RESEARCH ARTICLE

Awareness of influenza and pneumococcal vaccines in diabetic patients

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Abstract

Purpose In our study, it was aimed to evaluate the awareness of diabetic patients about vaccination status and vaccines.
Methods This cross-sectional study was conducted between January 2019 and February 2019. A survey questioning the level of knowledge about and vaccination status for influenza and pneumonia vaccines was applied by face-to-face interviews with patients with diabetes mellitus who admitted to the diabetes outpatient clinic. All results were evaluated with SPSS-20.0.
Results A total of 202 patients [66 male (32.7%) and 136 female (67.3%) patients; with a mean age of 57.7 ± 11.3 years and mean duration of diabetes 10.7 ± 7.9 years] were recruited in the study. Majority of the patients (92.6%) were type 2 DM patients. 59.4% of the patients had never been vaccinated. The rate of those who had pneumonia vaccine was very low, only 14.7%. The vast majority of the patients had knowledge about vaccines and their most common source of information was nurses. 53% of patients believed that diabetic patients should be vaccinated regularly. 16.8% of the patients were reluctant to have the recommended vaccine. The factor with greatest impact on this was that they did not consider the vaccine necessary. 52.5% of the patients recommended to be vaccinated had the recommended vaccine. 26.4% of the patients who were not enthusiastic about the recommended vaccine had pneumococcal vaccine after being informed about the vaccine.
Conclusion It was observed that the information given about vaccines positively affected the vaccination rate. The main barrier to vaccination was the lack of information about the need for influenza vaccination. Designing strategies and training programs for healthcare professionals and patients should be the main goal to improve vaccination coverage and vaccination rates.

Keywords Pneumococcal Vaccine · Diabetes Mellitus · Awareness · Vaccination Rate

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Introduction

Vaccination programs, one of the most effective public health interventions to reduce or eliminate the burden of communicable diseases, have fallen far below targeted levels even in the most developed countries. Routine vaccination is recommended by various organizations, as it is effective in reducing the risk of influenza and invasive pneumococcal disease in high-risk individuals [1, 2]. Since invasive pneumococcal diseases caused by streptococcus pneumoniae among diabetic individuals are associated with increased morbidity and mortality, vaccination has gained importance in these individuals [1, 3]. Therefore, governments have adopted routine vaccination programs as a health policy, and recommendations for routine pneumococcal vaccination are currently available in 29 European countries [4]. In Turkey, the ministry of health included the conjugate

pneumococcal vaccine (PCV13) within the scope of the expanded immunization program in 2016, and included all diabetic patients, regardless of age, in its routine vaccination program. In guidelines on adult vaccination published by ministry of health and association of endocrinology and metabolism, dual vaccination (PCV13 + PPV23) is recommended for all diabetic patients without seeking additional risk factors [5, 6].

Those with cardiovascular disease, diabetes mellitus (DM), or chronic lung disease are at higher risk of complications of certain diseases such as vaccine-preventable pneumonia and influenza. In a meta-analysis of 33,000 patients with community-acquired pneumonia, the mortality rate among patients with DM was 1.3 times higher [7]. Despite all governmental policies and healthcare provider recommendations, the vaccination rate of patients with DM still remains far below the target. In a recent population-based study, the vaccination rate for pneumococcus was 22.8%, whereas the vaccination rate for diabetic patients was 24.1% [8].

In DM or other major chronic conditions, vaccination is one of the most effective methods to control influenza transmission and reduce morbidity and mortality [9]. The underlying pathophysiological mechanisms of susceptibility to influenza in diabetic patients are not fully understood; however, the World Health Organization (WHO) recommends annual influenza vaccination. Impaired responsive response in the immune system has been proposed to be responsible for infection-related complications in diabetic patients [10]. Vaccination against influenza in patients with DM has been associated with a reduced risk of hospitalization and deaths from all causes, including pneumonia and influenza [9, 11].

In this study, it was aimed to determine the level of awareness on vaccines such as pneumococcus and influenza in DM patient population in Kocaeli.

