Determination of Platelets Parameters among Peoples Vaccinated with Oxford-AstraZeneca COVID-19 vaccines at Khartoum State -Sudan

Abstract:

Background: The global SARS-CoV-2 vaccination program has been hampered by the rare-and initially inexplicable emergence of vaccine-associated thrombosis, particularly venous territory strokes or other venous obstructions, including portal vein thrombosis, which has been dubbed Vaccine-Induced Thrombotic Thrombocytopenia (VITT). So, this Study was Conducted to determine platelets parameters among people vaccinated with the AstraZeneca vaccine at Khartoum state.

Materials & Methods: 50 AstraZeneca vaccinated participants were utilized as a case and 50 healthy non-vaccinated participants were used as control. The age of both groups ranged between (20-62) years with a mean of 34.6 ± 11.9. Platelets parameters were assayed for all patients using Sysmex KX-21.

Results: The statistical analysis was performed by using SPSS. The results of the study showed that there was no significant difference in platelets count and platelets indices when compared according to vaccine intake and gender. Also, the most frequent symptoms among vaccinated people were: Muscle pain at the site of puncture (56%), fatigue (54%), fever (34%), headache (22%), nausea (16%), and diarrhea (6%) respectively and develop no symptoms (30%).

Conclusions: The study concludes that the side effects of the COVID-19 AstraZeneca vaccine in Khartoum state, Sudan was consistent with the manufacturers' data. Healthcare providers and recipients of vaccines can be more confident about the safety of Oxford-AstraZeneca COVID-19 vaccines.

Keywords: AstraZeneca vaccine, COVID, platelets parameters, Khartoum state

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a novel member of enveloped RNA β-coronavirus (1), which is the cause of severe pneumonia with clinical symptoms different from known coronavirus caused pneumonia, such as SARS-CoV and MERS-CoV (2, 3).

The coronavirus disease 2019 (COVID-19) was first recognized in Wuhan, China, in December 2019. It rapidly spread across mainland China and became a global threat.

As of July 25, 2021, the causative pathogen, namely severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has infected 3,672,238 people and caused 4.16 M deaths globally. A striking aspect of COVID-19 is that the disease became a pandemic in less than 3 months (4,5).

Platelets are anucleate cell that continues to defy conventional logic; they are involved in mRNA translation and known to synthesize proteins for over fifty years. Various parameters reflect the condition of platelets, including platelets count and platelet indices (PI) which include: mean platelet volume (MPV), platelet distribution width (PDW), and platelet large cell ratio (PLCR). MPV reflects the average size of platelets. It is a marker that indicates subclinical platelet activation and maybe increase in some vascular conditions such as myocardial infarction (MI), coronary artery disease (CAD), cerebral ischemia, and PAD. Other platelet markers such as PDW, PLCR, and plateletcrit (PCT), which reflect platelet morphology, are also important in vascular events such as atherosclerosis and thrombosis. PDW indicates the distribution of platelet size. PLCR indicates the ratio of the younger platelet group that has the largest volume, and PCT gives the total mass of platelets (6).

Vaccination is considered the most promising approach for ending or containing the coronavirus disease 2019 (COVID-19) pandemic. In late February of 2021, a prothrombotic syndrome was observed in a small number of individuals who received the ChAdOx1 CoV-19 vaccine (AstraZeneca, University of Oxford, and Serum Institute of India), an adenoviral vector-based vaccine. Subsequently, similar findings were observed in a small number of individuals who received the Ad26.COV2. S vaccine (Janssen; Johnson & Johnson), also based on an adenoviral vector. This syndrome has been designated vaccine-induced immune thrombotic thrombocytopenia (VITT). It has also been called thrombosis with thrombocytopenia syndrome (TTS) and vaccine-induced prothrombotic immune thrombocytopenia (VIPIT) (7). However, such Studies in Sudan are lacking, hence the present study was conducted to determine platelets counts and parameters in Vaccinated Sudanese Subjects.

Materials & Methods:

Study design and population:

A descriptive cross-sectional study was conducted in Khartoum State during a period from July to October 2021. The study includes 50 subjects vaccinated with

AstraZeneca as the Case group and the other 50 non-vaccinated subjects as a control group. Inclusion criteria include an adult who was vaccinated with AstraZeneca vaccine of both male and female. The exclusion criteria include Subjects who were vaccinated with AstraZeneca more than a month or received other COVID-19 Vaccines, in Addition to pregnant women, patients treated with antimicrobial drugs or anti-inflammatory agents, diabetic Mellitus, smoker, and hypertensive patients.

