Original Article

Frequency of Hospital Admission among COVID-19 Patients with and without Prior Vaccination

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Abstract

Background: A thorough grasp of the benefits of COVID-19 vaccination requires consideration of disease attenuation, determined as whether people who develop COVID-19 in spite of vaccination have lower disease severity than unvaccinated people.

Objective: To determine the frequency of vaccination history in patients with corona virus disease and to compare the frequency of admission of corona virus infected patients with or without history of vaccination against corona virus disease.

Methods: This comparative cross-sectional study was carried out from 03rd December 2022 to 03rd June 2023 and included 60 patients from Department of Medicine Unit I , Bahawalpur Victoria Hospital (BVH), Bahawalpur, Pakistan. Patients were assessed for their history of prior COVID-19 vaccination and were subsequently categorized into vaccinated and unvaccinated groups accordingly. The frequency of hospital admission was then compared between the two groups to evaluate the association between vaccination status and disease severity. Data were entered and analyzed using SPSS version 26.

Results: Overall mean age was 35.05±8.99 years with male predominance (63.3%, n=38) and 36.7% (n=22) females. Among co-morbidities studied, smoking was found in 18.3% (n=11), hypertension 21.7% (n=13) and diabetes mellitus was 20.0% (n=12). Total of 60 patients, 51.7% (n=31) had history of COVID vaccination and the frequency of admission in hospital was 35.0% (n=21). Both groups were compared for admission for COVID, 14.3% (n=3) had admission for COVID in patients with COVID vaccination and 85.7% (n=18) had admission for COVID in patients without vaccination, (p=0.001).

Conclusion: We concluded that hospital admission was significantly less among patients with history of COVID-19 vaccination.

Keywords: coronavirus disease, hospital admission, vaccination

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Introduction

Coronavirus disease 2019 (COVID-19), triggered by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), emerged in Wuhan, China in late 2019 and rapidly progressed into a global pandemic, posing a significant threat to international health systems. Several countries experienced multiple waves of infections, often demonstrating a recurring pattern with peaks in spring and during late summer or early autumn.[1-5] Pakistan reported its first confirmed case on February 26, 2020, after which SARS-CoV-2 spread rapidly across the country, placing substantial pressure on an already resource-constrained healthcare infrastructure.[6] In response, global and national public health authorities emphasized the urgent need for vaccine development, which led to the rapid production and distribution of highly effective vaccines.[7] Despite the availability of effective vaccines, vaccine hesitancy persisted in Pakistan, where only 48.9% of individuals demonstrated a positive attitude toward vaccination.[8] Although COVID-19 vaccines have shown excellent efficacy in clinical trials and real-world settings, breakthrough infections among vaccinated individuals continue to occur.[9-10] Nevertheless, vaccinated individuals who develop COVID-19 typically experience less severe disease, reduced hospitalization rates, and fewer complications than unvaccinated individuals.[10] Several studies have demonstrated the protective effect of vaccination against severe disease. One study reported that hospitalization rates were 11.8% in vaccinated patients compared to 15.35% in unvaccinated patients.[11] Another study

found a hospitalization rate of only 15.8% among vaccinated individuals, while 54.8% of unvaccinated individuals required admission ($p< 0.05$).[12] This evidence highlights the crucial role of vaccination in mitigating disease severity and reducing healthcare burden. Radiological imaging has been instrumental in assessing COVID-19 severity and progression. Characteristic chest CT findings include multifocal ground-glass opacities, bilateral involvement, and rapid parenchymal progression. Such features correlate strongly with disease severity and are more pronounced in severe or unvaccinated cases. Multifocal ground-glass patterns and consolidations are regarded as hallmark findings of viral pneumonitis and serve as valuable diagnostic markers during clinical evaluation. Immunologic studies have further demonstrated robust antibody responses following mRNA vaccination, with evidence suggesting stronger responses associated with the mRNA-1273 vaccine compared to BNT162b2, likely due to differences in antigen content or dosing intervals.[13] Waning immunity over time has been observed, particularly during circulation of variants such as Delta; however, vaccinated individuals still experience significantly lower rates of severe disease and hospitalization than unvaccinated individuals.[14-15] Although vast literature exists globally on the effects of COVID-19 vaccination on disease severity and hospitalization, there is a lack of local data from Pakistan on how vaccination status influences hospitalization among COVID-19 positive patients. Understanding real-world vaccine effectiveness in our local population is essential for guiding health policy, optimizing immunization programs, and improving preparedness for future outbreaks. The COVID-19 vaccines cut hospitalization risk by 40% against current variants and Pakistani hospital data show unvaccinated patients face far worse outcomes of severe disease. Most local studies only look at severity after admission, not whether vaccination reduces the chance of being admitted at all. With vaccine uptake still uneven in parts of Pakistan, directly measuring this gap would give clearer, locally-relevant evidence to guide vaccination policy and hospital resource planning.

