

Pneumococcal and Influenza Vaccines in Dialysis Patients: Vaccination Information, Rates, and Patient Awareness

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ABSTRACT

Objective: Pneumococcal and influenza vaccination rates are still far below the desired levels in dialysis patients. We aimed to determine the pneumococcal and influenza vaccination information, rates, and knowledge levels of dialysis patients.

Methods: The study is a descriptive cross-sectional study in which 307 dialysis patients between 2020 and 2021 were analyzed retrospectively. Demographic characteristics of all patients and vaccination information were obtained from the face-to-face questionnaire and hospital medical records.

Results: Of the participants, 52.4% were males, and the mean age was 56 ± 15.45 years. The pneumococcal vaccination rate was 37.1%, and the influenza vaccination rate was 58.6%. Of 114 patients who had received a pneumococcal vaccine, 91.2% had received a single dose of the vaccine. While the type of vaccine could not be determined in 86.8% of the patients in this group, the rate of vaccination with the 2 types of the pneumococcal vaccine was only 8.8%. Annual vaccination was given to all those who were vaccinated against influenza. In the whole group, the rate of those who had never heard of the pneumococcal vaccine was 24.4%, while this rate was 6.5% for the influenza vaccine. The patients had a very low level of knowledge of both vaccines (41% and 53.7%, respectively).

Conclusion: Pneumococcal and influenza vaccination rate of dialysis patients was low. Influenza vaccination had been performed in compliance with the recommended scheme, but the doses of the pneumococcal vaccine were incomplete. Although the level of patient knowledge was low for both vaccines, patients were more aware of the influenza vaccine.

Keywords: Clinical nephrology, hypertension, dialysis patients, hemodialysis, influenza vaccine, pneumococcal vaccine

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INTRODUCTION

The risk of infectious complications is high among patients with chronic kidney disease (CKD).¹ Infections are the most common cause of hospitalization and death after cardiovascular diseases in patients with end-stage renal disease (ESRD), particularly those undergoing hemodialysis (HD).² Hospitals that adopted a vaccination regime for CKD and ESRD patients have reported lower infection rates and effectively lowered mortality and morbidity rates.²⁻⁴ It is known that especially patients with late-stage CKD have an increased sensitivity to infections and a lower rate of vaccine response due to a dysfunctional immune system. Although the rate

of vaccine response is low in this population, vaccines continue to be an important option for preventive care to reduce infection rates due to their favorable safety profiles. However, this subject has generally drawn little attention. These patients have been vaccinated at a lower rate than the general population irrespective of their baseline nephropathy or comorbidities.⁴⁻⁶ In a retrospective study reported from the United States, the overall pneumococcal vaccination rate was 44% and the influenza vaccination rate was 76%.⁷ We aimed to determine the pneumococcal and influenza vaccination information, rates, and knowledge levels of dialysis patients (DP).



Table 1. The Recommended Pneumococcal and Influenza Vaccination Scheme in Adults With CKD

Vaccine Type	Dose and Vaccination Scheme
Pneumococcal vaccine	<p>CKD patient unvaccinated against pneumococci:</p> <ul style="list-style-type: none"> - Administer PCV13 - Administer PPSV23 at least 8 weeks after the PCV 13 dose (dose 1); administer PPSV23 (dose 2) at least 5 years after the first PPSV23 dose. <p>CKD patient previously vaccinated with PPSV23:</p> <ul style="list-style-type: none"> - Administer PCV13 at least 1 year after PPSV23 (dose 1). - Administer PPSV23 (dose 2) at least 8 weeks after the PCV13 dose and at least 5 years after PPSV23 (dose 1) <p>CKD patient previously vaccinated with PCV13:</p> <ul style="list-style-type: none"> -Administer PPSV23 (dose 1) at least 8 weeks after the PCV 13 dose; administer PPSV23 (dose 2) at least 5 years after the PPSV23 dose <p>If the first vaccination series were started before the age of 65, all patients should receive an additional PPSV23 vaccine dose at the age of 65 years.</p>
Influenza vaccine (inactive)	An annual dose before the start of the influenza season
<p>CKD, chronic kidney disease; PCV13, 13-valent conjugate pneumococcal vaccine; PPSV23, 23-valent pneumococcal polysaccharide vaccine.</p>	

