Case report

External iliac artery injury secondary to indirect pressure wave effect from gunshot wound

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A B S T R A C T

In patients presenting with gunshot wounds, a high clinical suspicion of injury to vasculature and viscera remote from the projectile track is paramount. We present a case of a 17 year old male who sustained a gunshot wound to his abdomen and subsequently developed a right external iliac artery contusion requiring surgery as an indirect effect of the pressure wave from the bullet.

Introduction

Gunshot wounds (GSW) to the abdomen carry a high morbidity and mortality rate. Injury to abdominal viscera is common. However, there are few cases that report indirect injury as a result of the pressure wave effect created by the bullet. Even fewer cases exist for which indirect pressure wave injury resulted in the need of open surgery.

Case report

A 17 year old boy was brought into our major trauma centre, who sustained a single close range (2 m) gunshot wound (unknown calibre) to the left upper quadrant of his abdomen. No exit wound was noted. On clinical examination, the patient had a palpable but weak (compared to the contralateral side) right femoral and popliteal pulse with absent pedal pulses that were easily palpable on the left. His right foot was cold with a poor capillary refill.

The patient was resuscitated based on Advanced Trauma Life Support guidelines and our own major trauma protocols. A contrast CT scan encompassing his chest, abdomen, pelvis and lower limbs was then performed, which demonstrated multiple bowel injuries as well as intraperitoneal free fluid consistent with blood, possibly arising from the superior mesenteric artery territory. A non-occlusive luminal irregularity of the right external iliac artery and a small calibre right femoral artery were also noted. The single bullet was found lodged in the right ilium, in close proximity to the right iliac artery with no signs of contrast extravasation (Figs. 1–2).

The patient immediately underwent an exploratory emergency laparotomy. The origin of the bleeding was found to be a mesenteric vessel, which was subsequently ligated. There were multiple bowel injuries, which were all closed and stapled off in a “damage control” manner. The retroperitoneum was opened, exposing the right external iliac artery, which demonstrated significant bruising and damage along its length despite the arterial wall maintaining its integrity.

A right iliofemoral bypass with reversed great saphenous vein was performed on the patient. Following this, the damaged external iliac artery was ligated proximally and distally. There were
no postoperative complications and on examination a day after surgery, the patient had a warm and well-perfused foot. Doppler examination showed triphasic signals over the posterior tibial artery and biphasic signals over his anterior tibial artery. Unfortunately, the patient did not return for any follow-up after the operation, and thus no subsequent information is available.

Discussion

In patients with GSW, the range of injuries is not limited to the track of the projectile. Kinetic energy transfer from the bullet to adjacent tissues can cause diffuse disruption in tissue morphology and subsequent injury to vessels and viscera remote from the point of entry. Multiple factors affect the amount of kinetic energy released from a fired projectile. These include the initial velocity of the projectile, projectile shape, angle of the yaw upon impact, and type of the impacted tissue. The subsequent cavitation effect produced by a travelling projectile causes displacement of tissues surrounding its path and the kinetic energy dissipated may extend up to 7 cm from the missile track. This destructive energy has the potential to cause organ injury far from the track of the projectile. Thus, patients who sustain GSW may have vascular injuries remote from the visible point of entry and track of the projectile. Indirect vascular injury after GSW has been documented in the literature and is not limited to only the vasculature. Multiple reports of indirect injury to colon, spinal cord as well as other viscera has been described.

A high clinical suspicion of injury to vasculature and viscera remote from the projectile track is paramount in patients presenting with GSW. Our case report demonstrates the devastating nature of GSW and the indirect trauma that can arise secondary to the “pressure wave effect” in the vicinity of the projectile path, which compromised flow through the right external iliac artery in the patient despite the arterial wall integrity being maintained.

References

1. Fackler ML, Bellamy RF, Malinowski JA. The wound profile: illustration of the missile-tissue interaction. J Trauma. 1988;28:S21–S29.
2. Dana SE, DiMaio JM. Gunshot trauma. In: Payne-James J, Busuttil A, Smock W, eds. Forensic Medicine: Clinical and Pathological Aspect. London: Greenwich Medical Media Ltd; 2003:155–156.
3. An TL. Fatal thrombosis of internal carotid artery following minor blunt trauma to the neck. J Forensic Sci. 1989;34:699–702.
4. Mastaglia FL, Savas S, Kakulas BA, et al. Thrombosis of the internal carotid artery after closed head injury. Proc Aust Assoc Neurol. 1971;8:93–100.
5. Webster C, Mercer S, Schrager J, et al. Indirect colonic injury after military wounding: a case series. J Trauma. 2011;71:1475–1477.
6. Goonewardene SS, Mangat KS, Sargeant ID, et al. Tetraplegia following cervical spine cord contusion from indirect gunshot injury effects. J R Army Med Corps. 2007;153:52–53.