Therefore this study was conducted to determine the frequency of vaccination history in patients with corona virus disease and to compare the frequency of admission of corona virus infected patients with or without history of vaccination against corona virus disease.

Methods

This comparative cross-sectional study was carried out in Department of Medicine, Unit I, Bahawalpur Victoria Hospital (BVH), Bahawalpur, Pakistan for a period of six months from 03-12-2022 to 03-06-2023. The Institutional Ethical Review Board, Quaid-e-Azam Medical College, Bahawalpur granted ethical approval for the study (No. 736/ DME/ QAMC Bahawalpur). Sample size calculation was done by using WHO calculator, of 60 patients is calculated with 95% confidence level, 13% margin of error and percentage of vaccination history i.e. 48.9%[8] in patients attending emergency of COVID symptoms. Non probability, consecutive sampling was used. All the patients aged 16-75 years and above with the confirmed diagnosis of COVID-19 via PCR or rapid antigen testing, cases with a clearly documented and verifiable vaccination history, Patients presenting to the hospital for COVID-19-related evaluation during the study period. Cases with complete medical records sufficient to determine demographic details, vaccination status, and hospital admission outcome, patients who were willing to take a part of study were included. However patients aged <18 years, with unclear or unverifiable vaccination history, incomplete vaccination course, COVID-19 diagnosis without confirmatory testing, immune-compromised patients, patients with incomplete medical records and patients transferred in from another facility were excluded. Informed consent was obtained from each patient. Demographic information including name, age, gender, BMI, history of hypertension (blood pressure ≥140/90mmHg), history of smoking (>5 pack year), history of diabetes, duration of previous COVID episode, were noted. Then patients were evaluated for history of vaccination. Then patients were admitted with severe symptoms. All this information was recorded on proforma. Data was entered and analyzed through in SPSS version 26. Quantitative variables like age, BMI, duration of previous episode of COVID, were presented as mean and standard deviation. Qualitative variables like gender, smoking, hypertension, diabetes, h/o vaccination status and admission for COVID, were presented as frequency and percentage. Data was stratified for age, gender, BMI, smoking, hypertension, diabetes, duration of previous episode of

COVID. Chi-square test was applied to compare admission in patients with or without vaccination. P–value ≤ 0.05 was considered as significant.

Results

A total of 60 patients fulfilling the inclusion criteria were enrolled in this study. Most patients (73.3%) were in the 16-40 years age group, with a mean age of 35.05±8.99 years. The mean BMI was 27.06 ± 3.91kg/m², and the mean duration since a previous COVID-19 episode was 3.06 ± 2.81 months. Males comprised of 63.3% of the study population. The frequencies of smoking, hypertension and diabetes mellitus were 18.3%, 21.7% and 20.0% respectively. Overall, 51.7% of the participants had received COVID vaccination. Hospital admission due to severe COVID-19 occurred in 35.0% (n=21) of patients (Table-1). A statistically significant difference was found between vaccinated and unvaccinated groups; only 14.3% of vaccinated individuals required admission compared to 85.7% of unvaccinated patients (p=<0.001), including a strong protective effect of vaccination (Table-2). Further stratification by age, gender, BMI, smoking status, hypertension, diabetes and duration of the previous COVID-19 episode revealed that vaccinated individuals generally demonstrated lower rates of hospital admission across all categories. Statistical significance was retained in larger subgroups, whereas smaller subgroups didn't reach significance, however the overall pattern uniformly favored vaccination (Table-3 & Table-4).