Methods

This study was approved by the local ethics committee with project number KÜ GOKAEK 2019/16. DM patients who admitted to Kocaeli University Department of Endocrinology and Metabolic Diseases between January and February 2019 were included in this cross-sectional study. 202 patients over 18 years of age who gave informed consent for data collection and had no contraindications for vaccination were included in the study. Patients under 18 years of age, pregnant women, and patients with a history of allergic reaction to the vaccine and/or its components, active malignancy, severe neurological and psychiatric disorders were excluded from the study. After the routine diabetes outpatient control, information regarding patients' age, gender, and duration and treatment of diabetes was recorded. A survey questioning the

vaccination status of the patients in the last year, attitude towards vaccines and awareness on vaccines was applied using the face-to-face interview method. The patients were questioned about their socio-demographic characteristics, as well as their previous vaccination status, who gave the recommendation for vaccination and, if any, the name of the vaccine they had. If the patients were against vaccination, the reason for this was discussed face to face.

Statistical Analysis

All statistical analyses were performed using IBM SPSS for Windows version 20.0 (SPSS, Chicago, IL, USA). Kolmogorov–Smirnov test was used to assess the assumption of normality. Numeric variables were expressed as mean ± standard deviation and median (25th-75th percentile). Categorical variables were summarized as counts (percentages). Since normality assumption did not hold, comparisons of numeric variables between groups were carried out using Mann–Whitney U test. An association between two categorical variables was examined by Chi-square test. All statistical analyses were carried out with 5% significance and a two-sided p-value < 0.05 was considered statistically significant.

Results

A total of 202 [66 male (32.7%) and 136 women (67.3%) patients; with a mean age of 57.7 ± 11.3 years, and a mean duration of diabetes of 10.7 ± 7.9 years] who presented to the outpatient clinic of diabetes and met the inclusion criteria were recruited in the study. Majority of the patients (92.6%) were type 2 DM patients and only 3.5% of the whole population was being followed up with diet therapy alone. More than half of the patients had not been vaccinated before, and the majority of those vaccinated were vaccinated against influenza (87.8%). The rate of those who had had pneumonia vaccine was very low, only 14.7%. It was observed that the majority of the patients had received information about influenza and pneumonia from at least one source (78.2%, 71.8% respectively). The most common source of information for the patients was healthcare providers, consisting of doctors or nurses. While 83.2% of the patients stated that they would have the recommended vaccine, it was determined that only 52.5% of the patients finally had the vaccine (Table 1). Both genders had similar awareness on vaccination and a similar vaccination rate. 9 of 34 patients who answered "no" to the question of whether they could get the recommended vaccine had the vaccine at the end of the interview (Table 2).

Table 1 Demographic data and vaccination rate in patients

		n	%
Sexuality	Woman	136	67.3
	Man	66	32.7
Type of Diabetes	Type 1	15	7.4
	Type 2	187	92.6
Treatment of Diabetes	Diet	7	3.5
	OAD	99	49.0
	Insulin	20	9.9
	OAD+Insulin	76	37.6
Have you ever been vaccinated before?	Yes	82	40.6
	No	120	59.4
Which vaccinations did you have?	Influenza	62	75.6
	Pneumonia	3	3.7
	Hepatitis	5	6.1
	Influenza+Pneumonia	8	9.8
	Influenza+Hepatitis	2	2.4
	Pneumonia+Hepatitis	1	1.2
	All	1	1.2
Do you have information about the influenza vaccine?	Yes	158	78.2
	No	44	21.8
Who did you get information about the influenza vaccine from?	Doctor	40	25.3
	Nurse	111	70.3
	Television / Radio	4	2.5
	Friend / Neighbor	2	1.3
	Other	1	0.6
	Missing	44	21.8
Do you have information about the pneumonia vaccine?	Yes	145	71.8
	No	57	28.2
Who did you get information about the pneumonia vaccine from?	Doctor	32	22.1
	Nurse	106	73.1
	Television / Radio	2	1.4
	Friend / Neighbor	2	1.4
	Other	3	2.1
	Missing	57	28.2
Do you think diabetic patients should be vaccinated?	Yes	107	53.0
	No	14	5.9
	I don't know	81	40.1
If yes, which vaccinations should they have?	Influenza	22	20.6
	Pneumonia	8	7.5
	Hepatitis	1	0.9
	Influenza+Pneumonia	52	48.6
	All	24	22.4
	Missing	95	47.0
Do you get the recommended vaccinations?	Yes	168	83.2
	No	34	16.8
If your answer is no, why not do it?	Not effective	5	14.7
	Has harmful effects	5	14.7
	I do not think it is necessary	24	70.6
Have you had the recommended vaccine?	Yes	106	52.5
	No	96	47.5

Table 2 Situations of getting the recommended pneumococcal vaccine and barriers to vaccination

