Prevalence of Acute Acalculous Cholecystitis Following COVID- 19 Vaccination Using Ultrasonography

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Abstract: Acute Acalculous Cholecystitis (AAC) characterized by acute inflammation of gallbladder (GB) in absence of stones, COVID-19 is a contagious disease caused by severe acute respiratory syndrome corona virus 2.High number of cases reported to the Vaccine Adverse Event Reporting System (VAERS) among COVID-19 vaccine recipients with diverse locations. The unspecific symptoms and laboratory examinations impede the diagnosis of AAC, including fever, pain in right upper quadrant, and increased hepatic enzyme levels. So Ultrasound (US) has been considered as a good tool in assess and prediction of AAC following COVID- 19 vaccination. A descriptive cross sectional study on 113 participants exposed to COVID- 19 vaccination, scanned with US machine, for measuring GB wall thickness and other abnormalities. A data collection sheet, including age, gender, duration of vaccine, history of chronic disease and US finding. Statistical Package for Social Science (SPSS) used to analyze the collected data.

Among 113 participants, 66-showed AAC and 67 were healthy. Patients with AAC showed a highly significant difference ($p < 0.001$) in a mean GB wall thickness compared to healthy ones. Both groups were similar in age and gender distribution, chronic diseases were more common in AAC group. Vaccine duration was comparable, though a weak positive correlation was found between vaccine duration and wall thickness ($r = 0.299$, $p = 0.015$). Concluded findings support the ability of US in diagnosing AAC following this vaccination, contribute to the existing knowledge and helps guide clinical management.

Keywords: Ultrasound - Acute Acalculous Cholecystitis (AAC) - COVID-19 – Vaccination.

Introduction: Acute Acalculous Cholecystitis is characterized by acute inflammation of the gallbladder in the absence of stones, elderly and ill patients with underlying conditions are severely affected. This pathology may be insidious, with unexplained fever, leukocytosis, hyperamylasemia, or abnormal aminotransferases, and patients often lack right upper quadrant tenderness [1, 2]. On February 27, 2021, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for the Janssen COVID-19 vaccine to prevent lung infection due to coronavirus (SARS-CoV-2) [3-5]. In United States from March 2nd to April 21, 2021 about 7.98 million doses of the Janssen COVID-19 vaccine were administrated, rare cases of Cerebral Venous Sinus Thrombosis (CVST) with thrombocytopenia and Thrombosis with Thrombocytopenia Syndrome (TTS) were reported to the Vaccine Adverse Event Reporting System (VAERS) among vaccine recipients with diverse locations [6]. We present a case of Acute Acalculous Cholecystitis following a single dose inoculation of Janssen COVID-19 vaccine observed to

a young Congolese man. In recent years, the average life expectancy has been steadily increasing in many countries [7]. For example, China has experienced a significant increase in life expectancy, with the older population growing at a rate of 5% per year. In fact, it is expected that there will be more than 74 million individuals above 80 years of age by 2040 [8]. This patient population represents a clinical challenge as older individuals are at greater risk of presenting with an episode of acute Cholecystitis (AC) due to the organ dysfunction and weakened immune system, and up to 6% of older patients experience severe AC [9]. Acute Acalculous Cholecystitis (AAC) is a gallstone-free necrotizing inflammation of the gallbladder. Approximately 5–10% of all cases of AC were AAC, which tends to be more intricate with poor prognosis compared with acute calculus Cholecystitis (ACC) [10] as the comorbidities such as hypertension, coronary heart disease and diabetes in elder with AAC may anonymize the progress the disease. However, the gallbladder necrosis rate of AAC is about 40–60%, while the gallbladder perforation rate is as high as 5–15%. AAC is associated with a high mortality (30% in most studies; range 10–90% with early or late diagnosis, respectively) [11].

COVID-19 is known to enter host cells by binding to the ACE-2 receptors, which are commonly found throughout various organs including the liver, gallbladder and in high levels in the bile duct [12]. Furthermore, it has been discovered that SARS-CoV-2 can infiltrate gallbladder wall cells, mimicking acute cholecystitis. However, what is not well understood is the pathogenesis of SARS-CoV-2 in cholecystitis and whether it can be responsible for the progression of Cholecystitis to choledocholithiasis. [13].

