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Cardiovascular Manifestations Of Covid-19 In Unvaccinated And Vaccinate Patients Seen In Cardiology Outpatient Clinics

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Abstract

Introduction: Coronavirus disease-19 (COVID-19) is the cause of multi-system damage with the cardiovascular system at the center, constituting a fairly substantial morbidity and mortality factor. After the arrival of vaccination, the morbidity and mortality linked to Covid-19 fell considerably. Our aim is to determine the clinical and paraclinical manifestations associated with infection in unvaccinated and COVID-19-vaccinated patients seen in private cardiology consultations.

Methods: We carried out a retrospective analytical case-control study, from January 2021 to June 2022. All unvaccinated patients infected with COVID-19 were included in the case group and the vaccinated in the control group. Samples were matched by age and gender with one case for one control. Univariate and multivariate analyzes were then performed.

Results: 80 cases and 80 controls were selected. The majority of our patients were male in both groups, with an average age around 50 years old. The majority of risk factors and clinical and paraclinical manifestations predominated in unvaccinated infected subjects, despite the absence of significant difference. Some clinical parameters such as chest pain (adjusted p =0.004), fever (adjusted p =0.022) and signs of viral infection like flu and cough (adjusted p =0.003), as well as biological (inflammatory syndrome p adjusted = 0.015), cardiac ultrasound finding heart disease (p adjusted = <0.000), and other complications such as pneumopathy more than 10% on chest CT (p adjusted = 0.0184) were positively associated with non-vaccination after multivariate analyzes.

Conclusion: The majority of risk factors, clinical and paraclinical manifestations as well as complications predominated in unvaccinated infected subjects. Promotion of vaccination and booster doses is necessary for better protection against COVID-19 infection and its complications.

Keywords – Cardiovascular; COVID-19; Madagascar; Vaccine.

I. Introduction

Coronavirus disease-19 (COVID-19) is a viral disease caused by coronavirus or (SARS-CoV- 2) that can cause acute respiratory distress syndrome and multi-systemic disease [1][2] These complications, combined with cardiovascular risk factors, played their part in the morbidity and mortality associated with COVID-19 [2]. A lower mortality rate was found in correctly vaccinated individuals with a booster dose [3]. On the other hand, high mortality was found in unvaccinated people. A low rate of post-vaccination infection was also recorded during the same period [4]

Our aim is to determine the clinical and paraclinical manifestations associated with infection in unvaccinated and COVID-19-vaccinated patients seen in private cardiology consultations.

II. Methodology

It was a cross-sectional, retrospective, descriptive and analytical case-control study. The study was conducted over an 18-month period, from January 2021 to June 2022. The study was carried out in an outpatient cardiology clinic in Antananarivo Madagascar. We included in a patient over 18 years of age, seen in consultation, whether or not vaccinated against

COVID-19 and infected with COVID-19 who presented with typical signs of COVID-19, positive biological tests (antigenic TDR or PCR or GeneXpert or serology) chest CT scan showing signs of COVID-19 infection (ground-glass image, crazy paving).

According to their vaccination status, patients were classified into two groups. The case group is made up of "unvaccinated" infected individuals. The control group is made up of individuals vaccinated against COVID-19, infected more than 14 days after the 2nd dose for 2-dose primary vaccines, or infected after 14 days of the 01-dose primary vaccine. The parameters studied were sociodemographic parameters, cardiovascular risk factors, comorbidities, vaccination, signs, biological parameters, electrocardiogram and Cardiac Doppler ultrasound data. STATA 13 software was used to process and analyze the data. The Pearson or Fischer Chi-square test was used to assess associations between vaccination status and the various parameters. The significance threshold was $p < 0.05$.

III. Results

After matching our data, our two groups were predominantly male, with a sex ratio of 1.10 in the vaccinated group and 1.28 in the unvaccinated group.

The mean age of COVID-19 patients was 52.1 years and 51.15 years in vaccinated and unvaccinated respectively after matching. The patients ranged from 19 to 82 years of age.

A high concentration of COVID-19 infection was noted in our samples aged over 40.

