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Thrombus in Transit: A Case Report of Right Ventricular Thrombus with Massive Pulmonary Embolism and Right Ventricular Strain

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Abstract

We present a case of 72 year old patient who presented with chest pain, shortness of breath (sob) for 2 days and 3 episodes of collapses with loss of consciousness (LOC). His past medical history includes Prostate carcinoma, hypercholesterolaemia and he had AstraZeneca covid vaccines 6 months ago. He was haemodynamically stable and had urgent Computerized Tomography Pulmonary Angiography (CTPA), confirming bilateral pulmonary embolism with evidence of right heart strain. His clinical examination was unremarkable apart from dyspnoea. He was commenced on twice daily treatment dose Clexane and was not thrombolysed in view of haemodynamic stability. He had urgent bedside echocardiogram confirming right ventricular thrombus with associated right heart strain, with no evidence of Patent Foramen Ovale (PFO). Electrocardiogram (ECG) showed right bundle branch block (RBBB) and left axis deviation (LAD). He was discharged home after three weeks on Rivaroxaban 15 mg BD for 21 days followed by 20 mg OD.

Keywords: Hypercholesterolaemia • Prostate carcinoma • Electrocardiogram

Introduction

Right Heart Thrombi (RVT) are uncommon, usually found in association with Pulmonary Embolism (PE) and are mostly in transit originating from Deep Venous Thrombosis (DVT) in absence of Atrial Fibrillation (AF). It can occasionally arise from AF and heart failure. The current treatment strategy for RHT and PE is unclear as there have been no Randomized Controlled Trials (RCTs) evaluating various treatments. The incidence of right ventricle thrombus associated with PE is about 4% to 18% and its presence indicates increased mortality risk compared to PE alone [1]. The mortality associated with RVT associated with PE has been reported as 44% and 27% [2-4]. Due to lack of research, there is no clear consensus on treatment of these patients and various treatment strategies such as anticoagulation, thrombolysis and embolectomy has been used. The diagnostic modality of choice for these patients is computerized tomography pulmonary angiography (CTPA) however this can be difficult particularly in patients with renal failure and haemodynamically instability.

Case Presentation

A 72 year old patient presented with two days history of sob and 3 collapses with LOC. His vitals were heart rate 91 beats per minute (bpm), blood pressure (BP) 156/86, capillary Refill Time (CRT) 3 seconds, respiratory rate 19, apyrexial and saturation were 95% on 60% venturi mask. His COVID 19 lateral flow was negative and polymerase chain reaction test was also negative. His clinical examination was normal and there was no calf tenderness to suggest Deep Vein Thrombosis (DVT). His bloods showed mildly raised white cell count 12.8, neutrophil 9.2, creatinine 122, C-reactive protein 10 and D-Dimer was 23.18 (Table1). Arterial Blood Gas (ABG) showed type 1 respiratory failure with PO2 8.4, PCO2 4.4, normal Ph and lactate. ECG showed Right Bundle Branch Block (RBBB), Left Axis Deviation (LAD) and sinus rhythm (Figure 1). He weighed 89.6 kilograms (kg) and was commenced on twice daily treatment dose of low molecular weight heparin (LMWH). He had urgent CTPA, confirming extensive bilateral PEs with evidence of right heart strain (Figure 2). Patient was discussed with ITU and respiratory consultant on call for possible thrombolysis however a Page 5 of 10 decisions was made against it due to his haemodynamic stability. Patient was also discussed with interventional radiologist for consideration of embolectomy. Patient had a bedside echocardiogram to assess for PFO that confirmed the presence of right ventricular thrombus and dilated right ventricle. He also had a departmental echocardiogram that showed normal left ventricular size and systolic function with septal flattening suggestive of right heart overload and dilated Right Heart with impaired radial and preserved longitudinal function. The pulmonary pressure was elevated with estimated pulmonary artery systolic pressure (PASp)=66 mmHg+right atrial pressure (RAp). Echocardiogram also showed an echogenic mobile mass in the right ventricle without any evidence of PFO (Figure 3). Patient had computerized tomography of neck and thorax, abdomen and pelvis that did not show any evidence of malignancy. He had previous history of prostate cancer which was under remission and the CT scan showed only mildly enlarged prostate. The autoimmune screen was negative. He did not have any history of weight loss, was lifelong non-smoker and received both doses of AstraZeneca vaccine 6 months ago. He was in hospital for 3 weeks and made a complete recovery.

Differential diagnosis if relevant

The possible differential diagnosis includes infection, pneumothorax, pleural effusion, pulmonary embolism, and pulmonary oedema secondary to Myocardial Infarction (MI) or myocarditis. The inflammatory markers were only marginally raised however his clinical examination was unremarkable and he was apyrexial. The CTPA and other tests also did not show any evidence of infection. There was no pleural effusion on CTPA, CTAP and echocardiogram also did not show any evidence of pleural effusion. This patient had extensive pulmonary embolism and RV thrombus confirmed by CTPA and echocardiogram.

