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# Cardiogenic shock due to acute severe ischemic mitral regurgitation

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## ABSTRACT

The reduction in patients presenting with ST-elevation myocardial infarction (STEMI) during the COVID-19 crisis could have resulted from fears about developing COVID-19 infection in hospital. Patients who delay presenting with STEMI are more likely to develop mechanical complications, including acute ischemic mitral regurgitation (MR). We present a 69-year-old woman with an inferior STEMI and cardiogenic shock due to acute ischemic MR who delayed presenting to hospital due to the fear of COVID-19. Early identification of this mechanical complication using transthoracic echocardiography in the Emergency Department enabled the team to target her optimisation. Ultimately these patients require urgent surgery to repair the mitral valve and revascularize the myocardium but they are often too unwell to undergo surgery and even when it is feasible the outcomes are poor.

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## 1. Introduction

Early reperfusion therapy for ST-elevation myocardial infarction (STEMI) has led to a reduction in mortality and limited the incidence of mechanical complications (0.27%), including intraventricular septal rupture, free wall rupture and ischemic mitral regurgitation (MR) [1]. Although uncommon, mechanical complications are responsible for significant morbidity and mortality and require prompt diagnosis and management [2]. Several observational studies have shown a steep reduction in acute myocardial infarction presentation and the number of percutaneous coronary intervention procedures during the Covid-19 crisis [3–5]. In England, during the first month of lockdown, there was a 43% reduction in the number of primary percutaneous coronary intervention (PCI) for STEMI compared to previous months and a concomitant increase in symptoms-to-hospital times and door-to-balloon times [6]. These observations are worrisome for a resurgence in the mechanical complications of STEMI. We report a case of a patient that had a several days history of chest pain presenting with cardiogenic shock during the COVID-19 lockdown.

## 2. Case description

A 69-year-old woman presented to hospital with a crushing chest pain for several days but was trying to avoid a hospital admission due to fears of acquiring Covid-19 infection. Her medical history included ischemic strokes and chronic obstructive pulmonary disease. On admission, she looked unwell and was hypotensive (BP 70/40 mmHg) and

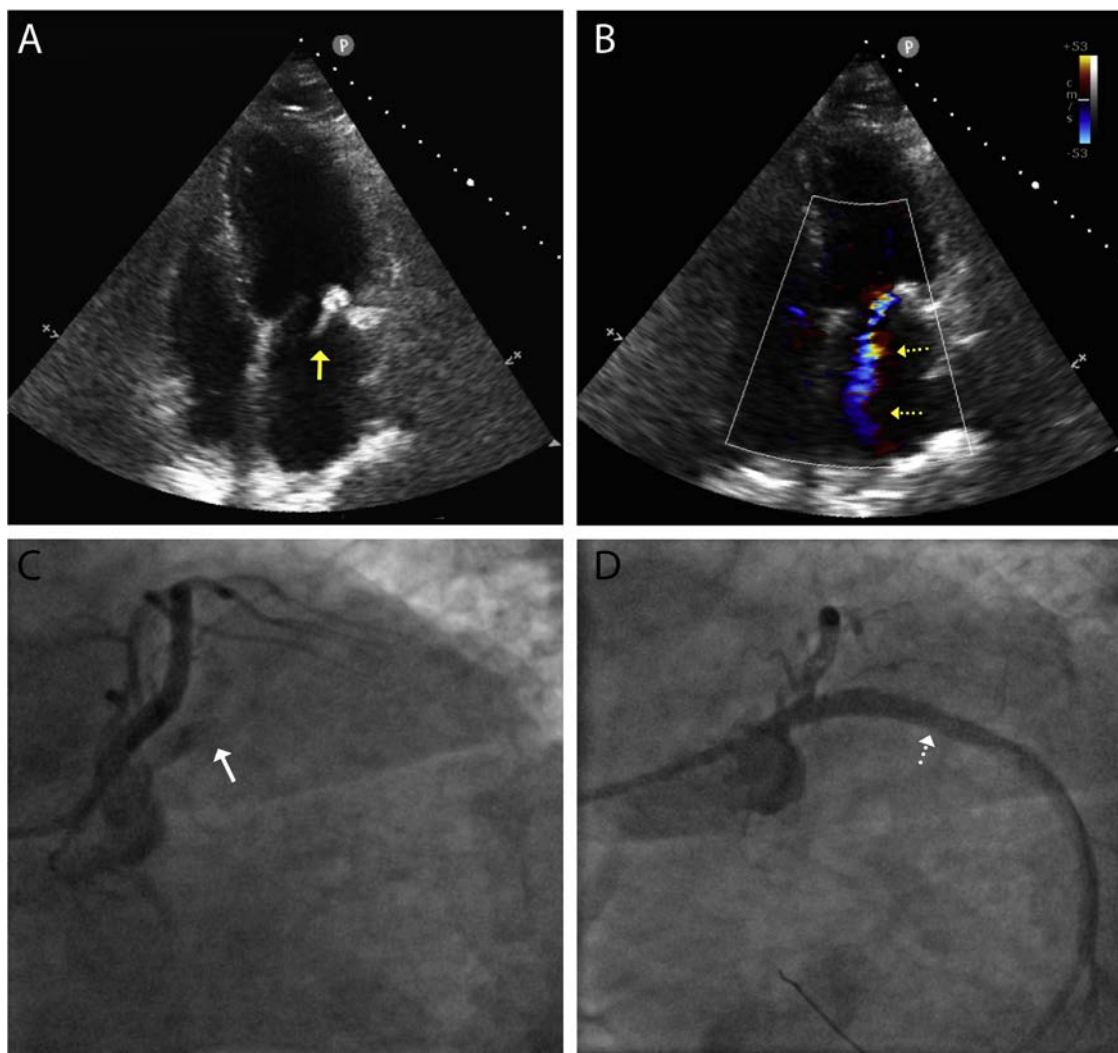
hypoxic (saturation 85% on air). Physical examination revealed a pansystolic murmur and bi-basal inspiratory crackles. Chest x-ray confirmed significant pulmonary oedema. Electrocardiogram showed sinus tachycardia with inferior ST-segment elevation in keeping with an inferior STEMI. In view of a loud pansystolic murmur and haemodynamic instability, an urgent bedside transthoracic echocardiogram was performed which revealed moderate left ventricular systolic dysfunction with inferior and posterior wall akinesis. Moreover, it showed a flail posterior mitral valve leaflet due to chordae tendineae rupture with associated severe MR (Fig. 1, Panel A and B; Video). An urgent cardiothoracic surgical opinion was sought. In the context of her significant co-morbidities, it was decided to perform percutaneous revascularization and stabilize the patient medically prior to cardiac surgery. An occluded proximal left circumflex artery was seen on coronary angiography and treated with a drug-eluting stent (Fig. 1, Panel C and D) and an intra-aortic balloon pump was inserted to improve haemodynamic status. However, patient's clinical status rapidly deteriorated requiring admission to intensive care unit for invasive ventilation. The patient developed multiorgan failure and died three days after admission.

