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SPOTLIGHT

A racing heart post-Pfizer/BioNTech BNT162b2

Hooi Khee Teo MBBS, MRCP, M Med (Int Med) | Kah Leng Ho MBBS, MRCP | Boon Yew Tan MB ChB, MRCP, FAMS, CCDS, CEPS | Chi Keong Ching MBBS, MRCP, FAMS (Cardiology), FHRS | Daniel Thuan Tee Chong MBBS, MRCP, FAMS

Department of Cardiology, National Heart Centre Singapore, Singapore

Correspondence
Hooi Khee Teo, 5 Hospital Drive, Singapore 169609.
Email: k.teohk@gmail.com; teo.hooi.khee@singhealth.com.sg

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Palpitations is one of the commonest side effects experienced post-messenger-RNA (mRNA) COVID-19 vaccination. However, in most patients this is self-limiting. Inappropriate sinus tachycardia (IST) has been documented to occur in patients who continue to experience persistent palpitations post-recovery from the COVID-19 infection.[1] It has been postulated that this is a result of immune-mediated effects on the individual's cardiac autonomic nervous system, resulting in an imbalance between the sympathetic and parasympathetic effects.

We present a case of inappropriate sinus tachycardia post-mRNA COVID-19 vaccination in a previously fit and healthy gentleman. He had experienced palpitations, light-headedness, and a decrease in exercise tolerance 2 days after the first dose and experienced worsening symptoms post-second dose of the vaccine.

A 53-year-old active, healthy male presented to the emergency department with a 2-month history of worsening palpitations associated with increased fatigue and reduced effort tolerance. He received his first dose of the BNT162b2 COVID-19 (Pfizer-BioNTech) vaccine at the end of May 2021 and started noticing palpitations 3 days after the vaccine. The resting heart rate reflected on his wearable fitness tracker showed an increase from a baseline of 70 to 80 bpm and 90 to 100 bpm. The elevated heart rate and palpitations persisted until the second dose of BNT162b2 COVID-19 (Pfizer-BioNTech) vaccine was administered 3 weeks later. The patient subsequently experienced worsening palpitations over the next 2 to 3 days with his resting heart rate increasing to a baseline of 100–110 bpm and peaked at 140 bpm with minimal exertion. He denied any illicit drug use and was not on any supplements or regular medications.

Clinical history and examination revealed elevated heart rate with normal blood pressure and temperature. There was no difference in symptoms on change of posture and no documented postural drop in blood pressure. 12-lead electrocardiograms (ECGs) showed sinus tachycardia (Figure 1). D-dimer was mildly elevated at 0.85 mg/L (Normal < 0.5 mg/L). The rest of the investigations including serial troponin levels, urine catecholamines and metanephrines screen, thyroid function tests, infective markers, and viral screen were all unremarkable.

An enhanced computed tomography of the pulmonary arteries performed in view of the mildly elevated D-dimer was negative for pulmonary embolism. Transthoracic echocardiography showed normal left ventricular ejection fraction of 57%, normal right ventricular function, morphologically normal valves, and a low probability of pulmonary hypertension. A 24-h Holter ECG monitoring showed sinus tachycardia with an average heart rate of 107 bpm, with normal diurnal variation but with a slightly elevated nocturnal heart rate of 70–90 bpm (Figures 2 and 3).

In view of distressing palpitations affecting his quality of life, he was initiated on Ivabradine 5 mg twice daily. The patient was counseled on beta-blockers but was not keen because of the potential side effects of fatigue and erectile dysfunction. At a review 2 months later, the patient reported an improvement in both symptoms and

Patient verbal consent was attained and documented prior to the initiation of this paper.

No clinical trial registration required as this is a clinical case.