Vaccination in CKD Patients General Considerations

One of the difficulties of vaccination of this patient group is the lack of an optimal vaccination policy due largely to varying epidemiological priorities of different countries.^{2,3} Table 1 shows the recommended pneumococcal and influenza vaccination schemes in adults with CKD around the world and in our country.⁸⁻¹⁰

METHODS

This is a descriptive cross-sectional study that enrolled 307 patients who had undergone dialysis (HD or peritoneal dialysis (PD)) at our hospital between January 2020 and February 2021 and who agreed to participate in the study on a voluntary basis. It was approved by Baskent University Institutional Review Board and Ethics Committee (Project No. KA21/262) prior to its onset. All participants voluntarily gave an informed consent form that contained information about the study; they also gave a written and signed informed consent after being informed about the study’s objective and method.

Study Design

Patient information was obtained with the help of a 14-item questionnaire administered with face-to-face interview techniques and electronic medical records. The participants were questioned about their age, gender, sociodemographic

characteristics such as educational status, information about pneumococcal and influenza vaccination (type of vaccine and time of vaccination), level of vaccination knowledge, and the source of information. Then, the information about the CKD cause, dialysis type and duration, and comorbidities were obtained via an electronic medical record system.

Statistical Analysis

Descriptive statistics were expressed as frequency (N) and percentage (%) for categorical variables and mean and standard deviation for continuous variables (median and minimum–maximum when applicable). All statistical analyses were performed with Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM SPSS Corp.; Armonk, NY, USA).

RESULTS

The demographic characteristics of the patients were shown in Table 2. Out of 307 patients in total, 52.4% were male and 47.6% were female, and their mean age was 56 ± 15.45 years. Of the patients, 92% were undergoing HD and 9.8% PD; 41.2% of the patients had been on dialysis for more than 7 years; 44.6% of the patients were primary school graduates. The most common causes of chronic kidney failure (CRF) were hypertension and diabetic nephropathy (28.7% and 26.7%, respectively). The most common conditions accompanying CRF were hypertension (32.2%) and heart disease (coronary artery disease/heart failure, 21.2%), with 17.3% of the patients having more than one comorbidity.

The pneumococcal and influenza vaccination rates for the whole group were 37.1% and 58.6%, respectively. Both vaccines were most administered in the last 6 months (57.9% and 60%, respectively). Out of 114 patients who had been vaccinated with the pneumococcal vaccine, 91.2% had received a single vaccine dose. In this group, the type of vaccine could not be determined, and the percentage of patients who had received the 2 types of the pneumococcal vaccine was only 8.8%. All of 180 patients who had received the influenza vaccine had received a single dose of vaccine (Table 3).

While the percentage of DP who had never heard of the pneumococcal vaccine was 24.4%, the percentage of those who had never heard of the influenza vaccine was only 6.5%. The patients had a very low level of knowledge of both vaccines (41% and 53.7%, respectively). It was determined that 34.5% of patients had no source of information about the pneumococcal vaccine. They obtained information from their family physician and television (30.3% for each). They had most obtained information about the influenza vaccine from their family physician (42.3%) (Table 4).

DISCUSSION

According to our study results, the vaccination rate of our patients was 37.1% for the pneumococcal vaccine and 58.6% for the influenza vaccine. The influenza vaccine had been

Table 2. Demographic Characteristics of the Dialysis Patients

	N = 307 (%)
Mean age (years)	56 ± 15.45
Gender	
Male	161 (52.4)
Female	146 (47.6)
Educational status	
Illiterate	59 (19.2)
Primary school	137 (44.6)
Secondary school	40 (13.0)
High school	42 (13.7)
College	29 (9.4)
Dialysis type	
Hemodialysis (HD)	277 (90.2)
Peritoneal dialysis (PD)	30 (9.8)
Duration of dialysis	
Last 6 months	31 (10.1)
1-3 years	75 (24.4)
4-6 years	74 (24.1)
7 years or longer	127 (41.4)
Causes of CKD	
Hypertension	88 (28.7)
Diabetic nephropathy	82 (26.7)
Genetic kidney disease (polycystic, Alport)	33 (10.7)
Chronic pyelonephritis	28 (9.1)
Glomerulonephritis	14 (4.6)
Other	13 (4.2)
Unknown	49 (16.0)
Comorbidity	
Hypertension	99 (32.2)
CAD/heart failure	65 (21.2)
DM	47 (15.3)
COPD/asthma	11 (3.6)
Rejected renal transplant	8 (2.6)
Solid organ tumor	7 (2.3)
Other	6 (2.0)
No comorbidity	11 (3.6)
Multiple comorbidities	53 (17.3)

The values were presented as N, number of patients (%); mean-standard deviation (SD). CKF, chronic kidney failure; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus.