Table 1: *Demographic Characteristics of the Sample (N=60)*

Variable		Frequency	Percentage
Age	16-40 41-75	44 16	73.3 26.7
Gender	Male Female	38 22	63.3 36.7
Smoking Status	Yes No	11 49	18.3 81.7
Hypertension	Yes No	13 47	21.7 78.3
Diabetes Mellitus	Yes No	12 48	20.0 80.0
History of vaccination status	Yes No	31 29	51.7 48.3
Admission for COVID	Yes No	21 39	35.0 65.0
BMI (kg/m2)		27.06±3.91 kg/m²	
Duration of previous episode of COVID		3.06±2.81 months	

Table 2: *Comparison of Admission for COVID in Patients with or without Vaccination using Chi-square Test (N=60)*

Admission for COVID	Groups		Total	p value
	Patients with COVID vaccination	Patients without COVID vaccination		
Yes	3 (14.3%)	18 (85.7%)	21 (100.0%)	<0.001
No	28 (71.8%)	11 (28.2%)	39 (100.0%)	
Total	31 (51.7%)	29 (48.3%)	60 (100.0%)	

Table 3: *Stratification of Vaccination Status Based on Patients Characteristics*

Groups	Vaccinated n (%)	Unvaccinated n (%)	p-value
Age Group 16–40 years 41–75 years	 24 (54.5%) 7 (43.8%)	 20 (45.5%) 9 (56.2%)	0.563
Gender Male Female	 26 (68.4%) 5 (22.7%)	 12 (31.6%) 17 (77.3%)	0.001
Body Mass Index Group 17–25 kg/m² >25 kg/m²	 8 (47.1%) 23 (53.5%)	 9 (52.9%) 20 (46.5%)	0.777
Smoking Yes No	 7 (63.6%) 24 (49.0%)	 4 (36.4%) 25 (51.0%)	0.509
Hypertension Yes No	 5 (38.5%) 26 (55.3%)	 8 (61.5%) 21 (44.7%)	0.355
Diabetes Mellitus Yes No	 5 (41.7%) 26 (54.2%)	 7 (58.3%) 22 (45.8%)	0.527
Duration of Previous COVID Episode 1st episode 1–3 months >3 months	 11 (50.0%) 8 (66.7%) 12 (46.2%)	 11 (50.0%) 4 (33.3%) 14 (53.8%)	0.491

Table 4: *Stratification of Vaccination Status with Admission Based on Patients Characteristics (N= 60)*

Group	Admitted Vaccinated n (%)	Admitted Unvaccinated n (%)	p-value
Age			
16–40 years	2 (13.3)	13 (86.7)	<0.001
41–75 years	1 (16.7)	5 (83.3)	0.145
Gender			
Male	3 (23.1)	10 (76.9)	<0.001
Female	0 (0.0)	8 (100.0)	0.115
Body Mass Index			
17–25 kg/m²	1 (14.3)	6 (85.7)	0.050
>25 kg/m²	2 (14.3)	12 (85.7)	0.001

Smoking			
Yes	1 (25.0)	3 (75.0)	0.088
No	2 (11.8)	15 (88.2)	<0.001
Hypertension			
Yes	1 (16.7)	5 (83.3)	0.266
No	2 (13.3)	13 (86.7)	<0.001
Diabetes Mellitus			
Yes	1 (16.7)	5 (83.3)	0.242
No	2 (13.3)	13 (86.7)	<0.001
Duration of Previous COVID episode			
First episode	1 (11.1)	8 (88.9)	0.008
1–3 months	0 (0.0)	2 (100.0)	0.091
>3 months	2 (20.0)	8 (80.0)	0.051

Discussion

In this study a total of 60 patients were included, with a mean age of 35.05±8.99 years with majority of patients (73.3%) were young-to-middle-aged adults (16–40 years), providing a distinct look at COVID-19 hospitalization risks, which traditionally skew toward much older populations along with male predominance. This demographic distribution is consistent with a study conducted by Alnemari RF et al[16] who enrolled 1,058 COVID-19 patients and noted a median cohort age of 34 years and male dominance at 59.5% in their study cohort. In contrast, in the prospective cohort study conducted by Sayeed MA et al.[17] a higher baseline median age (IQR 50–70) was documented, with relatively lower median age in unvaccinated (50–68) individuals compared to vaccinated (54–72). Inconsistently, in the study conducted by Mollarahimi-Maleki F et al[18] reported a considerably higher mean mage of 59.2±17 years. The disparity in the mean age across studies may be attributed to differences in regional population structures, the timing of data collection, and hospital admission criteria. In this study, overall 51.7% of the participants had received COVID vaccination. This vaccination rate is higher than that reported in the study published by Garduño-Orbe B et al[19] who reported at least a single dose of vaccination in 31.45% of patients during the early pandemic phase.