Tableau I: Distribution of patients by vaccination

Type of vaccination	N (%)
Jansen	35 (43,75)
Astra Zeneca	25 (31,25)
Covishield	15 (18,25)
Pfizer	10 (12,50)
Others	1 (1,25)
With Booster doses	7(8,75)
Without Boooster doses	73 (91,25)

Tableau II: Patient results by vaccination modality

Vaccine type	N (%)
Heterologous vaccine	33 (71,74)
Monologue vaccine	13 (28,26)

Among polyvaccinated individuals, 71.75% had received doses of the same vaccine.

Janssen vaccine (43.75%) was the most widely used type of vaccine

Tableau III : Parameters associated with vaccination status after multivariate analyzes

	unvaccinated N = 80 n(%)	Vaccinated N = 80 n (%)	OR ajusted	95 % IC	p adjusted
Clinical sign					
Chest pain	40 (50,00)	29 (36,25)	3.07	1.48- 6.56	0.004
Fever	21 (26,25)	3 (3,75)	5.29	1.27-21.98	0.022
Flu syndrome/cough	40 (50,00)	16 (20,00)	5.59	1.77-17.61	0.003
Biological					
Inflammatory syndrome	49 (61,25)	13 (17,81)	4.35	1.33-14.24	0.015
C-Reactive Protein	49 (61,25)	13 (17,81)	4.35	1,33-14.24	0.015
Electrocardiogram					
Segment ST flat / rigid	45 (56,25)	33 (41,25)	2.14	1.09-4.18	0.026
Cardiac Ultrasound					
Underlying heart disease	60 (75,00)	23 (28,75)	6,66	3,13- 14,17	<0,000
Complications					
Pneumonitis ≥ 10 % au CT scanner	14 (77,78)	4 (22,22)	4,02	1,26-12,83	0,0184

After multivariate analyses, non-vaccination exposes, in the event of COVID-19 infection, to a 5 times greater risk of developing a fever (adjusted p = 0.022) and to 5 times more likely to develop flu-like illness or cough (adjusted p = 0.003); 3.07 times more likely to develop chest pain (Adjusted p = 0.004); 4.35 times more likely to have a biological inflammatory syndrome and elevated CRP (adjusted p = 0.015); 2.14 times more likely to manifest a rigid/flat ST type repolarization disorder (adjusted p = 0.026) on the ECG and 4 times more likely to develop parenchymal damage ≥ 10% (adjusted p = 0.0184). The existence of a heart disease underlying the associated ETT non-vaccination would increase the risk of COVID-19 infection by 6 times (adjusted p<0.0001)

IV. Discussion

The rate of vaccination against COVID-19 has been low in Madagascar. The majority of cardiovascular risk factors and clinical and paraclinical cardiovascular manifestations predominate in unvaccinated infected subjects, but are statistically insignificant in most cases. Clinical parameters such as fever, clinical signs of virosis such as flu-like syndrome, non-specific chest pain), biological (inflammatory syndrome), ECG (ST flat repolarization disorder), ETT (underlying heart disease), other complications (COVID-19 pneumopathy ≥ 10% on CT scan), were positively associated with non-vaccination after multivariate analysis.

Our sample was predominantly male. Several other local and international studies have also demonstrated this male predominance in COVID-19 infection, irrespective of the patient's vaccination status. Male predominance is correlated with several factors, such as higher expression of ACE 2 in men than in women, which facilitates COVID-19 infection in men. The mean age of the subjects in our study was around 50 years (52.1 years in unvaccinated subjects and 51.12 years in vaccinated subjects), and this age difference between the 02 groups was also observed. Local and international studies of unvaccinated patients had found mean ages close to ours, such as those by Andriamahenina and Rakotoson and al in Madagascar, as well as that published by Christopher Petrilli et al. in the USA, who reported mean ages of 52, 50.3 and 54 respectively [5][6][7].