Table 3. Information About Pneumococcal and Influenza Vaccination

	Pneumococcal Vaccine, N = 114 (%)	Influenza Vaccine, N = 180 (%)
Vaccination		
Yes	114 (37.1)	180 (58.6)
No	193 (62.9)	127 (41.4)
Timing of vaccination		
Last 6 months	66 (57.9)	108 (60)
1-3 years	36 (31.6)	52 (28.9)
4-6 years	6 (5.3)	10 (5.6)
7 years or longer	6 (5.3)	10 (5.6)
Type of pneumococcal vaccine		
Type of vaccine unknown	99 (86.8)	
PPSV 23	2 (1.8)	-
PCV 13	3 (2.6)	-
PPSV 23 + PCV 13	10 (8.8)	-
Vaccination interval		
Single dose of vaccine	104 (91.2)	-
6 months	10 (8.8)	-

N, number of patients; PCV13, 13-valent pneumococcal conjugated vaccine; PPSV23, 23-valent pneumococcal polysaccharide vaccine.

administered in compliance with the recommended vaccination scheme, whereas the pneumococcal vaccine doses were incomplete. We determined a low level of patient knowledge of both vaccine types.

End-stage renal disease patients, particularly those who are on dialysis, are defenseless against invasive pneumococcal infections due to immune dysfunction¹¹; hence, the mortality rate of respiratory tract infections in this patient group is 14-16 times higher than the general population.¹² It has been found that the conjugated vaccine effectively prevents 75% of pneumococcal infections and 45% of pneumococcal pneumonia. The efficacy of the polysaccharide pneumococcal vaccine has been found to be 50-85%.^{13,14} Although it has been shown that the infection rates are reduced in centers having a vaccination scheme, vaccination rates are generally below the target levels in this patient group.⁵ Bond et al.⁷ reported that the pneumococcal vaccination rate was 44% among DP; another study reported by the same researchers also showed a pneumococcal vaccination rate of 21-41.8% and a favorable impact of vaccination on survival.¹⁵ Our study results were in accordance with the literature data, showing that our DP had a low pneumococcal

Table 4. The Patients' Level of Knowledge of the Pneumococcal and Influenza Vaccines and Their Source of Information

	N = 307 (%)	
	Pneumococcal	Influenza
Level of vaccine knowledge		
Never heard of vaccine	75 (24.4)	20 (6.5)
Heard of vaccine but had no knowledge	87 (28.3)	80 (26.1)
Had a very low level of knowledge	126 (41)	165 (53.7)
Had a very good level of knowledge	19 (6.2)	42 (13.7)
Source of information about the vaccines		
No source	106 (34.5)	47 (15.3)
Close surrounding	70 (22.8)	88 (28.7)
Family physician	93 (30.3)	130 (42.3)
Nephrology specialist	16 (5.2)	28 (9.1)
Chest diseases specialist	6 (2.0)	1 (0.3)
Infectious diseases specialist	4 (1.3)	1 (0.3)
TV	93 (30.3)	11 (3.6)
Pharmacist	2 (0.6)	1 (0.3)

N, number of patients; TV, television.

vaccination rate. Influenza vaccination rates of DP are also below desired levels although they have tended to increase in recent years. A study reported from the United States with a fairly large number of DP demonstrated that the influenza vaccination rates have steadily increased over a 10-year period, rising from 52% in 2006 to 71% in 2016.¹⁶ According to these data, our patients' influenza vaccination rate was below the expected level (Table 3).