		Have you been vaccinated?		p value
		Yes	No	
Sexuality	Woman	67.0% (71)	67.7% (65)	1.000
	Man	33.0% (35)	32.3% (31)	
Age	Year	60.5 (53.0–66.0)	58.0(50.5–63.0)	0.171
Duration of diabetes	Year	10.0(5.0–15.0)	9.0(4.0–13.75)	0.184
Do you have information about the flu vaccine?	Yes	76.4% (81)	80.2% (77)	0.630
	No	23.6% (25)	19.8% (19)	
Who did you get information about the flu vaccine from?	Doctor	23,5% (19)	27,3% (21)	0.841
	Nurse	71,6% (58)	68,8% (53)	
	Other	4,9% (4)	3,9% (3)	
Do you have information about the pneumonia vaccine?	Yes	74.5% (79)	68.8% (66)	0.434
	No	25.5% (27)	31.3% (30)	
Who did you get information about the pneumonia vaccine from?	Doctor	25.3% (20)	18.2% (12)	0.531
	Nurse	70.9% (56)	75.8% (50)	
	Other	3.8% (3)	6.1% (4)	
Do you think diabetic patients should be vaccinated?	Yes	60.4% (64)	44.8% (43)	0.015
	No	2.8% (3)	11.5% (11)	
	I don't know	36.8% (39)	43.8% (42)	
If your answer is no, why?	Not effective	11.1% (1)	16.0% (4)	0.506
	Has harmful effects	22.2% (2)	12.0% (3)	
	I do not think it is necessary	66.7% (6)	72.0% (18)	

Discussion

Vaccination against pneumococcal infections in patients with DM has achieved significant reductions in morbidity and mortality, although sufficient immunization rates have not yet been achieved in Turkey. In this study, while the level of knowledge about and vaccination rate for influenza vaccine were quite high, it was difficult to say this for pneumonia vaccine. Pneumococcal vaccination rates in patients with DM were found to be lower than those in the European and USA population.

Although regular vaccination for influenza and pneumococcus is recommended for those with chronic diseases in the high-risk group in order to reduce mortality and morbidity, sufficient vaccination has been able to be achieved in only a small number of high-risk individuals worldwide [12]. According to the WHO data, they reported that the influenza vaccination rate should be at least 75% in high-risk groups [13]. Current data show that the influenza vaccination rate is approximately 50.3% in European countries, whereas this rate is lower in many Asian countries [14, 15]. In the United States, the pneumococcal vaccination rate between the ages of 19–64 years was 23.0%, while it was 63.6% over 65 years of age. The vaccination rate for whites aged 65 and over (68.1%) was higher compared to those in blacks (50.2%), Hispanics (41.7%) and Asians (49.0%) [16]. In a Turkish study conducted with DM patients in 2006, while the

influenza vaccination rate was 9.1%, pneumococcal vaccination rate was only 0.1% [17]. In 2013, this rate increased up to 27% for influenza vaccine and to 9.8% for pneumococcal vaccine in diabetic patients [18]. In a recent Turkish study conducted in rural areas, 20% of the subjects were vaccinated with influenza vaccine and 11.1% with pneumococcal vaccine. Only 6.3% of all subjects had both vaccinations [19]. In a Turkish study conducted in the diabetic population in 2020, 34.1% of the patients had the influenza vaccine and 9.9% the pneumococcal vaccine [20]. The vaccination rate of high-risk patient population has gradually increased in our country over the past years. In our study, while the rate of DM patients who had influenza vaccine was 87.8%, this rate was 14.8% for pneumococcal vaccine. The rate of those who had both vaccinations was only 9.8%. The rates for both vaccines were found to be above the average of our country. Such different vaccination rates may be related to the governmental health policies, the awareness level and socio-economic status of the societies.

Healthcare providers play an important role in advising and encouraging the administration of vaccines, particularly to vulnerable patients. Awareness of healthcare providers on effectiveness of vaccines strongly influences vaccination recommendations [21]. In a previous study, the rates of physicians having accurate information about influenza and pneumococcal vaccines were 58.1% and 53.5%, respectively [22]. A study conducted in Pakistan revealed that

72.6% of doctors were not aware of the influenza vaccine recommendations and guidelines [23]. In a comprehensive Turkish study conducted with 12,574 healthcare providers, the rate of regular vaccination was found to be 6.7%, while it was found that 55% of healthcare workers had never had a influenza vaccine [24]. In a study conducted with healthcare providers, awareness on pneumococcal and influenza vaccines was 58.7% and 86.2%, respectively. The awareness on vaccines was highest among nurses with a rate of 70.2% [25]. In our study, it was determined that the patients mostly received information about both influenza and pneumococcal vaccine from the nurses. The higher rate in nurses than physicians as the source of information in this study may be related to several factors. First, diabetes education nurses have been in the same role for many years and second, the doctors in the diabetes outpatient clinic change every two months for the educational rotation.

