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POINT OF CARE ULTRASOUND (POCUS) SAVES LIVES; A CASE REPORT. UTILITY OF POCUS IN DIAGNOSIS OF AORTIC DISSECTION

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Key words: aortic dissection, emergency department, PoCUS, point of care ultrasound

ABSTRACT

Thoracic aortic aneurysm and thoracic aortic dissection are related conditions that can present with non-specific symptoms and are associated with high morbidity and mortality therefore timely diagnosis is pivotal. Trans-thoracic echocardiography may detect thoracic aortic pathology and is increasingly performed by emergency physicians at the bedside. Point-of-Care Ultrasound can help to differentiate the causes of shock, chest pain and dyspnea.

We describe the case of a pulseless electrical activity arrest in cardiac tamponade resulting from an aortic dissection in which PoCUS assisted in diagnosis and treatment by pericardiocentesis in the emergency department.

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CASE REPORT:

In June 2016, a 63-year-old male with a past history of hypertension not treated, presented to Casey hospital non-tertiary emergency department (ED) (without coronary care unit (CCU), intensive care unit (ICU) or cardiothoracic unit). He complained of central chest pain radiating to his left arm without any back pain. On arrival, he was afebrile with a blood pressure (BP) of 148/78 mmHg, HR: 86 bpm, RR: 18.min^{-1}, O_2 Sat 98% on room air. His initial electrocardiography (ECG) demonstrated infero-lateral T wave inversion **(Figure 1)**. Because of his increased troponin he had a provisional diagnosis of non ST segment elevation myocardial infarction (NSTEMI), and was anti-coagulated with Enoxaparine (1 mg.kg^{-1}) and dual anti platelet therapy with aspirin 300 mg and Ticagrelor 180 mg.

While awaiting transport to CCU of a tertiary hospital within the network, he became hypertensive with a BP of 190/110 mmHg, restless and subsequently unresponsive with pulseless electrical activity (PEA) arrest. Resuscitation was initiated according to ALS guidelines. Point-of-Care Ultrasound (PoCUS) during cardiopulmonary resuscitation (CPR) **(Figures 2 to 6)**, demonstrated a large pericardial effusion containing debris, suggestive of haemopericardium with clots and significant right ventricle (RV) and right atrium (RA) compression consistent with cardiac tamponade. An aortic intimal flap in descending aorta was visualised and aortic dissection as the cause was diagnosed. The largest pocket of haemopericardium, over the apex was detected and ultrasound guided pericardiocentesis with an apical approach (instead of traditional subxiphoid), was performed.