Objective: To study prevalence of acute Acalculous Cholecystitis Following COVID-19 vaccination.

Materials and methods: A descriptive cross sectional study deal with US findings to investigate GB inflammation following COVID-19 vaccination, conducted in Sudan- Khartoum State at Al-Ban Jaded Hospital. Data were collected from December 2022 to March 2023 and analysed between December 2025 to January 2026.The study targeted all patients attended for abdominal US examinations and they vaccinated against Corona virus within the past 9 months and consented. Pregnant women, patient have any GB pathology or risk factor, patients their COVID-19 vaccination less than 3 months and who refused to undergo the study were excluded. US machine was Mindray DP10 made in China, using a 3.5 MHz curvilinear probe, with full US department facilities. Total sample size was 133 participants, all were examined after overnight fasting to reduce intestinal gases and for adequate distension of GB; they were evaluated in supine position with the possibility of being placed in an upright, standing, or left lateral decubitus position to improve vision. A coupling gel applied to right upper quadrant of abdomen. GB measurements (cm) taken with the probe placed in the right hypochondrium, in midclavicular line and the angular head in the longitudinal and transverse planes. Maximum longitudinal and transverse measurements taken, gallbladder wall thickness (GBWT) were taken in the longitudinal plane upon arrested breathing. Data collected using a special data collection sheet including age, gender, duration of vaccination, history of chronic diseases and US findings. Data analysed using the Statistical Package for Social Sciences (SPSS) version 26. The statistical tests used included: Frequencies, Descriptive Statistics, One-Sample t-Test, Pearson Correlation, Scatter Plot analysis and Independent-Samples t-Test. permissions taken verbally from patients before examinations, they were informed about consented to the study, also they assured that their details would not be revealed. Before that, verbal permission also taken from heads of hospital and health centre where the study conducted.

Results:

Table (1) show age frequency distribution for AAC group:

Age group	Frequency	Percent

23-32/years	12	18.2
33-42/years	21	31.8
43-52/years	21	31.8
53-62/years	12	18.2
Total	66	100.0

Table (2) show age frequency distribution for Healthy group:

Age group	Frequency	Percent
28-36/years	20	29.9
37-45/years	21	31.3
46-54/years	11	16.4
55-63/years	15	22.4
Total	67	100.0

Table (3) show Gender frequency distribution for both groups:

	AAC group		Healthy group	
Gender	**Frequency**	**Percent**	**Frequency**	**Percent**
Female	29	43.9	27	40.3
Male	37	56.1	40	59.7
Total	66	100.0	67	100.0

Table (4) show History of Chronic disease for both Groups:

	AAC group		Healthy group	
History of Chronic disease	**Frequency**	**Percent**	**Frequency**	**Percent**
No	32	48.5	39	58.2
HTN	10	15.2	10	14.9
DM	8	12.1	7	10.4
HTN/DM	7	10.6	3	4.5
RA	3	4.5	3	4.5
RA/HTN	3	4.5	2	3.0
HTN/RA	2	3.0	1	1.5
DM/RA	1	1.5	2	3.0
Total	66	100.0	67	100.0

Table (5) Show descriptive statistics of age, US finding (Wall thickness/mm) and duration of vaccine for both groups:

Descriptive Statistics						
		N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age	**AAC group**	66	23	60	42.02	9.354
	Healthy group	67	28	60	42.91	10.226
Ultrasound finding (Wall thickness/mm)	**AAC group**	66	3.0	5.9	4.173	.6865
	Healthy group	67	1.5	3.0	2.416	.4575
vaccine Duration /months	**AAC group**	66	3	9	6.26	2.136
	Healthy group	67	3	9	6.97	1.850
Valid N (listwise)	**AAC group**	66				
	Healthy group	67				

Table (6) Show One -Sample Test for AAC group:

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2- tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
US finding(wall thickness)	-10.442-	66	.000	-.5836-	-.695-	-.472-

Table (7) show correlation between US finding (Wall thickness/mm) and COVID-19 vaccine Duration for AAC group:

Correlations

		Ultrasound finding (Wall thickness/mm)	Vaccine Duration /months
US finding (Wall thickness/mm)	Pearson Correlation	1	.299*
	Sig. (2-tailed)		.015
	N	66	66
Vaccine Duration /months	Pearson Correlation	.299*	1
	Sig. (2-tailed)	.015	
	N	66	66
*. Correlation is significant at the 0.05 level (2-tailed).			