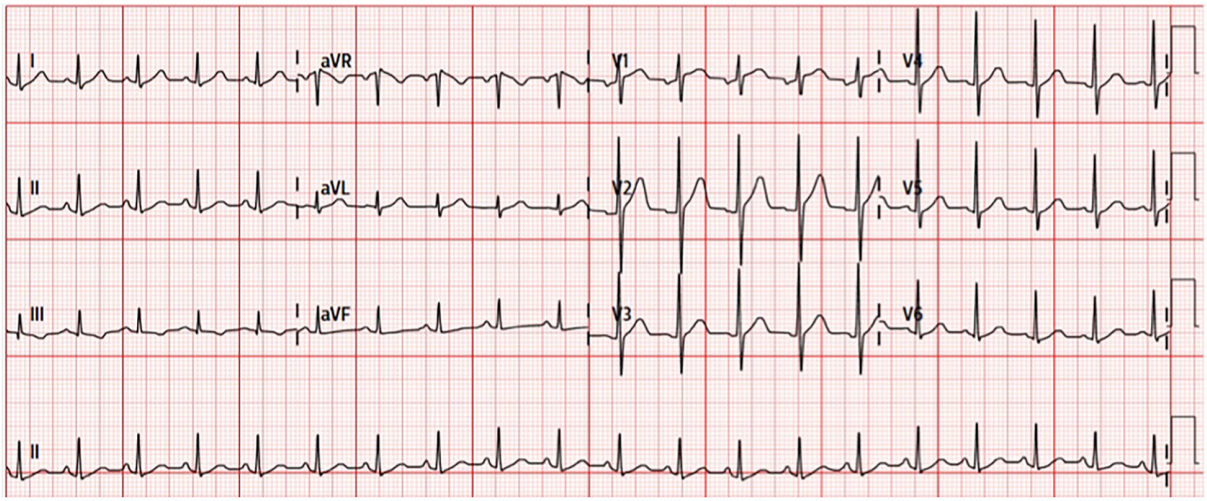

FIGURE 1 Presenting electrocardiogram (ECG) showing sinus tachycardia.

Hourly Summary

*RR Pause Criteria: 2000

		Heart Rate					Ventricular					Supraventricular				
Hour	Min.s Used	#QRS's	Min.	Ave.	Max.	Pauses	Iso	Cplt	Runs	Max Run	Max Rate	Iso	Cplt	Runs	Max Run	Max Rate
10	42	4941	99	118	134	0	0	0	0	0	0	0	0	0	0	0
11	60	7967	116	133	150	0	0	0	0	0	0	0	0	0	0	0
12	60	8097	120	135	151	0	0	0	0	0	0	0	0	0	0	0
13	60	8419	120	140	155	0	0	0	0	0	0	0	0	0	0	0
14	60	7798	114	130	140	0	0	0	0	0	0	0	0	0	0	0
15	60	7458	107	124	148	0	0	0	0	0	0	0	0	0	0	0
16	60	7169	98	119	136	0	0	0	0	0	0	0	0	0	0	0
17	60	6879	100	115	131	0	0	0	0	0	0	0	0	0	0	0
18	60	7549	108	126	144	0	0	0	0	0	0	0	0	0	0	0
19	60	7297	106	122	134	0	0	0	0	0	0	0	0	0	0	0
20	60	6817	100	114	135	0	0	0	0	0	0	0	0	0	0	0
21	60	6493	95	108	126	0	0	0	0	0	0	0	0	0	0	0
22	60	6613	90	110	129	0	0	0	0	0	0	0	0	0	0	0
23	60	5424	80	90	114	0	0	0	0	0	0	0	0	0	0	0
00	60	5032	72	84	105	0	0	0	0	0	0	0	0	0	0	0
01	60	4863	72	81	109	0	0	0	0	0	0	0	0	0	0	0
02	60	4744	67	79	103	0	0	0	0	0	0	0	0	0	0	0
03	60	4808	62	80	112	0	0	0	0	0	0	0	0	0	0	0
04	60	4666	68	78	100	0	0	0	0	0	0	0	0	0	0	0
05	60	4614	66	77	107	0	0	0	0	0	0	0	0	0	0	0
06	43	3630	69	84	113	0	0	0	0	0	0	1	0	0	0	0
07	0	0	---	---	---	0	0	0	0	0	0	0	0	0	0	0
08	0	0	---	---	---	0	0	0	0	0	0	0	0	0	0	0
	1225	131278	62	107	155	0	0	0	0	0	0	1	0	0	0	0

FIGURE 2 Hourly heart rate summary on initial 24-h Holter showing elevated average heart rate, especially during awake h.

effort tolerance. His wearable fitness tracker also showed that the average resting heart rate had improved to an average of 80–90 bpm.