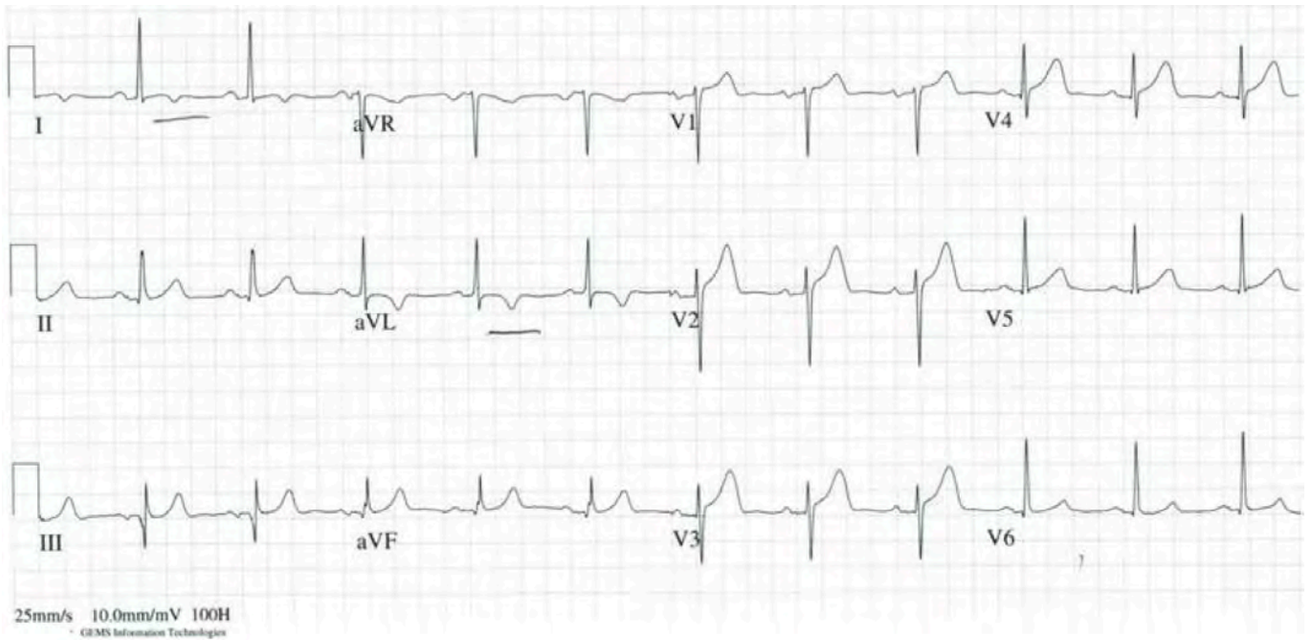

Figure 1: Initial ECG

Figure 2: Subcostal view of the heart and pericardium during cardiopulmonary resuscitation showing Pericardial fluid with debris suggestive of haemopericardium with clots ©PPouryahya

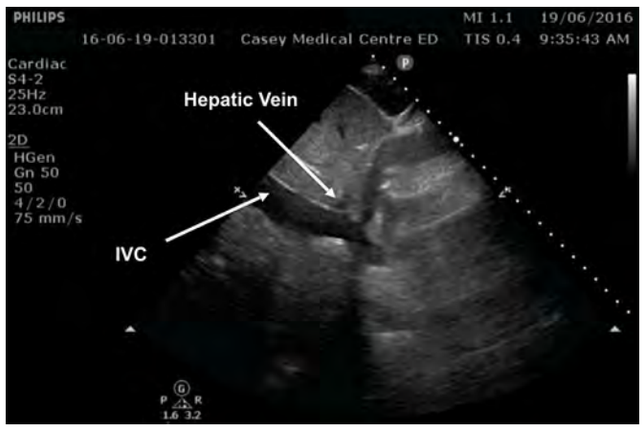

Figure 4: Subcostal view during cardiopulmonary resuscitation showing non-collapsible inferior vena cava and haemopericardium ©PPouryahya

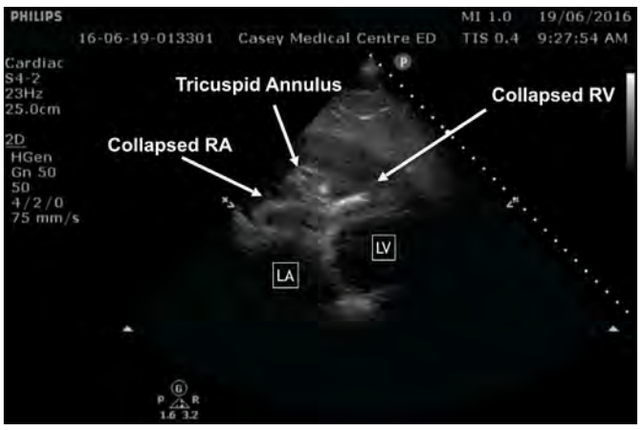

Figure 3: Subcostal view in diastole during cardiopulmonary resuscitation, demonstrating haemopericardium ©PPouryahya

Figure 5: Subcostal view during cardiopulmonary resuscitation showing descending aorta intimal flap ©PPouryahya

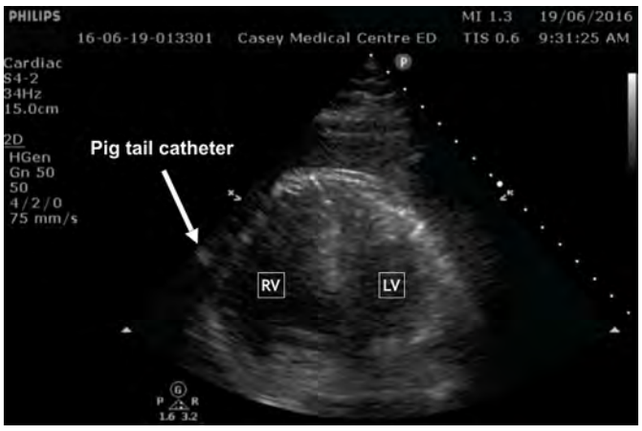

Figure 6: Apical view post pericardiocentesis and return of spontaneous circulation, demonstrating normal right ventricle size without echocardiographic tamponade ©PPouryahya

After draining of about 100 mL of bloody liquid spontaneous circulation was restored. A pericardial pigtail catheter with Seldinger technique was subsequently inserted. On telemetry, his EGC demonstrated ventricular tachycardia post pigtail catheter insertion, which reverted to sinus rhythm after direct current cardioversion (DCR) with a single dose of 100 KJ.

After further drainage of 200 mL of pericardial fluid repeat PoCUS showed absence of right heart compression.