## 3. Discussion

Acute ischemic MR due to papillary muscle or chorda tendineae rupture is rare (0.05%) but a serious complication which typically occurs 2–7 days following the initial ischemic event [1,7]. The posteromedial papillary muscle is more prone to an ischemic insult as it usually derives its blood supply from a single vessel (either right coronary artery or circumflex coronary artery) [8]. Acute ischemic MR often leads to cardiovascular collapse due to a reduction in stroke volume as a result of

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**Fig. 1.** A, Transthoracic echocardiogram (TTE) shows flail posterior mitral valve leaflet due to chorda tendineae rupture seen (yellow arrow) and moderate posterior mitral valve annulus calcification B, TTE shows an anterior directed jet of severe mitral regurgitation (yellow interrupted arrow). C, Coronary angiogram shows an occluded proximal left circumflex artery (white arrow). D, Coronary angiogram shows a drug-eluting stent successfully deployed in the left circumflex artery (white interrupted arrow) with excellent angiography result. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

blood being ejected into the left atrium during systole through the an incompetent mitral valve. Moreover, in a minimally enlarged left atrium, the sudden increase in left atrial pressures will result in pulmonary congestion. Thus, patients present extremely unwell with acute dyspnea, pulmonary edema and often in cardiogenic shock.

Physical examination may demonstrate a new holo-diastolic murmur heard loudest at the apex, but it may be absent in up to 30% of patients due to a large regurgitant orifice or low systolic blood pressure [9]. Therefore, the absence of a murmur on cardiac auscultation in patients presenting with cardiac sounding chest pain and severe dyspnea does not exclude mechanical complications of myocardial infarction and should prompt further investigations. Transthoracic echocardiography with color flow doppler in the emergency department is essential to confirm the diagnosis, assess severity and mechanism of mitral regurgitation, as well as exclude other causes of cardiogenic shock, such as ventricular septal rupture [2]. In papillary muscle rupture, a mobile triangular mass attached to a flail leaflet tip may be seen in prolapsing into left atrium. However, less impressive findings may be observed in partial papillary muscle rupture or chorda tendineae rupture, such as leaflet prolapse. The direction of the regurgitant jet on color flow doppler may provide important insights as to the etiology of the MR. [10]

Immediate treatment should focus on pharmacological (diuretics, vasodilators and inotropes) and mechanical strategies (intra-aortic balloon pump) to reduce afterload and, consequently, regurgitant volume and pulmonary edema, in order to stabilize patients prior to angiography or surgery [2]. Acute ischemic MR due to papillary muscle rupture or chorda tendineae rupture requires emergency mitral valve surgery and revascularization but carries a high operative mortality (20–30%) [11]. Without surgical correction, in-hospital mortality may be close to 80%; however, up to half of patients with severe ischemic MR are not offered a surgical option due to excessive surgical risk, hemodynamic instability and multi-organ failure [12]. Mitral valve replacement (bioprosthesis or mechanical valve) and coronary artery bypass graft has historically been the favored approach with robust data regarding outcomes and durability of the prosthesis. Nonetheless, mitral valve repair with reimplantation of the papillary and artificial chorda tendineae implantation has been reported and may be performed in experienced centers [13]. Finally, a minimally invasive, percutaneous edge-to-edge repair using MitraClip.

has been described in case reports and may be an option for those deemed too high-risk for cardiac but long-term outcome data are lacking [14].

## Contribution

ABG, JH conception and drafting of the manuscript. ABG and RS performed echocardiography and angiography. JH and RS reviewed and edited the manuscript. All authors gave final approval prior to submission.

## Declaration of Competing Interest

None declared.

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