

Cardiac Investigations in Paediatric Patients with Chest Pain Following COVID-19 mRNA Vaccination

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Abstract

Aim

It has been noted the presentation of paediatric patients to the Emergency Department with chest pain following COVID-19 mRNA vaccination. There have been reports of pericarditis and myocarditis diagnoses in some of these adolescent patients. This study aimed to determine the safety and efficacy of current guidelines for investigating chest pain COVID-19 mRNA vaccination.

Methods

This was a retrospective study, assessing the data over a 11 month period between August 2021 (when vaccinations for paediatric patients aged between 12-15 years first began in Ireland) to June 2022.

Results

In total, 30 patients met the criteria for involvement in this study. 23 (77%) patients were male. 17 (57%) patients reported symptoms after the second dose vaccine, and 13 (43%) patients after the first dose. Regarding investigations performed, all patients had an ECG performed and reviewed in the ED. 28 patients (93%) had a troponin level performed in the ED. Only 20 patients (67%) had a chest radiograph, and 12 patients (40%) had a creatine kinase level measured in the ED.

Discussion

In conclusion, initial investigations of ECG and troponin are key in informing whether specialist referral and further investigations such as echocardiogram or cardiac MRI are necessary.

Introduction

Chest pain following mRNA vaccination for COVID-19 has been reported in the adult population, with reports of pericarditis and myocarditis in some adult cases¹. It has been a documented cases with carditis and myocarditis diagnoses in some of adolescent patients². Cases are rare, with the overall UK estimate being 10 myocarditis cases per million doses of the Pfizer vaccine, and 7 pericarditis cases per million doses of the Pfizer vaccine³.

Vaccine-related myocarditis, particularly after mRNA COVID-19 vaccines, is thought to result from an immune-mediated response, possibly involving molecular mimicry, where the immune system mistakenly targets heart tissue⁴.

Most cases have been observed in male adolescents and young adults, typically within a week of the second vaccine dose, with symptoms such as chest pain and elevated cardiac biomarkers. The condition is usually mild and self-limiting, with most patients fully recovering after supportive care. Studies from countries like the U.S and Canada confirm a small but real risk of myocarditis, especially in younger males, though its incidence remains rare. Despite this risk, vaccination is crucial, as COVID-19 itself poses a higher risk of myocarditis and severe complications. There is limited research on Ireland's paediatric population, which may have unique demographic factors influencing outcomes. Filling this gap would contribute to better understanding vaccine safety in children and support national public health efforts.

The evaluation of children with chest pain following of mRNA COVID vaccination can be challenging. There are interim guidelines from several centres regarding the investigation of patients who present with new onset chest pain, shortness of breath, syncope, palpitations or dizziness shortly following mRNA vaccination for COVID-19. The primary aim of this study was to investigate the department's compliance with performing the recommended investigations in this sub-group of patients. The secondary aim was to assess if any of these investigations were consistently abnormal.

Methods

A single centre retrospective study was performed at Tallaght University Hospital, assessing the data over a 11 month period between August 2021 (when vaccinations for paediatric patients aged between 12-15 years first began in Ireland) to June 2022.

This study included all patients within the 12-15 year age group, presenting with new-onset chest pain, shortness of breath, syncope, palpitations or dizziness within 6 weeks of COVID-19 mRNA vaccination (either 1st of 2nd dose). We excluded any patient younger than 12 years or older than 15 years of age, or those with chest pain not related to COVID-19 vaccination or any other pre-existing medical condition.

Results

A total of 30 patients met the criteria for inclusion in the study. All patients were between the age of 12-15 years, with a median age of 13.5 years. 23 (77%) patients were male, reflecting a similar male preponderance seen in other case series³. 17 (57%) patients reported symptoms beginning after the second dose of the Pfizer Covid mRNA vaccine, and 13 (43%) patients after the first dose (*Figure 1*).

