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# Ball-Bearing Missile Embolization via Suprarenal Aorta

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Embolization of missiles following their penetration into the arterial system is an interesting and relatively unusual phenomenon. We present a case in which an explosion of a roadside bomb resulted in a penetrating wound of the suprarenal aorta.

The foreign body, a round metallic object (ball-bearing), although noted at the site of the aortic injury, disappeared after operative repair. It had embolized to the right common iliac artery and was detected by abdominal X-ray screening and

the disappearance of peripheral pulses of the right leg.

## Patient Description

A 30 year old man who was injured by a road mine explosion was admitted to the local area hospital. His blood pressure was 90/60 mmHg and pulse 130 beats per minute, and he complained of severe abdominal pain. The abdomen was rigid and no bowel sounds were heard. On auscultation, his chest was clinically clear with equal air entry on both sides.

Oxygen saturation was 99% with 4 L oxygen per minute. There were shrapnel wounds located over the lower anterior and posterior chest wall and the left upper arm. He was resuscitated and immediately taken to the operating room. Chest drains were inserted into both right and left pleural cavities. From the right side 1 L of blood was drained on insertion, followed by 200 ml over the next 90 minutes. No blood or air was drained from the left chest. At laparotomy, a ruptured spleen and perforated

small bowel were found, both of which were repaired.

Following surgery, the patient was transferred to our institution due to severe dyspnea. On admission, a chest computed tomography scan (with intravenous contrast injection) was performed to rule out the possibility of major thoracic vessel injury or any other chest pathology that might have been missed. A gastrografin swallow was also carried out, which showed no esophageal injury. The CT scan showed evidence of a persistent pneumothorax on the right side. Consequently, another chest drain was inserted on that side. Furthermore, in the region of the suprarenal aorta, a small para-aortic hematoma was noted, together with the presence of a foreign body near the origin of the superior mesenteric artery.

In consideration of a possible aortic injury, the patient was taken to the operating room. A left thoracoabdominal incision was performed that included the previous laparotomy incision, in order to gain maximal access to the suprarenal aorta. Medial visceral rotation was performed. Two lacerations were found in the aorta at the level of the superior mesenteric artery, one on the lateral and the other on the posterior aortic wall. After primary repair of the aortic lesions, we were unable to locate the foreign body. With the possibility in mind that embolization of the foreign body had occurred, the thoracoabdominal incision was closed and the patient placed on his back. Normal pulses were noted in the left leg, but were absent on the right side. X-ray screening showed a foreign body in the region of the right lower abdominal cavity. On reopening the abdomen, the foreign body was found obstructing the right common iliac artery at the level of its bifurcation. A transverse arteriotomy was performed and the foreign body removed.

The patient was discharged from hospital 18 days after surgery. During this period prolonged mechanical ventilation was required, and a tracheostomy was performed. On discharge the patient had a mild drop foot on the right side, possibly as a result of the ischemia. Follow-up 1 year later showed the patient to be well and active, with only a very mild disability as a result of the drop foot.

## Comment

Arterial embolization of foreign bodies is a relatively rare occurrence. Although sporadic reports have appeared in the literature during the years, the incidence of this phenomenon still remains rare. Michelassi et al. [1] reported an incidence of 153 cases up to the year 1988. These included both arterial and venous systemic embolizations, and covered a period of 154 years from when the first case was reported by T. Davis in 1834 of a wooden missile that embolized to the heart. Until 1996, only sporadic further cases had been reported. From 1960 to 1990, only 18 cases of penetrating injury to the thoracic aorta with missile emboli were reported [2].

There is an obviously preponderant male incidence, and as noted by Adegbeyegbe et al. [3], the incidence in the non-military situation is also growing as a result of increasing urban violence and the ease with which firearms can be obtained. The majority of these injuries are produced by low velocity weapons or shotguns. In our case there was an explosion of a roadside bomb that contained small round metallic objects (ball-bearings).

Clinically, it is important to document the number of entrance and exit wounds and to ensure that there is a correlation between them. If there are fewer exit wounds than there should be and the foreign body cannot be found in the region of the trauma, a presumptive diagnosis of missile embolism should be considered. The same applies if X-ray studies fail to show the foreign body in the related area of injury. Although in our patient the foreign body was noted on X-ray and CT scan, it could not be found after surgical repair of the aorta. In these situations it is very important to be aware of the possibility of embolization having occurred. In fact, it may be advisable to do a whole-body X-ray survey in gunshot wounds of the chest and abdomen. Aortography has been the gold standard for the diagnosis of aortic injury. However, this modality is being rapidly replaced by contrast enhanced CT scanning, which is a reliable diagnostic method for these types of injuries.

Missile emboli may be symptomatic or asymptomatic. Michelassi et al. [1] de-

scribed an incidence of 80% being symptomatic, 66.7% presenting with peripheral ischemia, and 13.3% having a neurologic defect. Our patient was symptomatic in that there were no peripheral pulses and he had a drop foot. It is obvious that symptomatic peripheral arterial missile emboli should be removed. Asymptomatic ones should also be removed since they may result in serious sequelae at a later stage. Adegbeyegbe and colleagues [3] described a case in which a bullet fragment embolized to the popliteal artery and later migrated further into the posterior tibial artery, with consequent vascular insufficiency requiring a lower extremity amputation 14 months after a penetrating gunshot wound to the abdominal aorta.

Less serious but nevertheless resulting in delayed symptomatology is the case described by Rich et al. [4]. This patient developed intermittent claudication of his right leg, having had a delay of 2 months between his injury and the removal of the peripheral arterial embolus. Removal of a missile embolus should, if at all possible, be done by means of arteriotomy overlying the foreign body. However, when this is not possible, embolectomy may be performed. It should be noted that embolectomy can cause intimal damage because of intraluminal manipulation of a foreign body.

Mortality associated with this condition is high. This may also be related to the associated injuries, as in our patient who had pulmonary contusion and splenic and small bowel injury and required prolonged mechanical ventilation and tracheostomy. It has been stated that the overall mortality rate for gunshot wounds penetrating the aorta is 50–70%. Demetriades et al. [5] reported a mortality rate of 87.5%. This highlights the necessity for early diagnosis and prompt treatment.

It is essential that physicians be aware of the possibility of embolization of these missiles, as this may worsen the prognosis even further. As stated by Shen and associates [2], the addition of a confounding variable such as a migratory intravascular bullet presents a formidable challenge for even the most experienced trauma centers.

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