



DOI 10.51231/2667-9507-2023-002-02-33-39

Protective role of sars-cov-2 vaccine against severe disease and mortality in hospitalized patients with COVID-19

G. Khachiashvili¹, O. Koniashvili^{1,2}, N. Korrapati¹, G. Gorgadze¹, L. Gabunia^{3,4}, K. Ghambashidze⁵, L. Ratiani^{6,7}, M. Pkhxaladze⁸

¹*Tbilisi State Medical University, Tbilisi, Georgia*

²*Acad. Nikoloz Kipshidze Central University Clinic, Tbilisi State Medical University, Tbilisi, Georgia*

³*Scientific Research-skills Center, Tbilisi State Medical University, Tbilisi, Georgia*

⁴*Department of Pharmacology, Tbilisi State Medical University, Tbilisi, Georgia*

⁵*Department of Pathophysiology, Tbilisi State Medical University, Tbilisi, Georgia*

⁶*The First University Clinic, Tbilisi State Medical University, Tbilisi, Georgia*

⁷*Department of Anesthesiology and Intensive Care, Tbilisi State Medical University, Tbilisi, Georgia*

⁸*Department of Therapeutic Dentistry for Children and Adolescents, Tbilisi State Medical University, Tbilisi, Georgia*

Abstract

Vaccination is the major source of specific prevention of COVID-19. It is important to assess its efficacy in terms of protecting infected patients from complicated disease and death. We aimed to study the protective role of the vaccine in hospitalized patients diagnosed with COVID-19 to assess its efficacy in decreasing the need of prolonged stationed care, impact on the disease severity and mortality. We conducted a retrospective randomized cross-sectional study on the patients of the First University Clinic of Tbilisi State Medical University.

Only 17.5% of randomly chosen 325 hospitalized patients were found to be vaccinated. About half of this vaccinated patients had not received second dose. The duration of hospitalization period was 1.2 times longer in fully vaccinated patients compared to unvaccinated ones. Mortality rate was 3.73 % in unvaccinated patients, while the same value equals 0 in the patients that received at list one dose of any vaccine. Unvaccinated patients are at relatively higher risk for getting severe infection and being hospitalized. During the hospitalization period positive history of vaccination was associated with decreased prevalence of various complications, the need of intensive care and mortality.

KEYWORDS: vaccine; mortality; COVID-19

Introduction

SARS-CoV2 Infection took lives of numerous people all around the world. Since vaccination is major source of specific prevention of this infection, it is important to assess its efficacy in terms of protecting patients from tremendous complications of this disease [1]. There are many uncertainties about the benefits of this vaccine amongst the people, sometimes including health care professionals. Even though vaccinated patients often have asymptomatic or very mild form of the disease, some cases may get complicated and require hospitalization. The history of vaccination is important even in those patients who require stationed or intensive care, since the vaccine can protect the patients from more severe complications and death. We aimed to study the protective role of the vaccine in hospitalized patients diagnosed with COVID-19 to assess its efficacy in decreasing the need of prolonged stationed care, impact on the disease severity and mortality.

Materials and Methods

We conducted a retrospective randomized cross-sectional study on the patients of the First University Clinic of Tbilisi State Medical University. From overall 4868 patients that have been hospitalized in the mentioned clinic during the year 2021 with the diagnoses of COVID-19, 325 patients have been chosen randomly. All of the patients



had confirmed SARS-CoV-2 infection based on Polymerized Chain Reaction test. The vaccination history of these patients has been studied in detail, as well as demographic data, the duration of hospitalization period, need of intensive care and mortality. All the statistical data have been calculated using IBM SPSS Statistics 26 software. Permission on using patient data has been gained from the director of the clinic and ethics committee.

Results

From randomly chosen 325 patients 82.46 % (n=268) had never been vaccinated against SARS-CoV2 at the moment of COVID-19 diagnoses. 8.3% (n=27) have been vaccinated once, 9.2 % (n=30) vaccinated twice. From those who got infected after the first dose of vaccine 6 have been vaccinated with The Pfizer BioNTech (BNT162b2) COVID-19 vaccine, 12 – The Sinopharm COVID-19 vaccine, 8-The Oxford/AstraZeneca (ChAdOx1-S [recombinant] vaccine) COVID-19 vaccine, 2-The Sinovac-CoronaVac COVID-19 vaccine.