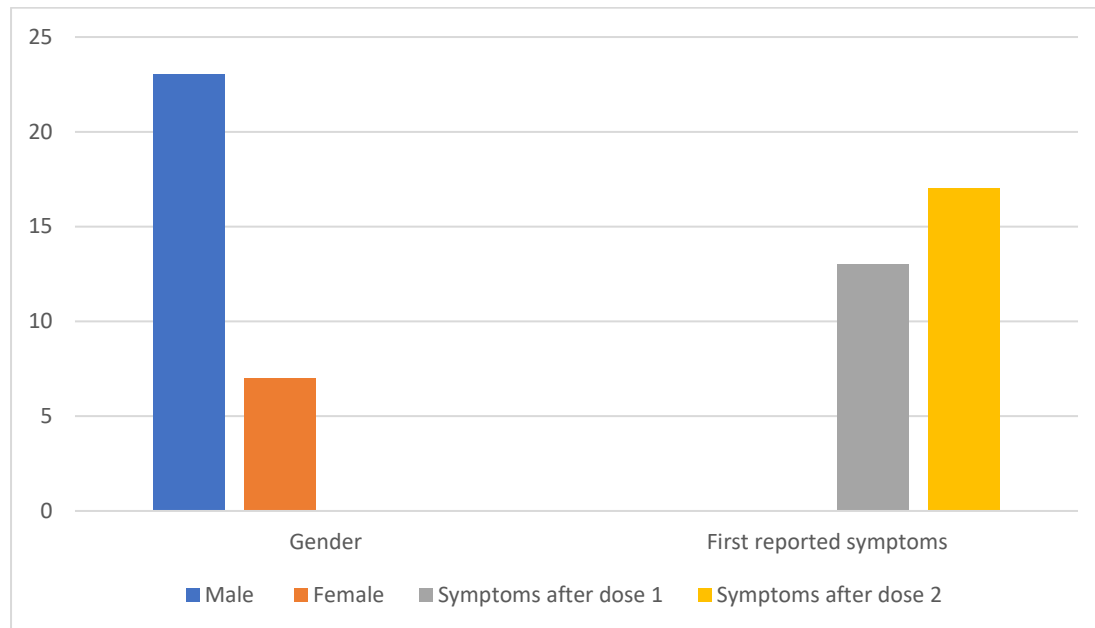


Figure 1: The gender split and dose after which symptoms first began for this study's patients

Regarding investigations performed, all patients had an ECG performed and reviewed in the paediatric emergency department (PED). 28 (93%) patients had a troponin level performed in the PED. 20 patients (67%) had a chest radiograph, and only 12 (40%) patients had a creatine kinase level measured. One patient had an echocardiogram performed in the PED (this patient was one of those who did not have a chest radiograph performed as the echocardiogram was deemed normal).

On review of the ECGs performed, majority were normal. Two ECGs had sinus tachycardia as their only finding, and one had a slightly prolonged QTc interval at 461ms with some evidence of left ventricular hypertrophy (R wave amplitude in V5 was 34mm and in V6 was 28mm). The latter patient was referred to the cardiology clinic after discussion with the cardiology team, where he had a normal ECG and echocardiogram and was subsequently discharged from clinic. One ECG showed ventricular tachycardia- this patient was subsequently transferred from the PED to the cardiology unit for arrhythmia management. Three other ECGs were discussed with the cardiology team but were deemed to be normal. In total, 5 of the 30 ECGs required discussion or review with the cardiology team.

Twenty eight patients had a troponin T level performed, with the majority returning a normal value (<14ng/L). Only 5 (17%) patients had an elevated troponin T, and these were only mildly elevated (14, 15, 16, 17, and 23ng/L). 2 of these patients with raised troponin had their troponin level re-measured soon after, showing normalisation of the value to below 14ng/L. None of these 5 patients had abnormal ECG findings.