Patients with pulmonary oedema can present with low oxygen saturation

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Table 1. Blood result showing white cell count, neutrophil, creatinine, C-reactive protein and D-Dimer.

Blood test	Reference Range	Day 1	Day 10
Haemoglobin	133 - 173 g/L	141	126
White cell count	3.8 - 11 10*9/L	12.8	11.7
Neutrophil	2 - 7.5 10*9/L	9.2	8.2
Platelet	150 - 400 10*9/L	101	295
Urea	2.5 - 7.8 mmol/L	6.9	8.2
Creatinine	59 - 104 umol/L	122	114
Sodium	133 - 146 mmol/L	141	137
Potassium	3.5 - 5.3 mmol/L	4.2	4.4
C reactive protein	0 - 5 mg/L	10	142
D-Dimer	0 - 0.5 mg/L FEU	23.18	Test not repeated
2019-Novel Coronavirus	SARS-COV-2 RNA not detected	2019-Novel Coronavirus	SARS-COV-2 RNA not detected
Troponin T	0-14	75	Test not repeated

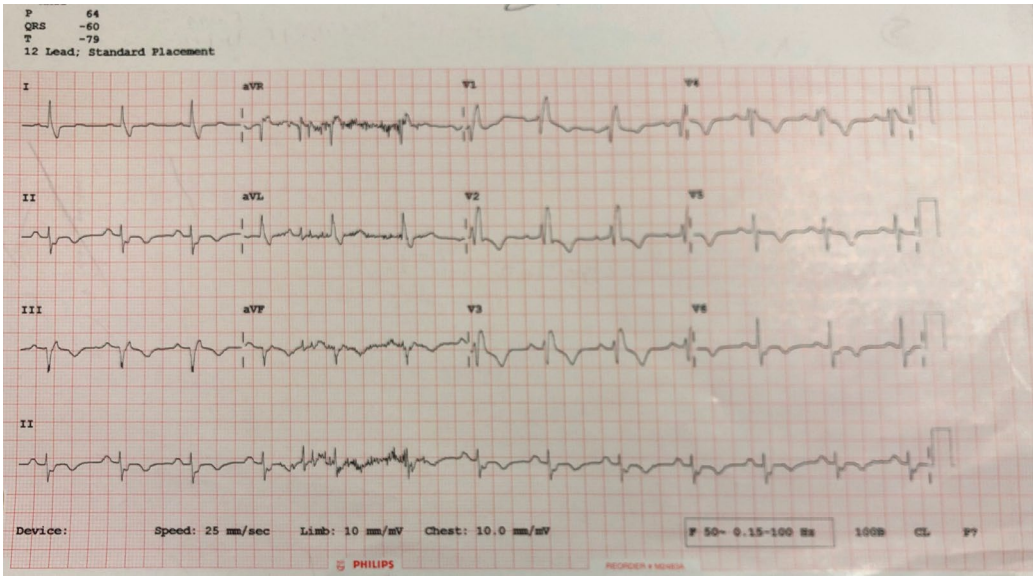

Figure 1. ECG shows RBBB, LAD and sinus rhythm.

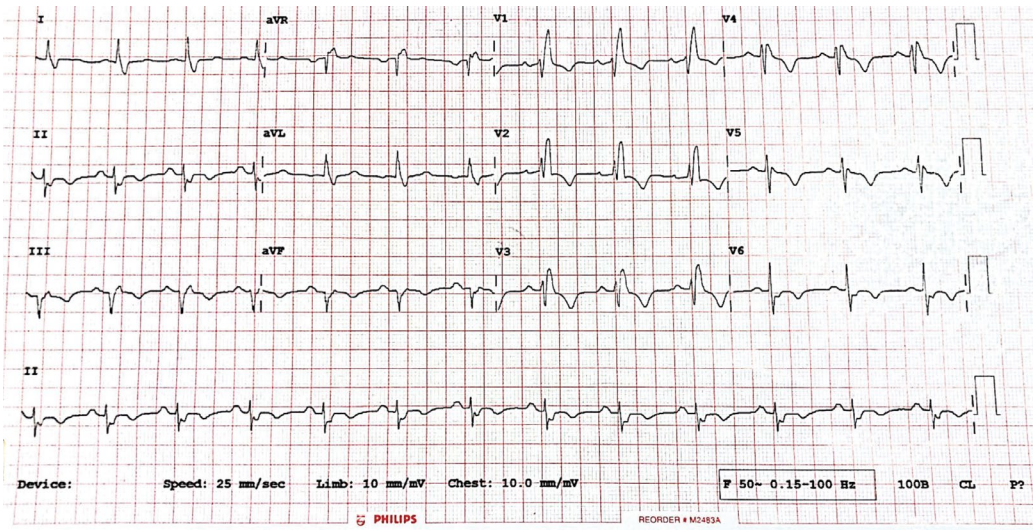

Figure 2. CTPA shows extensive PE extending up to the right ventricle.

however his chest examination was clear. Additionally, there was no evidence of pulmonary oedema on chest X-ray and CTPA. His Page 6 of 10 troponin T was 75 but there were no ischaemic changes on his ECG and raised troponin T was due to extensive PEs. He did not have recent infection and had no ECG features suggestive of myocarditis.