Sample collection

Venous blood samples were collected from each healthy people vaccinated with AstraZeneca after their signed informed consent. The suitable vein was located then the skin was cleaned by a 70%ethanol sterile syringe 3ml was used to collect blood then the blood was dispensed in a sterile EDTA blood container. Blood samples were analyzed by Sysmex KX-21.

Ethical consideration

The study received ethical clearance from the research board at the faculty of medical laboratories sciences; Alzaeim AlAzhari University .sample was taken from a participant after signing informed consent for participation, the participant was enrolled as a volunteer.

Statistical analysis

Data were computed and analyzed by using a statistical package for the social sciences SPSS version 26. The Student T-test was used to examine the difference between numerical variables and Categorical variables were expressed as a percentage. A p-value was set at less than 0.05 to be statistically significant.

Results

Demographic Data

In the present study, a total of 50 AstraZeneca vaccinated Subjects in their age range between (20-62) years with a mean of 34.6 ±11.9 were enrolled. Among them, 52% (26) were males, while 48% (24) were females. In addition, 50 healthy individuals were selected as the control group, 56% (28) were males, while 44% (22) were female. Table 1 displayed a comparison of platelets indices between vaccinated and non-vaccinated participants, where there was no significant difference in platelets count and platelets indices between vaccinated and no vaccinated subjects. The mean of **P-LCR% among non-vaccinated was** 25.9±7.1, Vs 24.8±5.9 among the vaccinated group. thrombocytes level among vaccinated and non-vaccinated participants.

Additionally, **(Plt)x109\L** count was 251.52±104.7, and 256.06±78.4 among non-vaccinated and vaccinated groups respectively.

Table 2 illustrated platelets indices related to gender in vaccinated participants. Both groups showed a higher frequency of normal thrombocytes levels, where elevated platelets count was statistically non-significant among females 270.58±77.1, (P-value ≤0.2). Regarding thrombocytes level among the studied group, there were no statistically significant differences. 4 (8%) have had thrombocytopenia among the vaccinated group, while 3 (6%) among non-vaccinated.

Table 4 displayed the most frequent symptoms among vaccinated people which were: Muscle pain in the site of puncture (56%), fatigue (54%), fever (34%), headache (22%), nausea (16%), and diarrhea (6%) and (30%) develop no symptoms. Figure 1 displayed general symptoms after AstraZeneca Chad Ox1 nCov- 19 vaccinations

Table 1: Comparison of platelets indices between vaccinated and non-vaccinated participants

	Group	Mean	SD	P. value
P-LCR%	Non vaccinated participants	25.9	7.1	0.4
	AstraZeneca vaccinated participants	24.8	5.9	
Pdw (fL)	Non vaccinated participants	14.09	2.6	0.1
	AstraZeneca vaccinated participants	13.50	1.8	
MPV (fL)	Non vaccinated participants	9.25	1.25	0.2
	AstraZeneca vaccinated participants	9.5	.82	
(Plt)x109\L	Non vaccinated participants	251.52	104.7	0.8
	AstraZeneca vaccinated participants	256.06	78.4	

Table 2 Comparison of platelets indices among gender in vaccinated participants

	Gender	N	Mean	Std. Deviation	p. value
P-LCR%	Males	26	23.8	5.4	0.2

	Females	24	25.9	6.2	
Pdw (fL)	Males	26	13.26	1.6	0.3
	Females	24	13.7	1.9	
MPV (fL)	Males	26	9.3	0.7	0.09
	Females	24	9.7	0.84	
x109\L (Plt)	Males	26	242.65	78.7	0.2
	Females	24	270.58	77.1	

Table 3: Thrombocytes level among vaccinated and non-vaccinated participants

	Vaccinated participants		**Non vaccinated participants**		**P value**
	Frequency	**Percent**	**Frequency**	**Percent**	
Thrombocytopenia	4	8.0	3	6.0	0.32
Normothrombocytes	46	92.0	46	92.0	0.54
Thrombocytosis	0	0	1	2.0	0.69
Total	50	100.0	50	100.0	