There are currently 2 types of anti-pneumococcal vaccines, namely 13-valent conjugate pneumococcal vaccine (PCV-13) and 23-valent pneumococcal polysaccharide vaccine (PPSV23), which contain 12 common antigens. It has been shown that administering both types of pneumococcal vaccines provide stronger protection. Therefore, the PCV13 vaccine in combination with the PPSV23 vaccine has been included in the vaccination schemes designed for immunosuppressive individuals, including CKD patients.^{4,17} The recommended dosing scheme includes the PCV-13 vaccine followed by the PPSV23 vaccine administered at least 8 weeks later, with booster doses of PPSV23 being administered every 5 years. In individuals who have received the PPSV-23 vaccine, on the other hand, PCV-13 should be administered at least 1 year after the PPSV-23 dose (Table 1). In our study, 91.2% of 114 patients who had received the pneumococcal vaccine had been vaccinated with a single vaccine dose. In addition, the type of vaccine could not be determined in 86.8% of patients in this group, and the percentage of patients who had received the 2 pneumococcal vaccine types was only 8.8% (Table 3). These findings suggest that there are defects in the recommended pneumococcal

vaccination schemes. We believe that the lack of a vaccination card or a national vaccination registry may have contributed to the higher rates.

It has been shown that DP who had been vaccinated against influenza enjoyed a 14% reduction in hospitalization due to influenza and pneumonia and an 81% reduction in intensive care unit admission.^{18,19} Both our national adult vaccination guideline^{9,10} and the international advisory committees strongly recommend that patients with chronic diseases including those undergoing dialysis be vaccinated with seasonal influenza vaccine on an annual basis.^{20,21} In line with this scheme, all our patients vaccinated against influenza had received annual influenza vaccines. It was also noteworthy that all of our patients who had been vaccinated with the influenza vaccine had knowledge of the necessity of the annual vaccine administration. Both the pneumococcal and influenza vaccines had been most administered within the last 6 months (57.9% and 60%, respectively). The fact that our study coincided with the COVID-19 pandemic may have been influential in this increase in the interest in these vaccines.

There are no specific domestic studies on the awareness and sources of information about vaccines among DP. However, a study by Mutlu et al.,²² which examined the vaccination rates and vaccine awareness by asking how patients had obtained the information about the necessity of vaccination and which factors had motivated them to get vaccinated in patients aged 65 years or older who presented to family medicine outpatient clinics, found that physicians effectively influenced more than

70% of patients. In addition, 57.44% of patients replied that they had not been vaccinated due to a lack of awareness of the necessity of vaccination and 12.35% due to concerns about their side effects. In a study from the United States, where influenza and pneumococcal vaccination rates of a group of patients with CRF and/or moderate-to-severe kidney disease were found 69.7% and 49.2%, respectively, most patients who had not been vaccinated against influenza reported that they had not been vaccinated due to a belief that the vaccine was not important (42%) or effective (21.2%).²³ A general look at the subject indicates that patients have an incomplete awareness of the vaccines and had no credible information about them. Similarly, our study demonstrated that our DP had a very low level of knowledge of both types of vaccines. Our patients had most received information about the influenza vaccine from their family physicians (42.3%). As for the pneumococcal vaccine, we found that the majority of patients had no source of information. The influenza vaccine showed a higher awareness level (Table 4). Guclu et al.²⁴ revealed that physician recommendation was the most important factor in vaccination decisions. Likewise, another regional study from our country reported by Ünal et al.²⁵ showed that the pneumococcal vaccination rates quadrupled within 6 months among individuals older than 65 years after family physicians had been trained about the vaccines. We found that family physicians had an important role in providing information about vaccines. Therefore, we are of the opinion that family physicians' support is important when implementing vaccination schemes.

The limitations of this study are its retrospective and single-center design. Moreover, due to the voluntary nature of study participation, some patients refused to participate.

Although it can be expected that widespread vaccination in this group of patients may lower the total cost of care and potentially improve patient well-being, CKD patients are apparently under-vaccinated than the general population. In conclusion, the pneumococcal and influenza vaccination rates were low in our DP. Whereas influenza vaccines had been administered in line with the recommended vaccination scheme, pneumococcal vaccines were incompletely administered. The level of knowledge of both types of vaccines was low; however, awareness of the influenza vaccine was better. Our study is the first-ever cross-sectional study that determined the status of vaccination among DP residing in Turkey. We would like to draw attention to the necessity of bringing regulations ensuring full implementation of these vaccination programs in DP and to increase their vaccination knowledge.

Ethics Committee Approval: Ethics committee approval was received from the Baskent University Institutional Review Board and Ethics Committee (Project No. KA21/262) prior to its onset.

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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