized, as should the importance of correct use of the device in patients' routine controls. Trainings given at least twice a year may be supported by reminders via telephone call or e-mail.

KEY WORDS

adrenaline auto-injectors, training, carriage, anaphylaxis.

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INTRODUCTION

Anaphylaxis is a life-threatening, acute-onset reaction that is characterized by manifestations in different organ systems and requires immediate treatment [1]. Its prevalence is estimated to be 0.3% in studies conducted in Europe [2]. Intramuscular adrenaline is used as a first-line intervention in the treatment of anaphylaxis [3]. A delay in adrenaline injection may have severe consequences and may lead to death [4]. The use of an adrenaline auto-injector (AAI) for adrenaline administration is a safe, fast, and convenient method [3]. There are AAIs with different mechanisms. The use of device requires special training. Because the majority of anaphylactic reactions occur outside the hospital, patients at risk for anaphylaxis should always carry AAI at all times and use it urgently and correctly if needed [5]. However, there are studies reporting that the rates of carriage and correct use are low [6–8].

AIM

In this study, we aimed to evaluate the rate of carriage of EpiPen® and usage skills, and mistake rates in device usage steps.

MATERIAL AND METHODS

STUDY DESIGN AND DATA COLLECTION

A single-centre study was conducted in our adult immunology and allergy outpatient clinic. Patients who had been previously prescribed EpiPen® and admitted to outpatient clinic were enrolled in the study during a 5-month period. Patients were trained about how and when to use the EpiPen® by allergy fellows. The training was done at the first prescription visit and was repeated on follow-up visits. The data about demographic features, the EpiPen® prescription indications and prescription date, the number of the device usage training sessions and the last training date, and the reasons for not carrying the device at all times were questioned.

Patients were practically evaluated with a trainer device that does not contain medication or a needle. Patients were scored in 6 steps for administration accuracy in accordance with instructions supplied by the manufacturer (EpiPen®, Mylan Specialty LP, Basking Ridge, NJ). The 6 steps are as follows: 1 – recognize device without examining for clues of how to use, 2 – remove the cap, 3 – select an appropriate injection site, 4 – press the correct end of the device to the injection site, 5 – press to activate the device, and 6 – hold in place for several seconds rather than just punch and remove. Users who accomplished all steps accurately were considered as competent in the use of an EpiPen®.

ETHICS STATEMENT

The study protocol was approved by the Ethics Committee (GO 16/361-07). The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants were informed about the nature of the study, and written informed consent was obtained.

STATISTICAL ANALYSIS

The statistical analysis was performed using the SPSS program version 26.0. (IBM Corp., Armonk, N.Y., USA). The values are presented as means ± standard deviation (SD) for data that demonstrated a normal distribution and as medians (minimum–maximum) for data that did not demonstrate a normal distribution. Categorical variables are stated as number and percentage. Pearson χ^2 test and Fisher's exact test were used to compare the categorical variables. A p-value of < 0.05 was considered statistically significant.

RESULTS

Forty-six patients were included in the study. Among these, 20 (43%) were female and 26 (57%) were male. The mean age of the patients was 45 ±13 years (min.–max.: 20–67). EpiPen® prescription indication included Hymenoptera venom allergy in 44 patients, food allergy in one patient, and idiopathic anaphylaxis in one patient. The median follow-up period of the patients was 12 months (min.–max.: 3–72) after the prescription, and the median number of EpiPen® training sessions that patients received was 1 (range: 1–4). The median time elapsed since the last training among patients who accomplished all 6 steps or failed to properly use the EpiPen® was 5 (range: 1–36) and 9 (range: 1–72) months, respectively. The demographic characteristics of the patients are shown in Table 1. None of the patients experienced anaphylaxis after EpiPen® prescription. One patient used it for a local cutaneous reaction after a bee sting.

Thirty-nine (39/46, 84.8%) patients obtained an EpiPen® after prescription. Twenty-nine patients (29/46, 63%) reported that they kept the device with them always, whereas 17 (17/46, 37%) reported they did not. The most frequently stated reason for not carrying an EpiPen® was the thought that it was not necessary (6/17, 35%). Reasons for not carrying an EpiPen® are shown in Table 2.

When the patients were compared in terms of the steps of using the device, it was seen that the patients who did not carry an EpiPen® ($n = 17$) made significantly more

TABLE 1. Demographic characteristics of the patients ($n = 46$)

Variable	*n* (%)
Sex:	
Female	20 (43)
Male	26 (57)
Age [years] Mean ± SD	45 ±13
EpiPen® prescription indications:	
Venom allergy	44 (96)
Food allergy	1 (2)
Idiopathic anaphylaxis	1 (2)
After prescription of EpiPen®, median follow-up period [months] (min.–max.)	12 (3–72)
Median number of EpiPen® training (min.–max.)	1 (1–4)
Median time elapsed since last training [months] (min.–max.);	
Who accomplished	5 (1–36)
Who failed	9 (1–72)

TABLE 2. Reasons for not carrying an EpiPen® ($n = 17$)

Variable	*n* (%)
I did not think it was necessary	6 (35.3)
I did not obtain it because it was difficult	2 (11.8)
I obtained the EpiPen® once and haven't had it prescribed again	2 (11.8)
I did not take it without any definite reason	2 (11.8)
I did not obtain it because I was afraid of its use	1 (5.9)
Other	4 (23.5)

mistakes than those who did ($n = 29$), except for one step (cap removal). The comparison of patients according to EpiPen® usage skills is shown in Table 3.