In our study, in the 02 groups, hypertension was the main cardiovascular risk factor found. As in our study, the Fatima study in Pakistan found that hypertension was the main risk factor in COVID-19 vaccinated (96 patients) and unvaccinated (104 patients) subjects, and the existence of pre-existing ischemic heart disease was the most common antecedent in this study (27 vaccinated and 32 unvaccinated patients p=0.398) [8]. Joseph Ebinger in the USA reported that hypertension and the existence of known heart disease increased the risk of complicated COVID-19 infection, irrespective of the patient's vaccination status [9]. High blood pressure correlated with a drop in antibody titer could be at the root of this increased risk of infection, even if the subject has been vaccinated [10]. In our study, 87.5% of patients had not had a booster dose, and the most commonly used vaccine was Janssen (43.8%). This high rate of incomplete vaccination is consistent with the low vaccination rate in Madagascar, which was 4.7% in July 2022, with only 4.4% of patients having completed their primary vaccination [11]. After adjusting our results, we also observed a significant predominance of virosis symptoms such as fever (OR= 5.29 [1.27-21.98] p adjusted= 0.022) as well as influenza-like illness and cough in unvaccinated patients (OR a = 5.59 [1.77-17.61] p adjusted= 0.003). A reduction in the incidence of these symptoms was observed in vaccinated subjects, due to a lower inflammatory response, lower viral loads and antigenemia levels induced by the presence of post-vaccination Ac [12]. After logistic regression, unvaccinated subjects were 2.14 times more likely to develop a rigid/flat ST repolarization disorder (adjusted p = 0.026) than vaccinated subjects. Concerning the predominant r-wave planing in our study, a publication by B. Long et al had noted the presence of this anomaly in COVID-19-infected subjects without specifying its prevalence or the patient's vaccination status [13]. This finding was echoed by Rosén et al, in their cohort study with 6% R-wave planing in patients infected with COVID-19 [14]. In a meta-analysis published by Navya Voleti et al, the risk of myocarditis was 7 times higher in unvaccinated individuals infected with SARS-CoV-2 than in those who had received the vaccine [15]. After multivariate analysis, the existence of underlying cardiac disease detected on cardiac ultrasound, combined with non-vaccination, increased the risk of COVID-19 infection by a factor of 6 (OR a = 6.66 (3.13- 14.17) p <0.0001). According to the literature, the existence of associated heart disease (hypertensive and ischemic) would increase the risk of complicated COVID-19 infection independently of the person's vaccination status [16]. The high prevalence of cardiac echography abnormalities in COVID-19 found in our study could be explained either by direct myocardial damage by the virus, or by an indirect mechanism via inflammation responsible for microvascular damage. Nevertheless, the absence of echocardiography prior to infection means that we cannot confirm a direct link between infection and the abnormalities found. COVID-19 pneumopathy ≥ 10% on CT was significantly predominant in our unvaccinated subjects, with a 4-fold greater risk of developing it in cases of infection associated with non-vaccination (adjusted p = 0.0184).

Several studies comparing lung lesions in vaccinated and non-vaccinated subjects have reported fewer CT lung lesions in vaccinated subjects and more severe lesions in non-vaccinated subjects, such as that by Miao Lai et al in China in 2023, that by Jyoti Bajpai et al in India in 2022 [17][18].

V. Conclusion

A reduction in hospitalization, symptoms, complications and morbidity and mortality linked to COVID-19 were observed after the arrival of vaccination. Our study is the first in Madagascar concerning the cardiovascular manifestations of COVID-19 in unvaccinated and vaccinated patients seen in cardiological outpatient clinics. A male predominance was found with an average age around 50 years. The majority of risk factors, clinical and paraclinical manifestations predominated in unvaccinated infected subjects. We found clinical signs like fever, flu syndrome, chest pain. The biological parameters found inflammatory syndrome. The electrocardiogram found flat ST type repolarization disorder, and finally ultrasound found underlying heart disease. COVID pneumonia -19 ≥ 10% on TDM, were positively associated with non-vaccination after multivariate analysis. However, our study has limitations requiring larger-scale studies to strengthen the results. The management of COVID-19 should be multidisciplinary and the promotion of vaccination and booster vaccinations should be strengthened in order to limit its complications.

References

[1]. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020; 382 (8):727–33.

[2]. White-Dzuro G, Gibson LE, Zazzeron L, White-Dzuro C, Sullivan Z, Diiorio DA, et al. Multisystem effects of COVID-19: a concise review for practitioners. Postgrad Med. 2021 Jan;133(1): 20-7.

