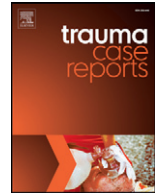




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Case Report

More than just a urinary catheter – Haemorrhage control by using a Foley catheter in a penetrating aortic root injury

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ABSTRACT

The prevalence of great vessel injuries in thoracic trauma is reported at 0.3–10%, predominantly due to a penetrating mechanism. Thoracic aortic injuries, more specifically those within proximity of the aortic root are challenging to manage and unceasing bleeding hampers adequate visualisation for performing repair. We report a case of a 31-year-old male that presented to the emergency department 1 h after sustaining a stab wound injury within proximity of the left upper sternal border. Vital signs were stable on presentation. Physical examination revealed a 1.5 cm laceration in the 3rd intercostal space. Chest X-ray revealed a small left pneumothorax, FAST scan was negative, and CT of the chest revealed left sided haemopneumothorax and haemopericardium. The patient was emergently transferred to the operating room where median thoracotomy was performed. A significant amount of bleeding was observed originating from a 1 cm laceration of the aortic root. Bleeding was controlled using a Foley catheter after unsuccessful attempts of digital compression, and the laceration was repaired using pledgeted sutures. Postoperative echocardiography and CT scan of the chest revealed normal cardiac functions with resolution of haemopericardium and haemopneumothorax, and the patient was discharged in a stable condition. High index of suspicion should be maintained for injury to the great vessels in patients with penetrating chest injuries, despite apparent haemodynamic stability. In this case, balloon tamponade using a Foley catheter served as a quick and simple technique that resulted in an almost bloodless field, facilitating adequate visualisation for definitive repair. Although the use of this technique has been previously described, this

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report serves as a reminder that a Foley catheter can be successfully used for balloon catheter tamponade in injuries to the aortic root.

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Introduction

From Galen's attempt to pack open chest trauma in gladiators, to modern day military experience with penetrating chest injuries, or the care provided at the top US metropolitan hospitals, mortality from penetrating chest injuries seems to have only marginally decreased [1]. The prevalence of great vessel injuries in thoracic trauma is reported at 0.3–10%, predominantly due to a penetrating mechanism [1]. Over the years, novel techniques have been described to achieve haemostatic control of penetrating cardiovascular injuries. A simple, fast, and readily available tool as a Foley catheter generally used to establish a flow, can ironically be used to halt a river's rapid stream extravasating from the highest pressurised system in the body, i.e. the aorta. Limited literature exists on repair of penetrating injuries to the thoracic aorta, more specifically, to the aortic root. We report the first case of haemorrhage control from a penetrating stab wound to the aortic root using a Foley catheter in a 31-year-old male.

Case presentation

A 31-year-old African American male presented 1 h after sustaining a knife stab wound injury within proximity of the left upper sternal border. He complained of progressive, moderate, left sided tearing chest pain, associated with shortness of breath. Past history was non-contributory. Social history was positive for drug and alcohol abuse. At the scene of injury, blood pressure was 80/55 mm Hg, and 1 L of normal saline was administered en-route to the hospital.

On examination, he was alert and in moderate painful distress. Heart rate was 96 bpm, and blood pressure was 155/130 mm Hg, with normal pulse oximetry. No jugular venous distention was appreciated. A 1.5 cm laceration in the left 3rd intercostal space was evident, with diminished breath sounds over the left basal lung field. Heart sounds were normal with intact peripheral pulsations. Initial serum haemoglobin was 11.9 g/dL with a normal baseline coagulation profile and a thromboelastography (TEG) analysis. A focused assessment with sonography for trauma (FAST) was negative. Plain chest x-ray revealed a small left sided pneumothorax. An emergent CT scan of the chest with contrast revealed left sided haemopneumothorax, and haemopericardium, without apparent extravasation of contrast (Fig. 1; A and B). The patient was immediately transferred to the operating theater. A left sided 36 F chest tube was inserted with expression of approximately 800 mL of bright fresh blood, that was subsequently clamped. Median thoracotomy was performed and a large clot was evacuated from the pericardial cavity, followed by a gush of bright red blood that appeared to originate from a 1 cm laceration of the anterior aspect of the aortic root. Blind suture placement could have jeopardised the left coronary ostium, and digital pressure could not achieve haemorrhage control. A 16 F silicon coated Foley catheter was inserted and advanced through the tear with partial inflation of the balloon using 5 cm³ of normal saline. The catheter was then pulled back resulting in a tamponading effect at the laceration site with successful achievement of haemorrhage control allowing adequate visualisation for repair (Fig. 2). Prolene 3-0 pledgeted sutures were used in a horizontal mattress fashion to repair the defect. The wound edges were retracted during repair allowing visualisation of the needle going through tissue and avoiding balloon penetration. The catheter was deflated and withdrawn as the final sutures were secured. Frank oozing was observed from the surrounding tissues raising suspicion for the development of coagulopathy. Approximately 3 L of blood was lost intraoperatively. Follow-up TEG analysis revealed an activated clotting time (ACT) of 121 s, maximum amplitude (MA) of 51.5 mm, and LY30 at 3.6%; a picture suggestive of trauma induced coagulopathy, necessitating initiation of our massive transfusion protocol. The patient's care was continued in the surgical critical care unit with gradual stabilisation of his condition. Postoperative echocardiography and CT scan of the chest were unremarkable, and revealed normal cardiac functions with resolution of haemopericardium and haemopneumothorax. The patient was discharged on postoperative day 11, continues to follow up on an out-patient basis, and is doing well at one year postoperatively.