Table 4 Symptoms Frequency among vaccinated participants

	Symptomatic		**Non-symptomatic**	
	Frequency	**Percent**	**Frequency**	**Percent**
Headache	11	22	39	78
Fever	17	34	33	66
Fatigue	27	54	23	46
Muscle pain in the site of puncture	28	56	22	44
Nausea	8	16	42	48
Diarrhea	3	6	47	94
No any thing	15	30	35	70

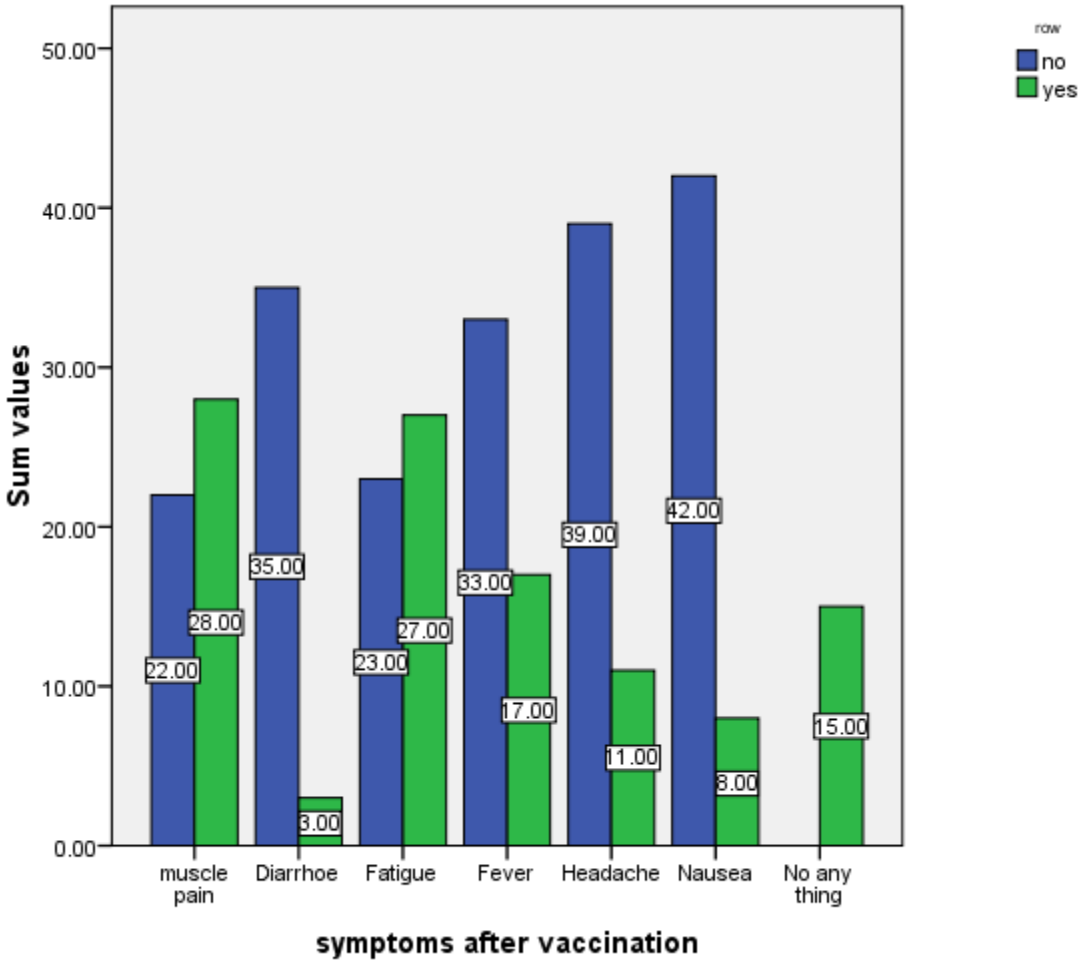

Figure 1: Symptoms after AstraZeneca Chad Ox1 nCov- 19 vaccinations

Discussion

Recently, the AstraZeneca ChadOx1 nCov- 19 vaccine has raised public alarm with concerns regarding the rare, but serious, development of thrombotic events, now known as vaccine- induced immune thrombotic thrombocytopenia (VITT), there is no published data regarding the history of such disorder in Sudan so the current study was applied to focus on this point (8). However, as with other drugs, reactions may occur following vaccination. (9) Some adverse reactions may not have been reported in pre-clinical trials due to their lower frequency, a smaller number of people participating in trials, and other similar restrictions. Thus, post-vaccination monitoring of the adverse reactions is important to inform the public and policymakers of the safety and possible severe reactions of the vaccine.