A repeat 24-h Holter performed 4 months later showed an improvement in the average heart rate from 107 bpm to 89 bpm and the burden of beats in tachycardia had improved from 71% to 33% (Figure 4).

Palpitations have been documented to be one of the commonest complaints in patients who have recovered from COVID-19 infection. A literature search showed that tachycardia post-COVID-19 vaccination is common too.[2–4] A study based on the WHO database reported an incidence of 16.4%,[2] whilst a recent US study (DETECT), using a smartphone app-based research platform, reported elevated resting heart rate in 71% and 76% of vaccinated individuals post-first and -second dose, respectively.[4] Resting heart rate trends documented in the DETECT study showed that the average resting heart rate returned to baseline by days 4–6 in the majority of patients. These changes were attributed to physiological stress response to the vaccine. This case is unique in that it describes symptomatic elevation in resting heart rate that persisted and worsened after the second dose of the COVID-19 vaccine.

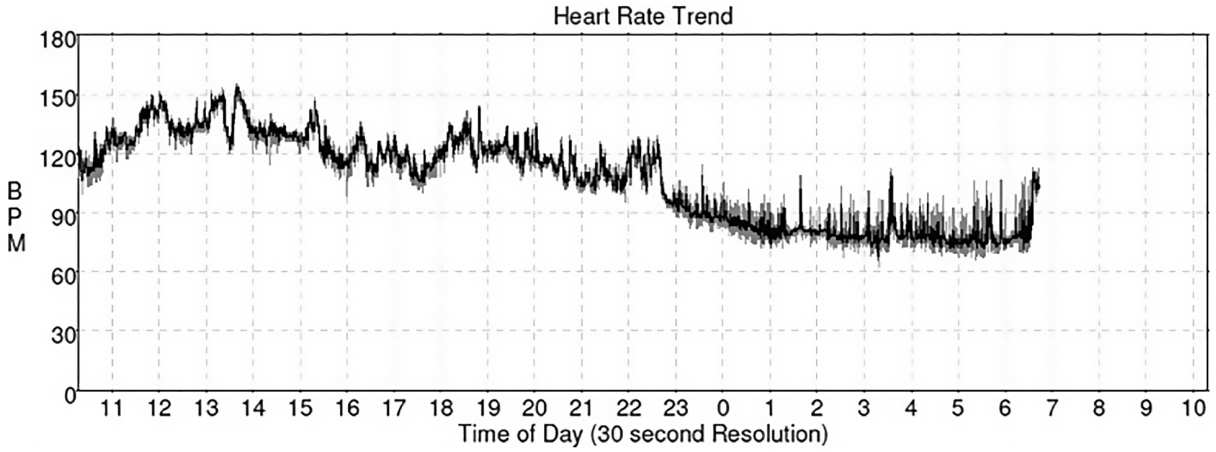

FIGURE 3 Graph showing heart rate trend on initial 24-h Holter reflecting peak heart of 155 bpm and average heart rate of 107 bpm.