Table (8) show Compare mean between wall thickness (U/S finding) in healthy and AAC groups through using Paired Sample Test:

Paired Samples Statistics						
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**	**P- value**
Pair 1	**U/S finding/Wall thickness(healthy)**	2.411	67	.4585	.0564	<.001
	U/S finding/Wall Thickness (cholecystitis)	4.173	66	.6865	.0845	

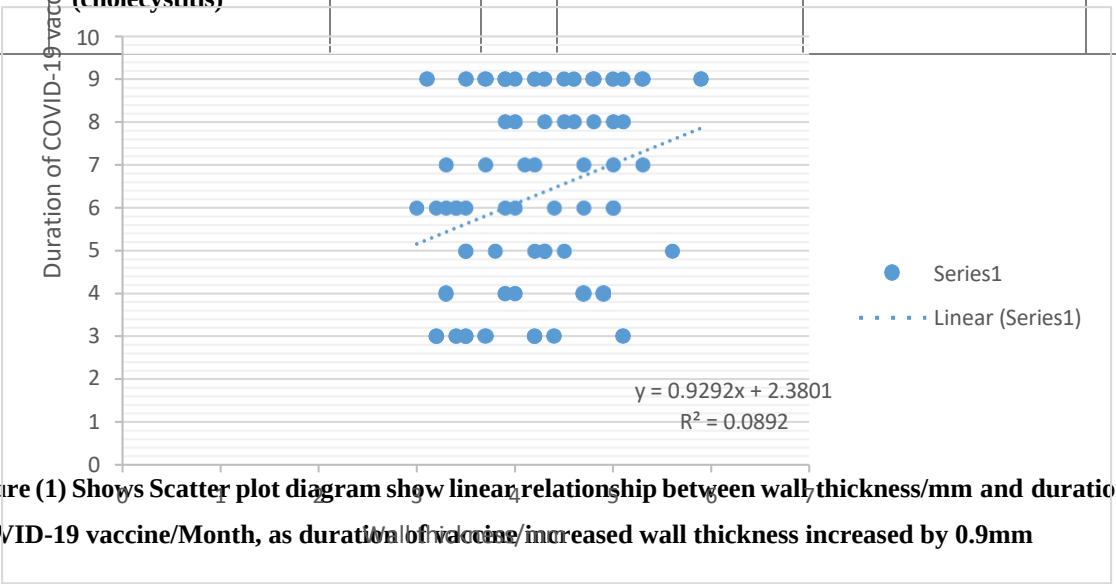

Figure (1) Shows Scatter plot diagram show linear relationship between wall thickness/mm and duration of COVID-19 vaccine/Month, as duration of vaccine increased wall thickness increased by 0.9mm

Discussion: This was cross sectional study design. Conducted in Sudan- Khartoum state at Al-Ban Jaded Hospital with the necessary US equipment and expertise, aimed to study prevalence of AAC following COVID-19 vaccination using ultrasonography. Data was collected between December 2022 to March 2023 and analyzed from December 2025 to January 2026. Total study sample size was 113 participants, all were vaccinated with COVID-19 vaccination (sub divided into two groups: 66 participants represent AAC group and other healthy group size was 67 participants, aged between 23-60 years old. The problem of the study was limited research has been conducted on the effects of COVID-19 vaccination on GB, especially using US imaging. Patients scanned with US Machine Mindray Dp10, for measuring GB wall thickness and other abnormalities. Data collection sheet was designed include age, gender, duration of vaccine, history of chronic disease and US finding.