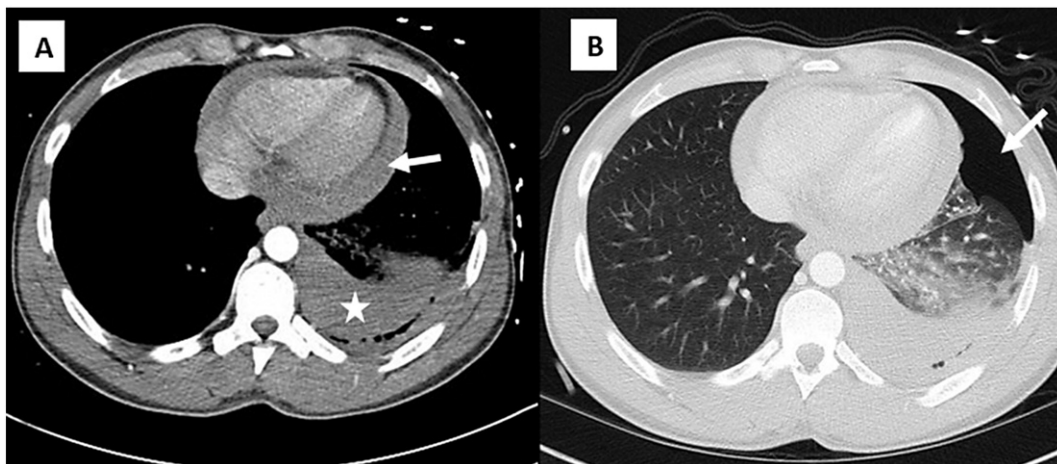


Fig. 1. CT of the chest with contrast showing (A) haemopericardium (white arrow) and haemothorax (star); (B) pneumothorax (white arrow).