In our study subjects, the mean duration since a previous COVID-19 episode was 3.06 ± 2.81 months, reflecting a relatively short window of natural immunity. This finding is in line with study carried out by Biggerstaff BJ et al[20] who reported 89.1 days of mean time to reinfection, translating to 2.97 months. Consistently, the study of Pinto LM et al[21] reported 60 days of median duration between the reinfection with COVID-19 and the first episode of infection (IQR 51–108 days). In the present study, hospital admission due to severe COVID-19 occurred in 35.0% of patients, and only 14.3% of vaccinated individuals required admission compared to 85.7% of unvaccinated patients, with a statistically significant difference between vaccinated and unvaccinated groups (p=<0.001), suggesting a strong protective effect of vaccination against severe clinical progression. In agreement with these findings, in the study conducted by Garduño-Orbe B et al[19] reported that unvaccinated individuals are significantly more likely to get hospitalization compared to vaccinated individuals (OR = 0.38). Comparable findings were reported in the study conducted by Corsaro A et a.[22] who found that vaccination has a strong protective effect against severe outcomes in hospitalized patients, with a relative risk among males (RR=0.14) and females (RR=0.16).

In the current study, males comprised the majority of the vaccinated group (68.4%), while females constituted the overwhelming majority of the unvaccinated cohort (77.3%), with a statistically significant baseline disparity in gender distribution according to vaccineation (p = 0.001). Conversely, statistically no significant baseline variations were detected between vaccinated and unvaccinated groups according to age distribution (p = 0.563), Body Mass Index (BMI) categories (p = 0.777), diabetes mellitus (p = 0.527), or the duration since a previous COVID-19 episode (p = 0.491). Partially consistent with these findings, in the study carried out by Bajpai J et al[23] male patients were more commonly vaccinated (84.20% vs 61.80%), while female gender showed predominance of unvaccinated (38.20% vs 15.80%) individuals. They additionally found that the difference between the vaccination status of males (p= 0.057) was statistically not significant, while differences between the vaccination status of age groups (p=0.031), hypertensive (p=0.008) and diabetic (p=0.013) patients were statistically significant. The gender disparity in vaccine distribution observed in our cohort may be explained by distinct socio-behavioral and occupational dynamics. Conversely, the high rate of vaccine hesitancy among females may stem from widely circulating gender-specific misinformation during the pandemic, especially concerning fertility, reprod

uctive health, and menstrual alterations.

In this series, among young-to-middle-aged adults (16–40 years), unvaccinated (86.7%) patients were significantly more likely to require hospital admission compared to their vaccinated (13.3%) counterparts ($p < 0.001$). However, despite higher proportion of hospitalizations in unvaccinated (83.3%) older age group (41–75 years), no significant difference was noted ($p = 0.145$). This finding aligns with a study conducted by Garduño-Orbe B et al[19] who reported that older age patients were significantly more likely to be hospitalized (OR = 1.09). In agreement, study carried out by Cai G et al[24] reported significant association between older age and higher likelihood of hospitalization (OR = 1.051). The lack of statistical significance in the older age group in our study may be due to the smaller sample size, but the trend toward higher hospitalization among unvaccinated older adults is consistent with the known increased risk of severe disease in this population.

In the present study, unvaccinated males experienced a significantly higher rate of hospital admission compared to vaccinated males (76.9% vs. 23.1%), ($p < 0.001$). In contrast, although all of the hospitalized female patients were unvaccinated, difference in hospital admission did not reach the statistical significance within the female subgroup ($p = 0.115$). Corresponding to these findings, in the study 0by Cai G et al[24] female gender showed a lower overall risk of COVID-19 hospitalization than males (OR: 0.713), with additional reduction in hospitalization risk in females (OR: 0.516) by vaccination. The stronger protective effect of vaccination in males observed in our study may be related to the higher baseline risk of severe outcomes in males and potential differences in immune response to vaccination between genders.