In this descriptive cross-sectional study in Khartoum a capital city of Sudan, we investigated platelets parameters and adverse effects following the administration of Oxford-AstraZeneca COVID-19 vaccines. The results of the study showed that there

was no significant difference in platelets count between vaccinated and non-vaccinated participants. This finding disagreed with the study of **L see et al** (10) who found that vaccine induce immune-thrombocytopenia between 2–5 days after the vaccination with most platelet counts under 109 109/l and with the study of Maryam et al (11) who found that incidence of VITT is perhaps 1 case per 100,000 vaccine exposures. The conflict and differences between the two studies can be attributed to different factors such as samples size, ethnicity difference, age of participants, as well as encountered comorbidities of participants.

Even if initial laboratory testing is normal, the presentation is late, or the clinical course is moderate, close follow-up, serial laboratory monitoring, and potentially specialized VITT testing are required in patients with a high clinical suspicion of the condition. Many issues remain unsolved about this recently found disease. Physicians must continue to submit instances so that we can improve our VITT diagnostic and therapy algorithms (12).

With regard to the gender of the studied groups, no significant difference was revealed in platelets indices in both groups, and no difference in platelets parameters among vaccinated males and female participants. Favaloro EJ et al (13) noted that early reports primarily identified young women, while later reports have identified a non-significant difference in platelets among both males and females of all ages. Earlier reports, particularly for the AZ vaccine, appear to have merely reported on the predominate cohort being vaccinated at the time, which was mostly (young) female healthcare professionals. As a result, there may be no gender or age restrictions when it comes to suspected VITT. In addition, the participants reported considerable systemic adverse effects, including muscle pain at the site of injection, fatigue, fever, and headache but very few reported having nausea and diarrhea. Site injection Muscle pain was observed to be the most common symptom. These findings are consistent with other recently published results (14, 15), which reported that injection site pain, fever, fatigue, headache, joint pain, and chills were more common with AstraZeneca compared to the other vaccines.

These infrequent thrombotic side effects are reminiscent of natural SARS-CoV-2 infection, itself associated with lung and systemic immunothrombosis manifesting as chest pain, pulmonary embolism, pulmonary infarction, systemic thrombosis, including Deep Venous Thrombosis (DVT), strokes, intestinal, cardiac, and renal ischemia affecting both arterial and venous territories (16,17). However, natural

SARS-CoV-2 infection is mediated by a single-stranded RNA virus, while vaccine-associated immunothrombosis is linked to DNA adenovirus-vectored vaccines.

Not every post-vaccination thrombocytopenia is "VITT." For example, following SARSCoV2 immunization with both the Pfizer and Moderna vaccines, many cases of apparent secondary immune thrombocytopenia (ITP) have been reported (18).

The extreme scarcity of VITT is most likely due to well-established processes of immune regulation to self-proteins, with tolerance being remarkably difficult to break. A further factor is the small size of DNA inoculums in applicable vaccines, which results in unsatisfactory DNA-PF4 co-engagement to break tolerance. The possibility of RNA or DNA entering the systemic circulation in sufficient quantities to cause similar immunopathology appears to be negligible at the magnitudes currently delivered by vaccine inoculums (19, 20).

Conclusion

This study concludes that: AstraZeneca COVID-19 vaccines do not affect platelets parameters. The most common post-COVID-19-vaccination side effects reported by participants who received the vaccine were injection site pain and fatigue.

Limitation of the study:

The current findings should not be generalized to the entire country; as it was only conducted in the state of Khartoum. Further research covering entire Sudan is recommended to confirm the preliminary findings of this study. Because the study does not take full responsibility for the first and second doses, information about the intensity and severity of side effects is limited. As a result, another study on post-vaccination side effects should be conducted to differentiate between side effects that appeared after the first dose, second dose, and both doses. A smaller sample size may also make it difficult to generalize the results, so large sample size is required. However, due to lower coverage and vaccine shortages, the findings of this study may provide a useful insight into the situation and may play an important role in reducing vaccine hesitancy among the general public.

Data Availability:

All datasets generated and analyzed during this study are included in the manuscript.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and

country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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