The study showed that in AAC group, the majority of patients were between 33–42 years (31.8%) and 43–52 years (31.8%) (Table1), descriptive statistics in (Table 5) further confirm a mean age of 42.02±9.35 years. Healthy group showed largest proportion in 37–45 years (31.3%) (Table2), with a mean age of 42.91±10.23 years (Table 5), these

results disagree with A. Bruni et al [14]. (2020) and Bianca Maria Wahlen et al [15]. (2022) both reported findings from single patients (n=1 each). Our study included a larger sample size (113 participants).

The study observed that in (Table 3) gender distribution, males comprising 56.1% and females 43.9% in AAC group, and in healthy group, male was 59.7% and female 40.3%.

According to chronic disease history, (Table 4) the study found that in AAC group 48.5% had no chronic disease, while hypertension (15.2%) and diabetes (12.1%) were common comorbidities. In addition to, healthy group shows that 58.2% had no chronic disease, with hypertension again the most frequent condition (14. 9%). These findings highlight that chronic diseases had no clear affects, which may contribute to GB pathology. These results agree with A. Bruni et al [14]. (2020) and Bianca Maria Wahlen et al [15]. (2022) described patients without chronic disease history related to GB pathology.

Regarding to US findings (Wall Thickness) in the AAC group, descriptive statistics show a mean wall thickness of 4.17±0.6865 mm (range 3.0–5.9 mm). While in healthy group, descriptive statistics show a mean wall thickness of 2.41±0.4575mm (range 1.5–3.0 mm). (Table 5). These results collectively demonstrate that GB wall thickening is a reliable diagnostic marker of cholecystitis. These results disagree with A. Bruni et al [14]. (2020) reported GB wall thickness of 7.7 mm, and Bianca Maria Wahlen et al [15]. (2022) reported 8.9 mm. Our study found lower mean thickness in the AAC group (4.17 mm), though still significantly higher than healthy one (2.41 mm).

Vaccine duration, show a mean of 6.26 months (range 3–9 months) in AAC group. While in the healthy group, show a mean of 6.97 months (range 3–9 months) (Table 5). The correlation analysis in (Table 7) reveals a significant positive relationship between vaccine duration and wall thickness ($r = 0.299$, $p = 0.015$). These results observed that longer vaccine duration may be associated with subtle increases in GB wall thickness. These results agree with Both A. Bruni et al [14]. (2020) and Bianca Maria Wahlen et al [15]. (2022) reported linked onset of cholecystitis symptoms temporally to vaccination. Our study finding a modest correlation between vaccine duration and wall thickness.

The study demonstrated that in (Table 5) the mean wall thickness in AAC group was (4.173mm),which was significantly higher than the test value of 3 mm ($t = -10.442$, $p < 0.001$).(Table 6). In addition, the paired sample test in (Table 8) comparing healthy vs. AAC groups confirmed a highly significant difference ($p < 0.001$), which was; mean of wall thickness in AAC group was higher than healthy group. This result reinforces the diagnostic utility of ultrasound wall thickness in differentiating Cholecystitis from healthy states.

Conclusion: Overall, we concluded that the findings support the clinical utility of US (wall thickness) in diagnosing AAC and highlight the potential influence of chronic diseases and vaccine duration on GB changes.

Recommended that: monitor symptoms in those vaccinated, conducting Standardize US protocols, recognize subtle signs, and develop clinical guidelines for accurate diagnosis.

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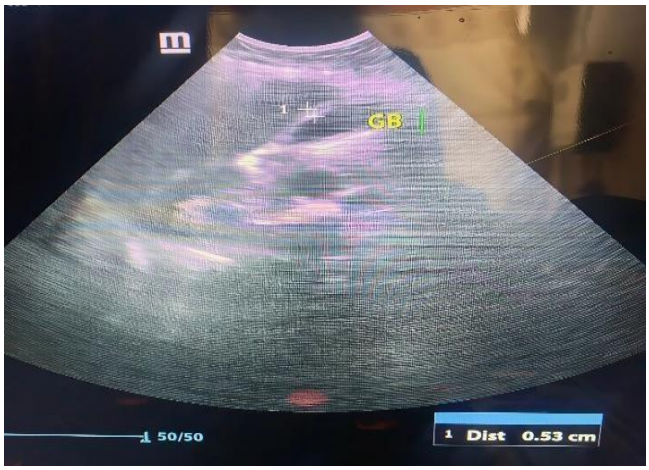

Image (1): 45 years female, US showed GB wall thickness measured 5.3 mm.