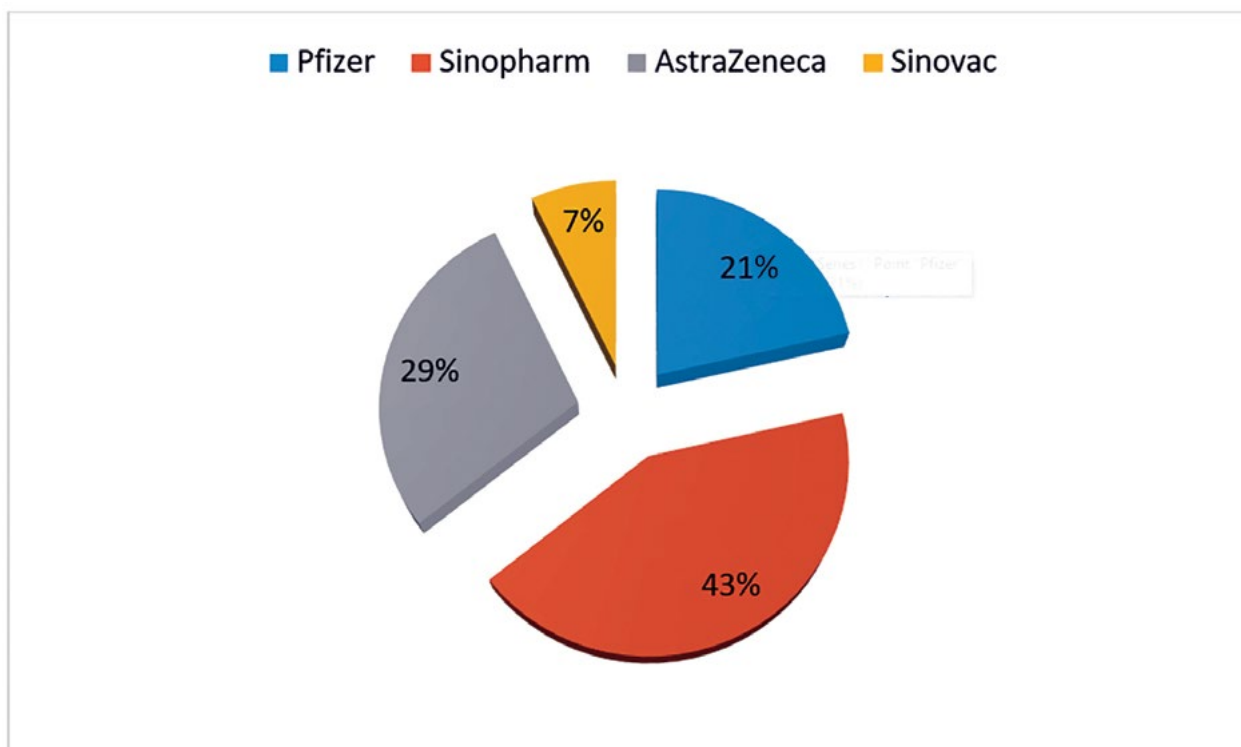


Fig. 1. Vaccine distribution. Single dose of SARS-CoV2 Vaccine



Among fully vaccinated patients 12 have received two doses of Sinopharm, 13 – Pfizer, 3 – AstraZeneca, 1-Sinovac. Figure 2.