There are many barriers behind the failure to reach the targeted levels in adult vaccination. In general, these include the lack of knowledge of physicians, inadequate access to healthcare, the cost of the vaccine, and the benefits and safety of the vaccines [22, 26]. In a study conducted with a Lebanese adult population, the only related barrier to regular influenza vaccination was found to be "considering the vaccine as unnecessary" [27]. In a German study, "fear of side effects" and "not requiring vaccination" were identified as the most important factors affecting influenza vaccination [28]. Social isolation and living alone in the elderly > 65 years of age have been found to be an important barrier to vaccination [29]. In a cross-sectional study, significant barriers to vaccination were identified in 24% of diabetic patients and 42% of healthcare providers [30]. Doctors' advice for being vaccinated is one of the most important factors in achieving goals in adult vaccination [31]. Doctors in developing countries feel the need to update their knowledge, but this is not always achieved due to time and financial constraints. Increasing physicians' knowledge about and awareness on vaccines improves vaccination rates [18]. In our study, the rate of patients receiving information from doctors about influenza and pneumococcal vaccine did not exceed 25%. The most common barrier for the patients to have the vaccine was found to be considering the vaccine as unnecessary. 26.4% of the patients who answered "no" to the question "Would you get the recommended vaccine?" had the pneumococcal vaccine as a result of being informed about the vaccine. 44.2% of the patients who answered ''no'' or ''don't know'' to the question "Do you think diabetes patients should be vaccinated?" had the pneumococcal vaccine as a result of being informed about the vaccine.

Several strategies have been proposed to increase vaccine coverage and vaccination rate in high-risk populations. Foremost, national and international scientific associations for high-risk diseases should provide stronger strategies for

vaccination. Education of potential vaccine recipients in the at-risk group and promotion of vaccines is an important factor in raising awareness. Recent research has demonstrated the effectiveness of web-based apps that provide vaccine information via websites and social media. Promoting vaccination through community organizations and home visiting programs can increase vaccination rates. Strong vaccination programs should be developed as a governmental policy to increase vaccination rates. Reminding physicians the patients' vaccination status through medical records or electronic records is one of the most effective factors to increase vaccination rates. In our clinic, regular training meetings are held and informative posters are used to raise awareness on vaccines [30, 32, 33].

Severe acute respiratory syndrome coronavirus 2-related disease (COVID-19) has become one of the most alarming pandemics of recent times. COVID 19 has disrupted vaccination services in countries all over the world and has remained one of the most important barriers to vaccination services in recent times. COVID-19 is more severe in patients with DM, chronic lung and cardiovascular diseases, which are risk factors for pneumococcal infections [34]. Pneumococcal vaccines are known to reduce hospitalization rates for pneumonia in the adult population older than 65 years of age. This is important, as older people are the highest-risk group for death from COVID-19 [35]. Approximately 10% of deaths from COVID-19 are thought to be caused by pneumococcal superinfection. Therefore, it is anticipated that potential secondary infections can be prevented by vaccination [36]. In an observational study involving 11,672 patients, people who received the pneumococcal vaccine during the same year were found to have a significantly lower risk of contracting COVID-19 [37]. Similarly, in a retrospective study involving a total of 27,201 patients, previous influenza vaccination was associated with a decrease in the number of positive COVID-19 tests and improved clinical outcomes [38]. As stated by WHO, pneumococcal vaccine reduces the risk of secondary bacterial infections, rather than protection against COVID-19 infection [39].

This study has a few limitations. Since the study was conducted in a tertiary health facility in Kocaeli, it may not reflect the country's actual vaccination rate. The low level of awareness of physicians may not reflect the data of primary and secondary care centers, as assistant doctors regularly rotate every two months in this center due to training. Finally, participants may differ socio-demographically and it is possible to differ in vaccination practices.

Conclusion

As shown by this study, the level of awareness on vaccines still remains to be a serious global problem, leading to low vaccination rates. Misinformation about vaccines can be a major cause of low vaccination rates. Vaccination rates can

be improved by interventional efforts that support vaccination, such as electronic medical records, posters, short films, reminders for patients and service providers.

Declarations

Conflict of interest The authors declare that they have no competing interests.

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