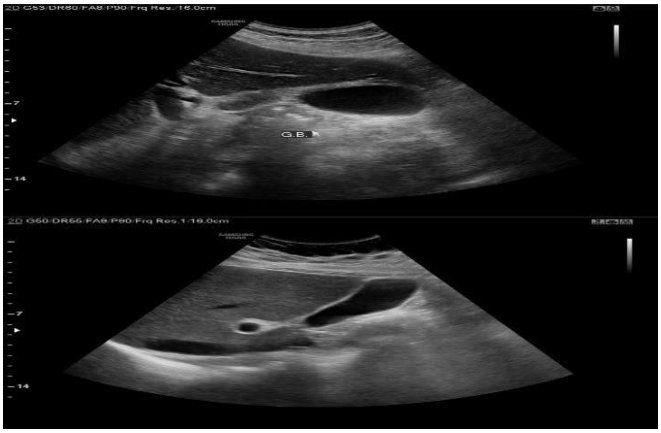

Image (2): 34 years male, US showed GB wall thickness measured 5 mm.

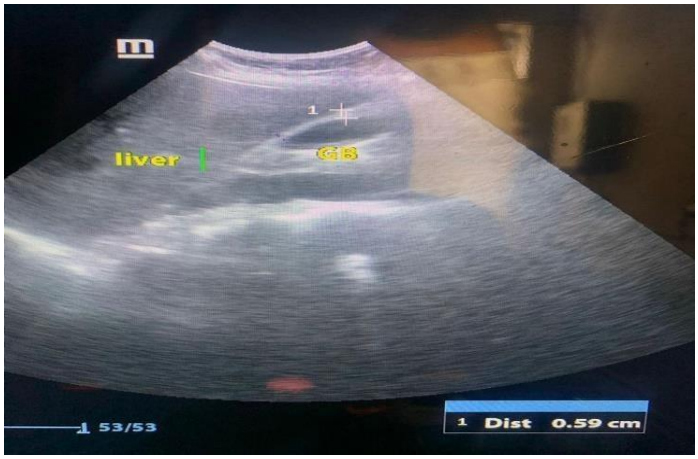

Image (5): 39 years' female, US showed GB wall thickness measured 5.9 mm

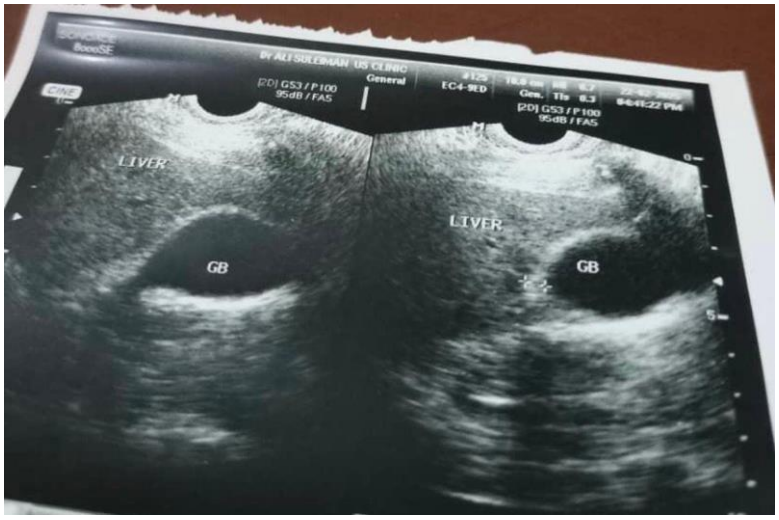

Image (6): 38 years' male, US image showed GB wall thickness measured 5.6 mm