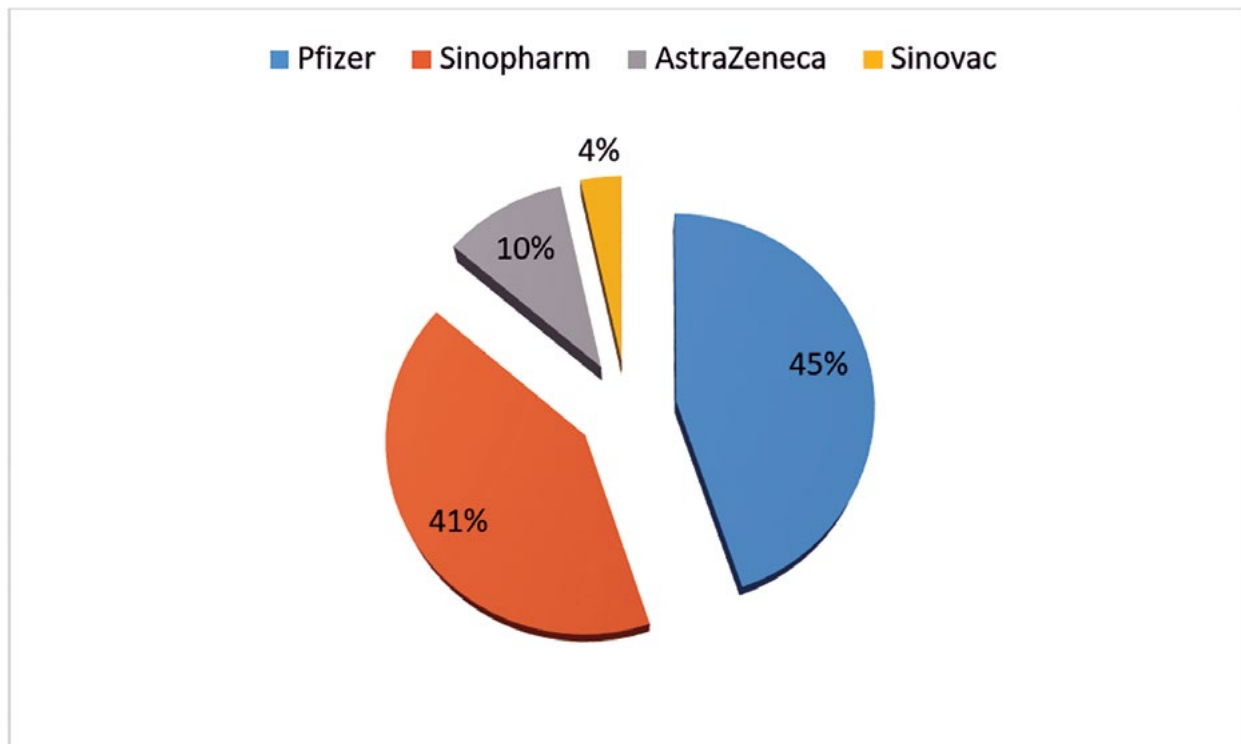


Fig. 2 Vaccine distribution. 2 doses of SARS-CoV2 Vaccine

In the group of fully vaccinated patients, age ranged from 25 to 89. Mean age was 50.5 with Standard Deviation +/- 16.47. 46,7 % of the patients (n=14) were female, 53,3 % (n=16) Male. Hospitalization period varied between 1-13 days, mean value equals 7.9 days. None of the patients required Intensive care, none of the cases had lethal outcome (mortality rate=0).

We calculated same values for the patients that had received only one dose before having been diagnosed with COVID-19. Age range was 20-83 years, mean 54.8, Standard Deviation 18.27. 37% (n=10) were male, 63% (n=17) female. Mean duration of hospitalization period – 9.5 days, Standard deviation 7,47. 4 patients required intensive care, but none of the patients died (mortality rate=0).

The biggest group of hospitalized patients was composed from those, who had not received any dose of the vaccine prior to getting infected with SARS-CoV-2. Age range: 21-89, mean age 45.97, Standard Deviation 1 – 8.33. 89 Patients were male (33.2%), 179 – female (66,7 %). Mean value of hospitalization period 9.7 days, Standard deviation – 8,17. 14 patients required intensive care, 10 Patients died. See the table 1.

**Table 1.** Characteristics of hospitalized patients

	NOT VACCINATED	VACCINATED WITH SINGLE DOSE	FULLY VACCINATED
Mean Duration of Hospitalization period	9.7 days	9.5 days	7.9 days
Need of ICU	5.22%	0.14%	0%
Mortality	3.73%	0%	0%

We retrospectively observed the periods between the last shot of the vaccine and confirmation of the SARS-CoV-2 infection and assessed presumable timeframe, when patients could get infected with the virus. 80% of the patients got infected and developed COVID-19 more than 4 weeks after receiving the second bolus: time interval ranged between 1-5 months. Remaining patients got infected earlier after the 2nd dose. See the table 2.

Table 2. Timeframe of infected with the virus in vaccinated patients

TIMEFRAME BETWEEN 2ND DOSE AND SARS-COV2 INFECTION	NUMBER OF CASES	PERCENTAGE
0-1 week	2	6.67%
1-2 weeks	0	0.00%
2-3 weeks	1	3.33%
3-4 weeks	3	10.00%
> 4 weeks	24	88.89%
Total	30	100%

Most cases of confirmed SARS-CoV-2 infection after the single dose also occurred after more than 4 weeks, but the pattern of timeframe distribution was somewhat different. See the table 3.