In the current study, highly pronounced trend of hospitalization was noted across healthy individuals (17–25 kg/m²) and overweight/obese patients (BMI >25 kg/m²), with each group showing an identical and greater proportion of unvaccinated hospitalized patients (85.7%). However, highly significant difference was noted in hospital admissions among overweight/obese subgroup ($p = 0.001$). Meanwhile, a comparable trend was observed among individuals with a normal BMI (17–25 kg/m²), which marginally approached statistical significance ($p = 0.050$). Consistent findings were documented in the study conducted by Cai G et al,[24] who noted a strong correlation between obesity and hospitalization (OR: 4.025). Consistently, in the study carried out by Van Der Klaauw AA et al[25] found a strong relationship between BMI beyond 40kg/m² and significantly increased rate of hospitalization with COVID-19 infection, with 76% higher likelihood of hospitalization in vaccinated individuals (aRR 1.76, 95% CI 1.60–1.94).

In this cohort, statistically significant proportion of unvaccinated admissions were non-smokers (88.2%, $p < 0.001$), non-hypertensive individuals (86.7%, $p < 0.001$), and non-diabetic patients (86.7%, $p < 0.001$). Meanwhile, despite the fact that the majority of hospitalized patients with high risk behaviors or comorbid conditions, such as smoking (75.0%, $p = 0.088$), hypertension (83.3%, $p=0.266$), or diabetes (83.3%, $p=0.242$) were unvaccinated, the differences between the vaccinated and unvaccinated admissions did not reach statistical significance. These findings highlight that while vaccination reduces the overall risk of hospitalization, comorbidities still play a significant role in determining outcomes. Aligning with these findings, the study conducted by Garduño-Orbe B et al[19] found that among unvaccinated patients, smoking, obesity, and hypertension (OR = 4.75, OR = 3.85, and OR = 2.94 respectively) increased the likelihood of hospitalization, while among those who had received vaccination, diabetes mellitus and hypertension (OR = 3.62 and OR = 2.88 respectively) were key predictors of hospitalization, suggesting that while vaccination reduces the overall risk of hospitalization, comorbidities still play a significant role in determining outcomes.

Additionally in this study, unvaccinated patients experiencing their first documented COVID-19 episode (88.9%) were significantly more likely to be hospitalized compared to vaccinated individuals (11.1%), $p = 0.008$. However, difference between the vaccinated and unvaccinated hospitalized patients among those with a history of 1–3 months of COVID-19 episode ($p = 0.091$) or greater than 3 months ($p = 0.051$) prior to hospitalization was statistically not significant. This finding is consistent with studies conducted by Porru S et al[26] found that symptomatic SARS-CoV-2 breakthrough infections among healthcare workers rose from 70.5% when measured less than 64 days post-booster to 86.2% when more

than 130 days have elapsed. The shorter interval between the episodes in our study may have conferred some protection, but the small sample size limited the ability to detect statistically significant differences.

Conclusion

In current study we compared the frequency of admission of corona virus infected patients with or without history of vaccination against corona virus disease. We found that total of 60 patients, 14.3% (n=3) had admission for COVID in patients with COVID vaccination and 85.7% (n=18) had admission for COVID in patients without vaccination. (p=<0.001). We concluded that hospital admission was significantly less among patients with history of COVID-19 vaccination.

Ethical Approval: The Institutional Ethical Review Board, Quaid-e-Azam Medical College, Bahawalpur granted ethical approval for the study (No. 736/ DME/ QAMC Bahawalpur).

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Authors' Contribution:

AM: Conception and design, acquisition of data, drafting of article, analysis and interpretation of data, final approval of the version to be published

SN: Drafting of article, analysis and interpretation of data
MZ: Acquisition of data, drafting of article

RS: Analysis and interpretation of data, critical revisions for important intellectual content

KN: Drafting of article, analysis and interpretation of data

AR: Drafting of article, analysis and interpretation of data

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