De-identified videoclips of the PoCUS findings (within the Monash Health policies) were sent to the cardiothoracic team at our tertiary hospital and the patient was urgently transported to the operating theatre (OT) at this centre with ongoing pericardial drainage en-route because of accumulation of haemopericardium and resulting cardiac tamponade.

Without any other imaging modality, the patient underwent an emergency thoracotomy and pericardial window followed by repair of a type A aortic dissection with Dacron(r) graft and was subsequently admitted to ICU.

POST-OPERATIVE COURSE

Early progressive postoperative deterioration with low cardiac index, high lactate and very high inotropic and vasopressor requirement shortly happened after ICU admission. Trans-esophageal echocardiography (TOE) was performed and revealed moderate pericardial effusion and hematoma with RV and RA compression as well as a small effusion around LV and 2 cm hematoma around aortic graft. This required transfer back to OT for re-do sternotomy and evacuation of the hematoma. Six hours after his return to ICU, still in cardiogenic shock he was transferred back to OT for second re-do sternotomy, evacuation of remaining hematoma and ligation of a small pericardial artery as the cause. Sternotomy site was left open on transfer to ICU. His TTE in day two demonstrated concentric LV hypertrophy with brisk LV contraction with inotropicsupport, and moderate pulmonary hypertension. Subsequently his sternal wound was closed on day six.

Unfortunately, he suffered multi-system organ failure resulted from hiscardiogenic shock including:

- Ischemic hepatitis (Alanine aminotransferase (ALT) peak at 3000 $IU.L^{-1}$, Bilirubin > 300 $mg.dL^{-1}$, INR 1.9, without ultrasonographic evidence of cholelithiasis or cholecystitis).

- Acute kidney injury (ATN) with renal failure (Cr: 450 $\mu mol.L^{-1}$, Urea: 35 $mmol.L^{-1}$, eGFR: 11 $mL.min^{-1}$) requiring continuous veno-venous hemodialysis (CVVHD).

- Thrombocytopenia requiring hematological consult which was diagnosed as multifactorial secondary to consumption, dilution, hepatic injury, medications and possibly compensated DIC.

- Digital ischemiato the tip of fingersand toes with good peripheral pulses without ultrasonographic evidence of arterial occlusion, required vascular surgery consultation and was diagnosed secondary to high inotropic requirement.

During his ICU stay on day 14, he became febrile with suspected ventilator associated pneumonia (VAP) and was started on Vancomycin, Piperacillin-Tazobactam and Micafungin. The antibiotics were stopped after seven days post negative cultures and stable respiratory status. Subsequently after successful T-price trial on day 20, he was extubated on day 21.

He had poor neurological recovery with global weakness, particularly in his left lower limb with upper plantar reflex bilaterally. Despite his normal CT Brain his electroencephalogram (EEG) was suggestive of encephalopathy without epileptiform activities. Neurology team was consulted and diagnosed possible right frontal region infarct. However, on day 26, he demonstrated full neurological recovery on discharge from ICU to cardiothoracic ward without any focal neurologic deficit as well as complete recovery of ischemic hepatitis.

Ongoing renal failure, MAG3 nuclear renal scan was performed which was consistent with severe ATN. After nephrology consult, hemodialysis (HD) was planned, however, ultrasound prior to permacath insertion demonstrated internal jugular and subclavian vein non-occlusive eccentric thrombus at right subclavian central venous catheter (CVC) site. CVC was removed and he was started on heparin infusion.

After resolution of the thrombus, permacath was inserted and he was started on HD, however after complete recovery of his ATN and no further need for HD, permacath was removed.

He also was treated with Norfloxacilin in consultation with infectious disease (ID) team because of Citrobacter urinary tract infection (UTI) for two weeks prior to his discharge and remained asymptomatic subsequently.

He was discharged after 54 days of hospitalisation on Amitryptiline and Pregabalin, for management of his pain secondary to digital ischemia as well as antihypertensive medications with cardiothoracic, vascular surgery, nephrology outpatient follow-up.

In his first outpatient follow up with nephrology and cardiothoracic team he demonstrated normal renal function and controlled blood pressure, as well as stable thoracic aortic graft and discharged from their care.