Of 29 EpiPen®-carrying patients, 11 (11/29, 38%) correctly demonstrated all steps of the trainer device, while the majority committed at least one mistake. The most frequent mistake was failing to remove the cap ($n = 15$, 51.7%). The other mistakes were the following: 10 (34.5%) patients did not press to activate, 6 (20.7%) patients did not hold in place for several seconds, 4 (13.8%) patients did not select an appropriate injection site, and 2 (6.9%) patients did not press the correct end of the device. The percentage of correct demonstrations for each of the 6 steps among patients who carry an EpiPen® is shown in Figure 1.

The whole study group was categorized into 4 groups according to last training session (0–6, 7–12, 13–24, and > 24 months ago) and compared according to accurate EpiPen® usage. There was no significant difference between those who accurately demonstrated EpiPen® ($n = 11$) and those who did not ($n = 31$) ($p = 0.104$).

DISCUSSION

In the present study, the carriage rate of EpiPen® and the correct demonstration of all steps among EpiPen®-carrying patients were found to be 63% and 38%, respectively. The most frequently stated reason for not carrying an EpiPen® was the thought that it was not necessary, and the most frequent mistake was failing to remove the cap (35% and 51.7%, respectively).

In the management of anaphylaxis, intramuscular adrenaline injection is the fundamental treatment that should be done in the first line [3]. Because rapid intervention can be vital at the onset of the reaction, it is important for patients to carry the AAI with them and apply it correctly when necessary. The fact that patients do not carry the device with them at all times is the primary problem in the administration of AAI. In a research, impediments to carrying and using an AAI were investigated, and the most frequent impediments were identified as insufficient device design, inadequate physician recommendation and patient training [9]. In the study by Ridolo *et al.*, it was reported that 82% of the patients carried an AAI with them [10]. In other studies, the carriage rate was reported as 71%, 79.7%, and 44% [7, 11, 12].

TABLE 3. Comparison of patients according to EpiPen® demonstration

Steps	Patients who carry EpiPen® ($n = 29$) *n* (%)	Patients who did not carry EpiPen® ($n = 17$) *n* (%)	*P*-value
Recognize the device	29 (100)	11 (64.7)	0.001
Remove the cap	14 (48.3)	4 (23.5)	0.178
Select an appropriate body site	25 (86.2)	8 (47.1)	0.007
Press the correct end of the device	27 (93.1)	8 (47.1)	0.001
Press to activate the device	19 (65.5)	5 (29.4)	0.039
Hold in place for several seconds	23 (79.3)	5 (29.4)	0.002

In a population-based study, Australian adolescents' carriage behaviour was evaluated, and the carriage rate was found to be suboptimal [13]. In our study, this rate was 63%, which was lower than previously reported. "The belief that adrenaline is unnecessary" was determined to be the most frequent reason for not carrying the device at all times (35%). Sixteen patients who did not carry an EpiPen® had been receiving venom immunotherapy (VIT), with a median VIT time of 4 years (range: 1.5–5). These patients may have felt safe because of the VIT they had received.

The patients' ability to use the AAI correctly is just as important as carrying the AAI. In previous studies, the correct usage rates were found to be 38% and 39.4%, and it was stated that the most common mistakes were made in the steps of removal of the safety cap and holding the injector in place [6, 7]. In another study, in which 101 patients were evaluated, it was determined that the most common mistake was not holding the AAI in place for at least 10 s [14]. In the study of Ridolo *et al.*, it was seen that the most common mistake was selecting an inappropriate injection site [10]. In our study, the correct demonstration of all steps among EpiPen®-carrying patients was found to be 38%, and the most common mistake was failing to remove the cap (51.7%). These findings were consistent with previous studies. When the patients were compared according to EpiPen® demonstrations, it was seen that the patients who did not carry an EpiPen® made significantly more mistakes than those who did, except for one step (cap removal).

There are studies evaluating the factors that impact to the correct administration of AAIs [11, 15]. In a recent research from Turkey, an inverse relation was found between the time since the last training and the accurate administration of AAIs, and training at 6-month intervals was reported to be optimal [11]. In another study, parents who received training less than 12 months ago and 24 months ago were compared, and no difference was determined in the accurate use of AAIs [15]. In our study, we also found no significant difference between those who accurately demonstrated EpiPen® use and those who did not (p = 0.104). However, it was determined that 7 of the 11 patients who accurately demonstrated EpiPen® usage had received the training within the last 6 months.

CONCLUSIONS

Our findings give important information about EpiPen® carriage and usage skills. In line with this study and previous studies, the significance of always carrying the device at all times should be emphasized, as should the importance of correct use of the device in patients' routine controls. Trainings given at least twice a year may be supported by reminders via telephone call or e-mail.

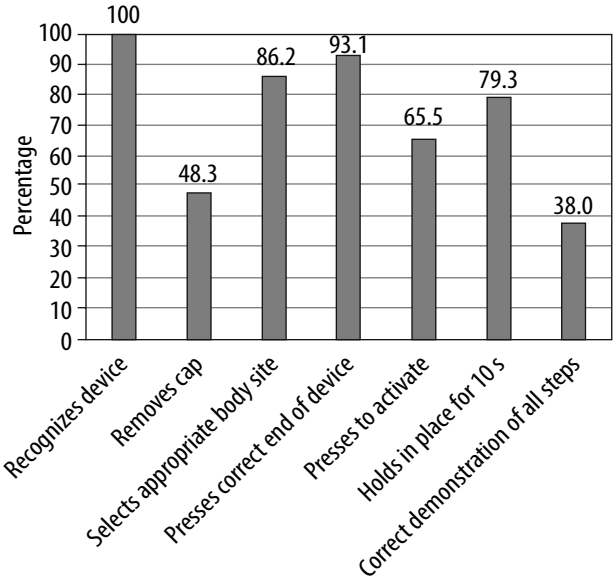

FIGURE 1. Percentage of correct demonstrations for each of the 6 steps in using the EpiPen® (n = 29)

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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