Table 3. Timeframe of infected with the virus in vaccinated patients

TIMEFRAME BETWEEN 1ST DOSE AND SARS-COV2 INFECTION	NUMBER OF CASES	PERCENTAGE
0-1 week	5	18.51%
1-2 weeks	4	14.81%
2-3 weeks	3	11.11%
3-4 weeks	2	7.40%
> 4 weeks	13	48.10%
Total	27	100%

Discussion

The aim of the study was to demonstrate the protective role of the vaccine in hospitalized patients diagnosed with COVID-19. The fact that from randomly chosen 325 hospitalized patients only 57 patients were found to be vaccinated at least once and only 30 patients were vaccinated twice, already emphasizes the possible role of vaccination in decreasing the need of hospitalization. Even in patients that need hospitalization, vaccine can have significant impact on clinical course and outcome of the disease. The duration of hospitalization period was 1.2 times longer in fully vaccinated patients compared to unvaccinated ones. But most importantly vaccine showed absolute efficacy against the mortality risk in the patients we reviewed: mortality rate was 3.73% in unvaccinated patients, while the same value equals 0 in the patients that received at list one dose of any vaccine. Sinopharm (n=24) was the common vaccination brand patients have reported to be vaccinated from followed by pfizer (n=19).

To avoid potential bias, we reviewed important demographic factors as well. The two groups of patients were not significantly different from each other. Furthermore, the mean age of unvaccinated patients was 8.83 years less than those who received single dose and 4.6 years less than fully vaccinated ones. Despite this fact the frequency of severe disease, complicated with septicemia, respiratory insufficiency, the need of intensive care and mechanical ventilation was notably higher in unvaccinated patients. 77.8 % of the patients that were admitted to Intensive Care Unit had never been vaccinated, and all of the remaining patients had received only single dose.

Other studies done on hospitalized patients around the world found similar results as well. Vaccination against COVID-19 reduced the severity of the disease, decreased hospitalization rate and death [2]. All four COVID-19 vaccines had durable effectiveness in reducing the risks of hospitalization and death [3]. There is reduced risk of severe infection in patients who were fully vaccinated and had a booster.

Admission to intensive care units (ICUs), intubation for mechanical ventilation, and death were more likely to occur among unvaccinated persons than among fully vaccinated persons without or with a booster [4], our study also found that mortality was zero in admitted patients who were vaccinated with a single dose and those fully vaccinated. Although admission to intensive care was still evident in those vaccinated with one dose, irrespective of vaccine brand, vaccination with at least 2 doses prevents severe infection and intensive care admission.

It is interesting that most of the patients got infected with the SARS-CoV2 in a timeframe between 1-5 months following the first/second dose vaccination, but cases of confirmed infection were also common after short period of the single dose, possibly implying at insufficient time for full immunity.



Conclusion

From our study it is evident that unvaccinated patients are at relatively higher risk for getting severe infection and being hospitalized. During the hospitalization period positive history of vaccination was associated with decreased prevalence of various complications, the need of intensive care and mortality. Getting a booster shot might further decrease the risk of infection in vaccinated patients and also reduce the hospitalization rate among patients who are vaccinated [5].

Acknowledgements

Society of Rheology, 405133029; Popularization of Rheology Science Program (PRSP).

References:

1. Marfe G, Perna S, Shukla AK. Effectiveness of COVID-19 vaccines and their challenges (Review). *Exp Ther Med.* 2021;22(6):1407. doi: 10.3892/etm.2021.10843.
2. Chemaitelly H, Houssein HA, AlMukdad S, et al. Duration of mRNA vaccine protection against SARS-CoV-2 Omicron BA.1 and BA.2 subvariants in Qatar. *medRxiv 2022.03.13.22272308*; doi: <https://doi.org/10.1101/2022.03.13.22272308>.
3. Lin DY, Gu Y, Wheeler B, et al. Effectiveness of COVID-19 vaccines over a 9-Month period in North Carolina. *N Engl J Med.* 2022;10;386(10):933-941. doi: 10.1056/NEJMoa2117128.
4. Danza P, Koo TH, Haddix M, et al. SARS-CoV-2 Infection and Hospitalization Among Adults Aged ≥ 18 Years, by Vaccination Status, Before and During SARS-CoV-2 B.1.1.529 (Omicron) Variant Predominance – Los Angeles County, California. November 7, 2021-January 8, 2022. *MMWR Morb Mortal Wkly Rep.* 2022;71(5):177-181. doi: 10.15585/mmwr.mm7105e1.
5. Nordström P, Ballin M, Nordström A. Risk of infection, hospitalization, and death up to 9 months after a second dose of COVID-19 vaccine: a retrospective, total population cohort study in Sweden. *Lancet.* 2022;399:10327, 814-823. doi: 10.1016/S0140-6736(22)00089-7.