[3]. Mathieu E, Ritchie H, Rodés-Guirao L, Appel C, Giattino C, Hasell J et al. United States: COVID-19 weekly death rate by vaccination status, All ages. 2021; 5 :947–53

[4]. Ho JS, Sia CH, Ngiam JN, Loh PH, Chew NW, Kong WK, et al. A review of COVID-19 vaccination and the reported cardiac manifestations. Singapore Med J. 2021; 19.

[5]. Rakotoson JL, Rafitoharson N.L.E, Andriamahenina FPP, Nandimbiniaina AM, Razafindrasoa Z.A, Andriarimanga, D.O et al. Les corrélations entre la dyspnée, la désaturation et l'étendue initiale des lésions pulmonaires des infections à SARS-CoV-2 vues au service de pneumologie du CHU-JRB Antananarivo Madagascar. Rev Malad Respir Actual. 2022;14(1):119.

[6]. Andriamahenina FPP, Tiaray Harison M, Rakotondrabe ID, Rafitoharson NLE, Razafindrasoa AZ, Andriarimanga DO et al. Les infections à SARS-CoV-2 vues dans le service de pneumologie du CHU Befelatanana Antananarivo Madagascar. Rev Malad Respir Actual. 2022 ;14(1):119.

[7]. Petrilli CM, Jones SA, Yang J, Rajagopalan H, O'Donnell L, Chernyak Y, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. BMJ. 2020; 369:m1966

[8]. Fatima S, Zafar A, Afzal H, Ejaz T, Shamim S, Saleemi S, et al. COVID-19 infection among vaccinated and unvaccinated: Does it make any difference ? PLoS One. 2022; 17(7): e0270485.

[9]. Ebinger JE, Driver M, Joung S, Tran T, Barajas D, Wu M, et al. Hypertension and Excess Risk for Severe COVID-19 Illness Despite Booster Vaccination. Hypertension. 2022. 79(10): e132-e134.

[10]. Soegiarto G, Wulandari L, Purnomosari D, Dhia Fahmita K, Ikhwan Gautama H, Tri Hadmoko S et al. Hypertension is associated with antibody response and breakthrough infection in health care workers following vaccination with inactivated SARS-CoV-2. Vaccine .

[11]. Edouard M, Hannah R, Rodés-Guirao L, Appel C, Giattino C, Hasell J et al. Share of people who completed the initial COVID-19 vaccination Protocol Madagascar.

[12]. manatidou E, Gkiouliava A, Pella E, Serafidi M, Tsilingiris D, Vallianou NG, et al. Breakthrough infections after COVID-19 vaccination: Insights, perspectives and challenges. Metabol Open. 2022; 14:100180.

[13]. Long B, Brady WJ, Bridwell RE, Ramzy M, Montrief T, Singh M et al. Electrocardiographic manifestations of COVID-19. Am J Emerg Med. 2021; 41: 96 –103.

[14]. Xu CC, He ZS, Lei W, Zhu JZ, Zhao DG, Kong JD, Wei Y, Xu Y, Huang JA. Anti-SARS-CoV-2 spike immunoglobulin G and immunoglobulin M titers decrease as the interval between the second dose of inactivated vaccine and disease onset is prolonged in infected pat. Clin Respir J. 2023 ;17(4):270-76

[15]. Voleti N, Reddy SP, Ssentongo P. Myocarditis in SARS-CoV-2 infection vs. COVID-19 vaccination: A systematic review and meta-analysis. Front Cardiovasc Med. 2022, 29;9:951314.

[16]. Lai M, Wang K, Ding C, Lin X, Xu C, Hu et al. Impact of inactivated COVID-19 vaccines on lung injury in B.1.617.2 (Delta) variant-infected patients. Ann Clin Microbiol Antimicrob. 2023; 22:22

[17]. Bajpai J, Kant S, Verma A, Patwa AK, Atam V, Chaudhary SC, et al. The Severity of COVID 19 Pneumonia in Vaccinated vs. Non-vaccinated Patients in the Second Wave: An Experience From a Tertiary Care Center in India. Cureus. 2022 ; 26; 14(5):e25378.

[18]. Ebinger JE, Driver M, Joung S, Tran T, Barajas D, Wu M, et al. Hypertension and Excess Risk for Severe COVID-19 Illness Despite Booster Vaccination. Hypertension. 2022; 79(10):e132-e134.