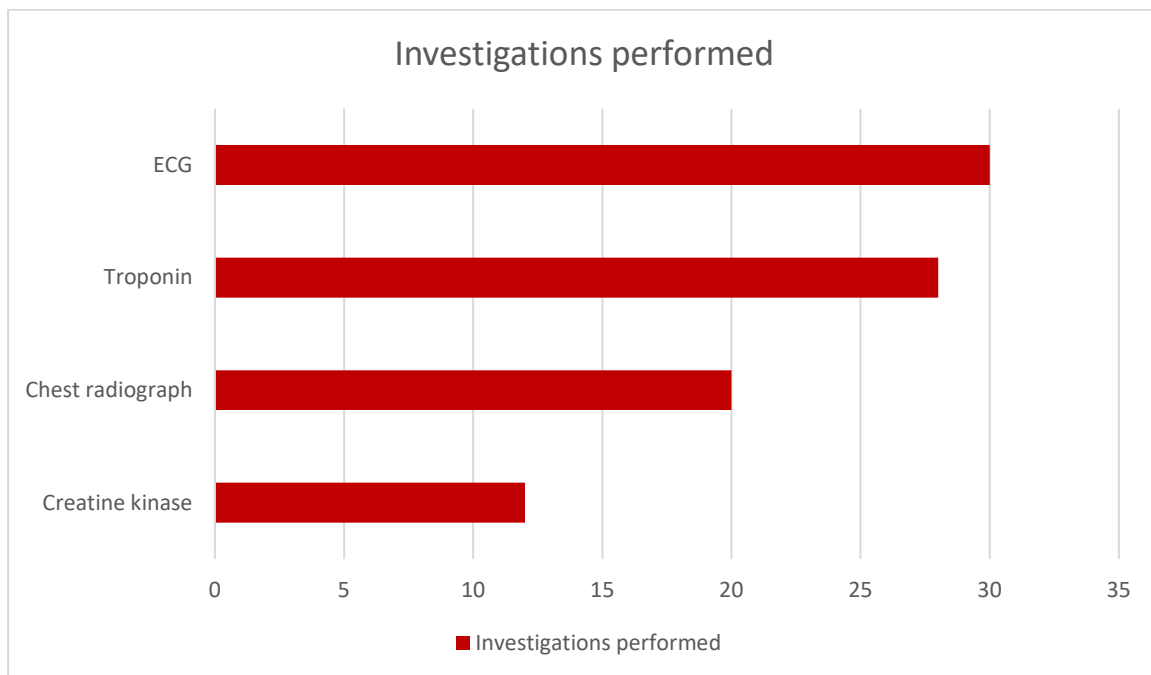


Figure 2: Graph demonstrating the compliance of clinical investigations performed in the ED for this study's patients

20 patients had a chest radiograph performed, of which all were normal. Measurement of creatine kinase level was only performed in 12 of the patients and all were normal. Out of 30 patients included in our study, no patient developed myocarditis, pericarditis or cardiomyopathy.

Discussion

Our study showed that there has been 100% compliance with performing ECG for all patients who presented with new-onset chest pain or cardiac symptoms following Covid mRNA vaccination. In our study, none of the investigations were severely deranged or abnormal. Clinical follow-up of the patients revealed that the vast majority had a mild, self-limited period of symptoms which resolved a few days later. All of the patients who had reported symptoms after the first vaccine, chose to receive their second Covid vaccine and reported no recurrence of symptoms thereafter.

In general, male populations are at a higher risk of developing pericarditis or myocarditis after vaccination⁶. Symptoms are also more prevalent after the second dose of COVID-19

vaccine⁶. International guidelines universally recommend for an ECG and troponin level to be measured in the first instance for patients suspected of having vaccine-related pericarditis or myocarditis^{3,5,6}. They also recommend that if the initial investigations are normal (i.e. ECG and blood investigations), patients do not require cardiology referral⁶.

Given that all patients in our study experienced mild, self-limited symptoms and opted for their second vaccine dose without recurrence of symptoms, this supports the safety of continued vaccination even in those who experience initial side effects. These results can inform future guidelines by reinforcing that routine cardiology referrals may not be necessary when initial investigations are normal, streamlining patient management and reducing unnecessary healthcare burdens. Additionally, the study highlights the need for ongoing monitoring of at-risk populations, such as males and those receiving second doses, while ensuring continued public confidence in vaccine safety.

There are a number of limitations to our study. The retrospective nature of the study may also introduce biases due to incomplete medical records. As the sample was small and drawn from a single hospital over a limited period, the conclusions may not fully capture the broader population, particularly in different geographical or demographic contexts. Larger, multi-centre studies would be necessary to confirm these findings and strengthen the evidence for widespread vaccination safety protocols, especially in diverse settings. Nevertheless, our results offer a foundation for refining post-vaccine monitoring and may inform broader vaccination efforts, but should be interpreted with caution due to these limitations.

In conclusion, initial investigations of ECG and troponin level are key in informing whether specialist referral and further investigations such as echocardiogram or cardiac MRI are necessary. Chest radiograph should be considered in individual cases when seeking other differentials or if assessing for pericardial effusion. Creatine kinase measurement has not been a routinely recommended investigation of choice by the international guidelines.

Declarations of Conflicts of Interest:

None declared.

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