Treatment if relevant

This patient was admitted with 2 days history of sob and 3 collapses with LOC. His blood gases showed type 1 respiratory failure and was requiring 60% oxygen *via* venturi mask to maintain oxygen saturation above 94%. He was

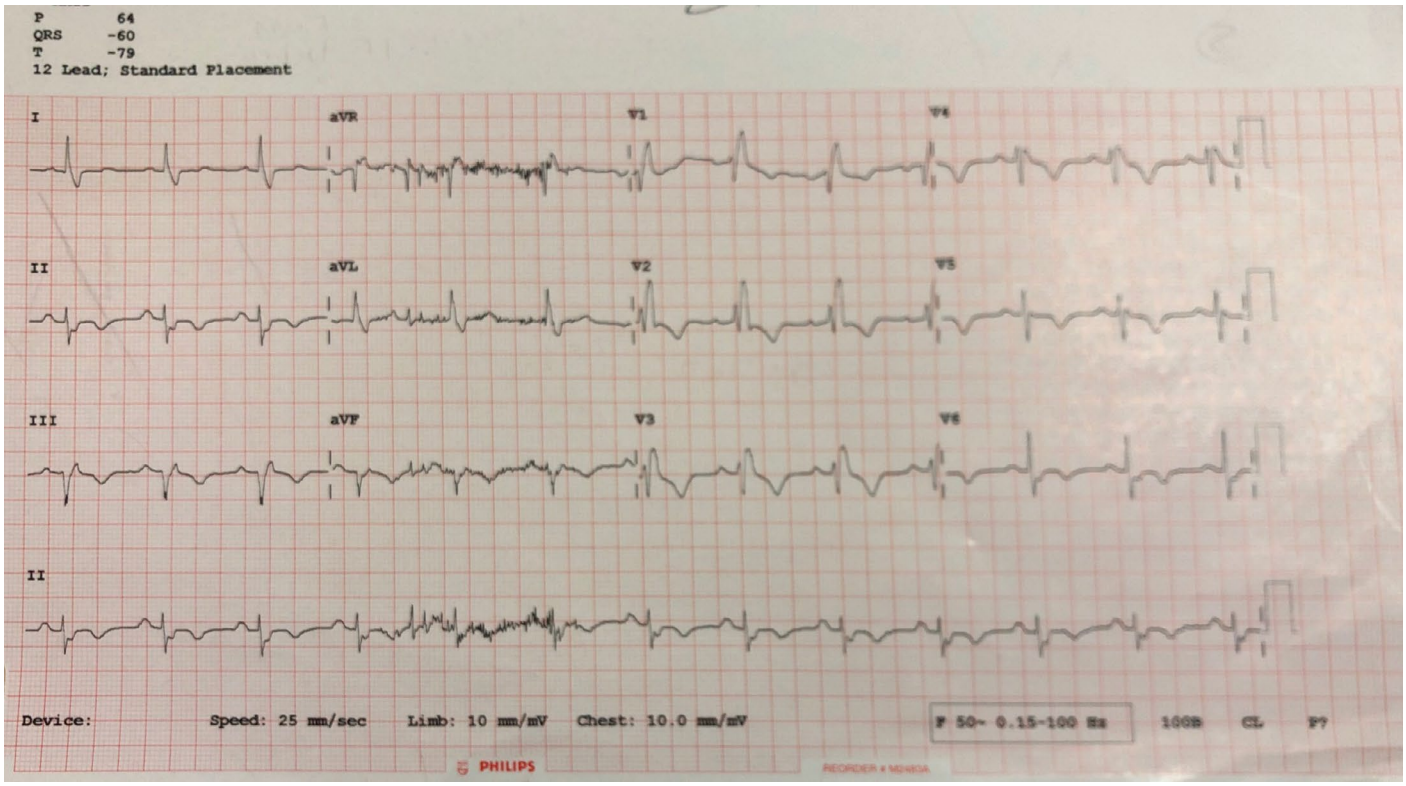

Figure 3. Apical 4 chamber view showing RV thrombus.

commenced on 90 mg clexane twice daily and was not thrombolysed in view of his haemodynamic stability. His oxygen requirement reduced over the next few days and was weaned off oxygen. He remained apyrexial throughout admission and was maintaining saturations above 95% without oxygen requirement. He was discharged home on Rivaroxaban 15 mg BD for 21 days followed by 20 mg OD with a 1-month outpatient follow up. Repeat echocardiogram prior to discharge showed reduction in RV size and the size of thrombus.