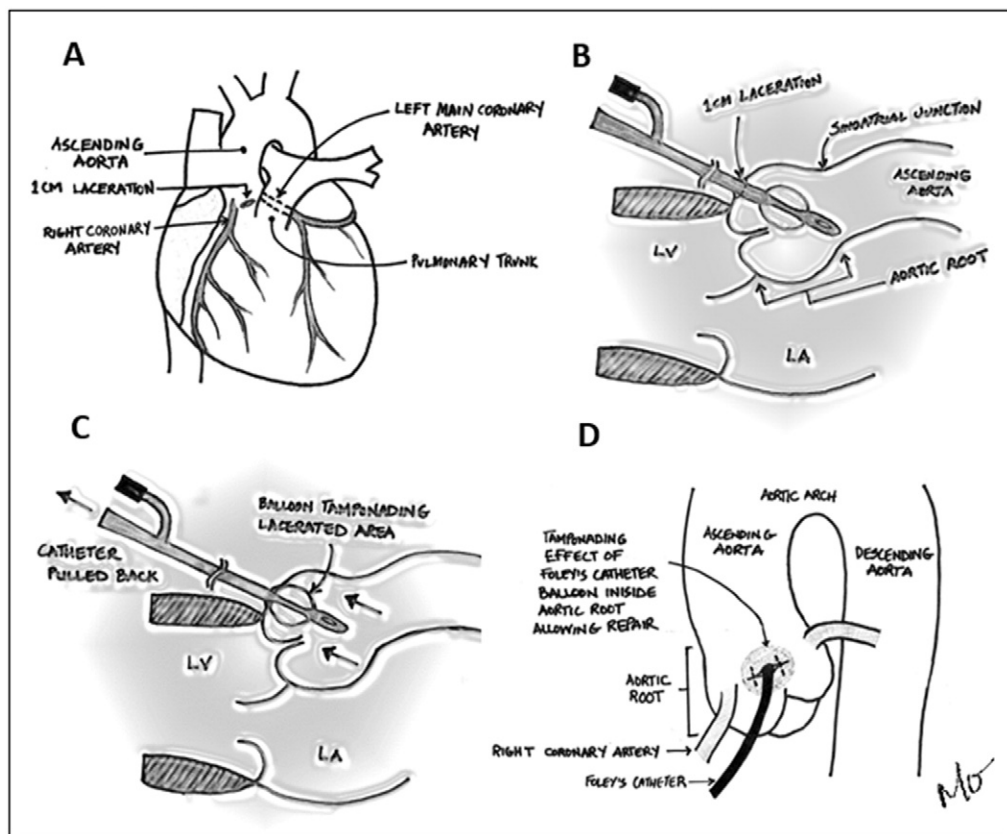


Fig. 2. Illustration demonstrating (A) anterior site of aortic root injury; (B) cut section showing insertion and inflation of Foley's catheter through the laceration and; (C) pull back of Foley's catheter resulting in tamponade effect at the laceration site allowing; (D) laceration repair (pledgets not shown).

Discussion

Thoracic trauma constitutes approximately 10–15% of all traumas and represents 1 in 4 trauma related fatalities [2]. The mortality rate in thoracic aortic trauma is reported at a striking 80–90% [3,4]. The scenario is almost dictated by a “fast and the furious” effect in that, those who have a shorter transit time to the trauma center potentially do better, and those who have more severe injuries typically lose the race. Most patients present in a haemodynamically unstable condition, however, the real diagnostic challenge exists when patients present ambulating with nonspecific clinical signs [3]. These patients may appear as the lucky ones, however, their course may deteriorate rapidly into an equally dramatic scenario.

Tension caused by haemorrhage into mediastinal supportive tissue results in a myriad of symptoms including retrosternal or interscapular pain, cough, dyspnoea and hoarseness [3]. Complications such as haemothorax and pneumothorax should be excluded, with close surveillance for the development of cardiac tamponade, even in patients who initially present with haemodynamic stability [5]. Plain chest x-ray may reveal mediastinal widening, haemothorax or pneumothorax [3]. CT has a diagnostic accuracy of approximately 98% for aortic injury and can aid in planning operative management [3]. However, CT should not delay management in patients with haemodynamic instability. Angiography represents the most accurate diagnostic modality, however is time consuming where minutes equal life [3]. In our case, initial haemodynamic stability and negative results of the FAST scan warranted our decision to perform the CT, which dictated immediate transfer of the patient to the operating theater.

Partial occluding clamps or inflow occlusion of the superior and inferior vena cava, has been used to allow for permissive hypotension facilitating repair of injuries to the ascending or transverse aorta [4]. In instances where placing clamps is not possible, balloon catheters have been described as an alternative.

In 1960 Taylor and Williams were the first to describe balloon catheter tamponade as a technique to control intraoperative bleeding. Ever since, several reports have described the use of Foley's and Fogarty catheters in cardiac and vascular surgeries [6]. Balloon catheters can be inserted at the site of the defect or immediately proximal to the site of injury followed by careful advancement and balloon inflation until haemorrhage is controlled [6]. This facilitates repair using pledgeted sutures which are tightened as the catheter is deflated and withdrawn. We did not encounter any previous reports in the English literature comparing the use of Foley vs Fogarty catheters in achieving bleeding control. Fogarty catheters however, have a narrower luminal diameter, thus may technically facilitate suturing and wound approximation around a smaller catheter shaft. In our case, only a Foley catheter was promptly available and yielded successful bleeding control. Cardiopulmonary bypass is infrequently obligatory in cardiovascular injuries unless injury to the coronaries has been sustained [7].

Conclusion

High index of suspicion should be maintained for injury to the great vessels in patients with penetrating chest injuries, despite apparent haemodynamic stability. In our case, intraoperative insertion and inflation of a Foley catheter through a 1 cm laceration in the aortic root achieved haemostatic control after failed attempts of digital compression. This technique was both quick and simple, and resulted in an almost bloodless field that facilitated adequate visualisation for definitive repair.

Conflict of interest statement

None.

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Nothing to declare.

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