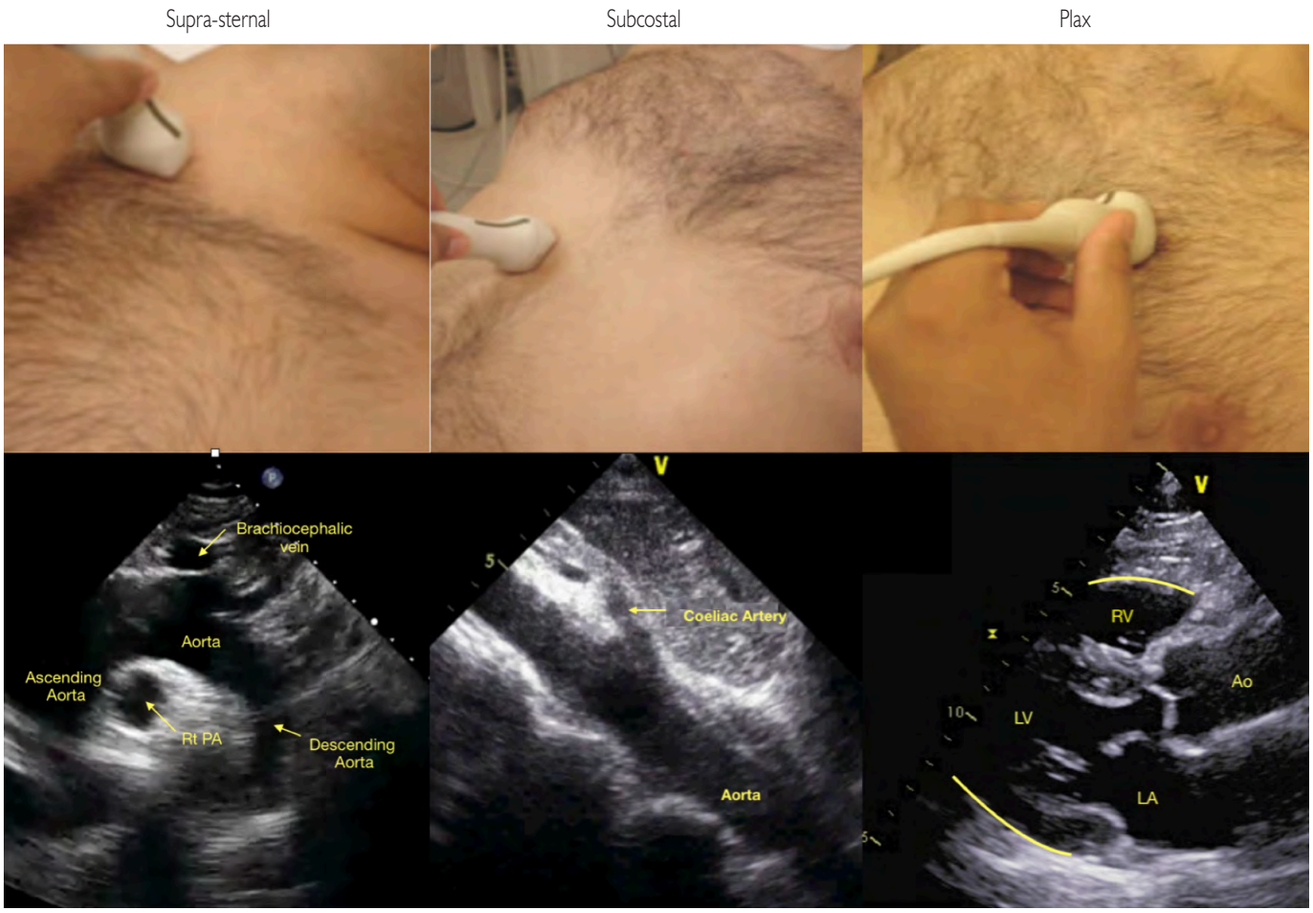

Figure 7: Recommended point-of-care ultrasound views for suspected thoracic aortic dissection ©PPouryahya

DISCUSSION

This case illustrates the utility of PoCUS to diagnose an aortic dissection and expedite further consultation and prompt management in a critically unwell patient and the distinct advantage of rapidly providing relevant information at the bedside. These interventions also negate the need to transfer critically ill patients to the radiology suite. Multiple studies have shown that ultrasound modalities such as echocardiography and lung ultrasound have significantly impacted on patient management in the ED.

Visualisation of an intimal flap by ultrasound may carry a sensitivity of 67-80% and specificity of 99-100% for dissection. This rapid, non-invasive method of diagnosis may aid in the early detection and treatment of this deadly diagnosis.

TTE cannot exclude aortic dissection however it may detect it if present and it significantly depends on the operator, as well as the type of dissection (Stanford A or proximal Vs Stanford B or distal).

To increase the accuracy of the PoCUS / TTE, we recommend three following PoCUS views if thoracic aortic dissection is suspected **(Figure 7)**:

- Parasternal long axis for proximal aorta
- Supra-sternal view for aortic arch
- Subcostal view for descending aorta

However, the subcostal view is the only practical view during CPR.

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