Outcome and follow-up

This patient was followed up in respiratory outpatient clinic two months after discharge and showed good resolution of symptoms. He was also seen by Haematology consultant in the outpatient clinic and was happy with his progress. He also had a repeat echo as an outpatient and showed complete resolution of the thrombus.

Discussion

RV thrombus and pulmonary embolism can occur together and carries significant mortality risk. There is lack of research in this regard and there is lack of guidelines for treating such cases. Most cases of RV thrombus and PEs are due to atrial fibrillation or patent foramen ovale; however there was no evidence of either in this case. Malignancy is another possible cause for extensive pulmonary embolism however there was no evidence of malignancy in his case.

The European Working Group on ECG has identified three patterns of the right heart thrombi based on 2D echocardiogram findings [5]. Type A thrombi are highly mobile and are likely dislodged from peripheral venous clots. Patients with type A clots have a high mortality risk of up to 42% due to extreme mobility of the clots. Type B thrombi are similar to left heart thrombi, are almost immobile indicating there in situ formation and their mortality risk is about 4%. The third type Type C thrombi are rare, share characteristics of both type A and C and are highly mobile. They resemble myxoma in appearance and have mortality rate intermediate between the above two types. The echocardiogram in our case showed a mobile echogenic mass in the right heart traversing through the tricuspid valve measuring 2 cm^2 indicating type C thrombus and there was no evidence of peripheral venous thrombosis.

There is no clear consensus regarding the treatment of right hears thrombus in transit with extensive pulmonary embolism and treatment options include anticoagulation, thrombolysis, and embolectomy. The success rate of treatment depends on patient clinical status and Rose P, et al. [3] reported the mortality rate as 100%, 28.6%, 23.8%, and 11.3% with no therapy, anticoagulation, surgical embolectomy, and thrombolysis. However, no significant difference between these treatment options was reported in other studies based on in-hospital mortality [6-8].

Another case study of 63 year old patient with right heart thrombus and massive pulmonary embolism was successfully treated with apixaban who presented with six days history of dyspnoea and peripheral oedema [8]. Cases of right heart thrombus have been reported in patients with nephrotic syndrome, patent foramen ovale and COVID 19 infection however our patient did not have evidence of any of these [9-12]. Our patient had both doses of AstraZeneca vaccine that has been linked to clots in patients however there is no reported case of RV thrombus associated with it.

A study based on 12441 patients with pulmonary embolism from the Registro Informatizado de la Enfermedad TromboEmbólica (RIETE) registry and baseline echocardiogram reported the prevalence of RHT as 2.6% [13]. The risk factors identified to increase the of RHT were younger age, previous bleeding, congestive heart failure, cancer, syncope, systolic blood pressure <100 mmHg, and arterial oxyhaemoglobin saturation <90%. This study also reported that patients with RHT were significantly more likely to die from any cause and from pulmonary embolism during follow-up. The outcome was worse for patients with RHT compared to those without it.

The Right Heart Thrombi European Registry, a prospective, international study reported the prognostic significance of RHT characteristics in patients with acute pulmonary embolism and It's main finding was that the clinical prognostic scores such as "simplified pulmonary embolism severity index" and "shock index" and the haemodynamic status at the time of pulmonary embolism diagnosis predicted mortality, while the RHT characteristics did not. In this study, a subgroup of patients with intermediate-risk pulmonary embolism and right ventricular strain had increased mortality risk compared with those without RHT [14].

The Moderate Pulmonary Embolism Treated with Thrombolysis trial

(MOPETT trial) was another randomised control trial of thrombolytic *vs.* anticoagulation in moderate PE. This demonstrated an increased survival and reduction in PA pressure in patients receiving half dose thrombolytic with no increased bleeding risk. This patient was discussed with Respiratory consultant for consideration of thrombolysis however they advised against thrombolysis including half dose thrombolysis [15].

Conclusion

- There are currently no evidenced-based guidelines for the treatment of thrombus in transit associated with extensive PE and right ventricular thrombus.
- Type A thrombi are morphologically serpiginous, mobile and associated with severe PE. Thrombolysis maybe indicated in this subgroup based on patient's haemodynamic status and in the absence of contraindications.
- Echocardiogram can be useful in early detection of RV thrombus to assess for PFO and facilitate the treatment decision.
- Apixaban has been proven to be non-inferior to warfarin and LMWH in patients with RVT and massive pulmonary embolism.
- Patients with younger age, heart failure, cancer, recent bleeding, syncope, hypotension and hypoxaemia were associated with an increased risk of RHT and carries worse prognosis.

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