Hourly Summary

*RR Pause Criteria: 2000

		Heart Rate					Ventricular					Supraventricular				
Hour	Min.s Used	#QRS's	Min.	Ave.	Max.	Pauses	Iso	Cplt	Runs	Max Run	Max Rate	Iso	Cplt	Runs	Max Run	Max Rate
10	53	5432	84	102	123	0	0	0	0	0	0	0	0	0	0	0
11	60	6679	92	111	130	0	0	0	0	0	0	0	0	0	0	0
12	60	7238	104	121	143	0	0	0	0	0	0	1	0	0	0	0
13	60	6788	94	113	129	0	0	0	0	0	0	0	0	0	0	0
14	60	6056	89	101	116	0	0	0	0	0	0	0	0	0	0	0
15	60	5587	83	93	104	0	0	0	0	0	0	0	0	0	0	0
16	60	5571	79	93	107	0	0	0	0	0	0	0	0	0	0	0
17	60	5224	78	87	100	0	0	0	0	0	0	0	0	0	0	0
18	60	5634	79	94	116	0	0	0	0	0	0	0	0	0	0	0
19	60	5728	83	95	109	0	0	0	0	0	0	1	0	0	0	0
20	60	5406	79	90	104	0	0	0	0	0	0	0	0	0	0	0
21	60	5431	77	91	104	0	0	0	0	0	0	0	0	0	0	0
22	60	5363	76	90	102	0	0	0	0	0	0	0	0	0	0	0
23	60	4911	63	82	102	0	0	0	0	0	0	0	0	0	0	0
00	60	4305	62	72	87	0	0	0	0	0	0	0	0	0	0	0
01	60	4090	54	68	98	0	0	0	0	0	0	0	0	0	0	0
02	60	3976	58	66	81	0	0	0	0	0	0	0	0	0	0	0
03	60	3898	53	65	92	0	0	0	0	0	0	0	0	0	0	0
04	60	3879	54	65	87	0	0	0	0	0	0	0	0	0	0	0
05	60	3862	53	64	92	0	0	0	0	0	0	0	0	0	0	0
06	60	4688	57	78	105	0	0	0	0	0	0	1	0	0	0	0
07	60	6356	83	106	128	0	1	0	0	0	0	1	0	0	0	0
08	50	5548	91	111	141	0	0	0	0	0	0	0	0	0	0	0
	1363	121650	53	89	143	0	1	0	0	0	0	4	0	0	0	0

FIGURE 4 Hourly heart rate summary on follow-up 24-h Holter showing improvement in the average heart rate.

IST is most often defined as an average heart rate of more than 90 bpm, or a persistent increase in heart rate to more than 100 bpm disproportionate to the level of physical or emotional state of the individual.[5] The diagnosis of IST can be difficult. Patients may be asymptomatic or present with symptoms like palpitations, light-headedness, or decrease in exercise capacity. Numerous mechanisms have been proposed for IST. This ranges from autonomic dysfunction, neurohormonal dysregulation, intrinsic sinus node hyperactivity, and channelopathies like gain-of-function mutation of the pacemaker hyperpolarization-activated cyclic nucleotide-gated 4 (HCN4) channel in familial causes. Closely associated with IST is postural orthostatic tachycardia syndrome (POTS), a clinical syndrome which is defined as an increase in heart rate of ≥30 bpm when standing for >30 s without orthostatic hypotension.

Management of IST is challenging, beta-blockers are often ineffective and high doses may result in debilitating side effects like fatigue. Ivabradine an I_f blocker has been shown to be effective in reducing the average heart rate and, most importantly, ameliorating symptoms and improving exercise tolerance.[5]

Despite the temporal sequence of events, it is also important to consider the possibility that this patient could have coincidentally developed IST during the time of vaccination or have undiagnosed IST.

There is still much to be known about the mRNA COVID-19 vaccine and this case illustrates that we need to consider a variety of differential diagnoses including IST and postural orthostatic tachycardia syndrome. Other differential diagnoses like pulmonary embolism and even anxiety should also be considered. This will allow for appropriate management and patient counseling.

Palpitations is a commonly experienced side effect of post-mRNA COVID-19 vaccination and is often self-limiting in most patients. However, further evaluation should be considered in patients with prolonged symptoms, especially those who have documented sinus tachycardia. Ivabradine may be considered in patients diagnosed with IST, especially in those who have a contraindication to beta-blockers or have concerns about potential side effects like fatigue.

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CONFLICT OF INTEREST

All authors have no conflicts of interest to declare.

ETHICS STATEMENT

No ethics approval required as this is a clinical case.

DISCLOSURES

All authors have no relationships with industry.

ORCID

Hooi Khee Teo https://orcid.org/0000-0003-1760-9616

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