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Case Report

Firearm injury to the left buttock with uterus penetrating trauma ☆,☆☆

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ABSTRACT

A multispecialty trauma team must provide care for pelvic gunshot wounds (PGW) due to the high risk of associated morbidity and mortality, the high density of organs that might be wounded within the pelvis, and the potential consequences of these complicated injuries. We present a case of a 59-year-old woman hemodynamically stable with firearm injury to the left buttock. CT examination showed free air in the peritoneal cavity and in the retroperitoneum and a focal contrast extravasation within the uterine fundus. The patient underwent urgent laparotomy that revealed triple bowel perforation (sigmoid colon, medium rectum, ileum) and a laceration of the posterior and anterior uterine wall at level of the cervix with no signs of active bleeding. The bullet was lodged above the peritoneal reflection, in the right pelvis, and it was removed, and handed over to the judicial authority. The perforated bowel segments were resected with Hartmann's procedure and ileal anastomosis. The uterine laceration was repaired. Although all the viscera and the structures along the trajectory can be harmed, pelvic gunshot wounds have the potential to inflict serious injury. Nongravid uterine traumas are a unique occurrence, and proper care requires an understanding of lesion grading. Finding the gynecological lesion in female patients is essential to receiving the best care and protecting the reproductive system.

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Introduction

Pelvic penetrating trauma represents a diagnostic and therapeutical challenge because of injuries of both intraperitoneal and extraperitoneal structures (part of the small bowel, colon, rectum, bladder, nervous, and genital structures) and the possibility of vascular lesions that rapidly affect hemodynamics [1,2]. Nongravid penetrating uterus traumas an exceptional event and they are usually associated with other multiple organ injuries in blunt trauma. In penetrating trauma, the reproductive system may be trespassed by the bullet and the knowledge of injury's grading and lesions assessment is necessary to achieve the correct management [3]. Herein, we report a case of a 59-year-old woman with pelvic gunshot trauma.

Case report

A 59-year-old woman was brought to the emergency department with a firearm injury to the left buttock. She was hemodynamically stable and conscious. She had no comorbidities or previous surgery. At physical examination, there were no signs of peritoneal irritation, no abdominal pain, no hematuria. All laboratory findings were unremarkable. At physical examination, the entry bullet wound was visible in the left gluteal region, but no exit wound was found.

Multidetector computer tomography of the abdomen and pelvis was performed with and without contrast. The examination was performed in the 4-phase protocol, before and after contrast administration (Iomeron 370-400 Bracco, Milan, Italy, injected at 3.5/4 mL/sec): unenhanced, arterial, portal venous and delayed phases, using a Dual Source CT (Siemens Somatom).

On CT imaging, the bullet was visualized in the right pelvis determining severe beam-hardening artifact. Foci of gas and surrounding stranding within the subcutaneous fat in the left gluteal region were identified on CT with defect of cutaneous planes, confirming the entry wound (Fig. 1). The bullet's trajectory was delineated form the left gluteal region into the right pelvis with a resulting pelvic hematoma. The bullet was close to the iliac vessels and confident exclusion of vessels injury was not possible but active bleeding was not detected. No pelvic fractures and bullet's fragment were detected. The bullet's trajectory analysis was determined at CT using CMPR (curved multiplanar reformation) reconstructions. CT MPR reconstructions allowed to highlight the bullet's longitudinal course, form the left buttock (entry point) and the path through the rectum, at the level of its extraperitoneal part, the uterus, the sigmoid colon and the ileum (Fig. 2).

There was evidence of free air in the peritoneal cavity (Fig. 3) and in the retroperitoneum (Fig. 4); in addition, there was a mesenteric hematoma adjacent to the small bowel (Fig. 3). Based on these CT findings an intra-ed extraperitoneal bowel perforation was suspected.

Along with the intestinal injuries, there was also a small, linear area of hyperattenuation within the uterine fundus that was linked to a hematoma in the Douglas pouch and suggested uterine vascular injury (Figs. 5 and 6).

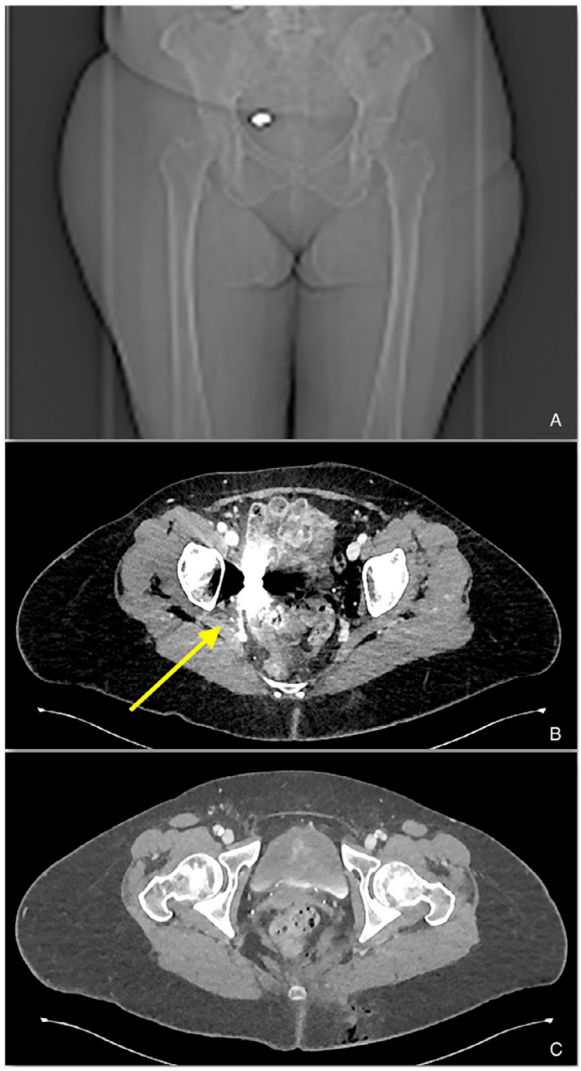

Fig. 1 – (A-C). Frontal CT scout view (A) and axial CT images enhanced with intravenous contrast (venous phases) of the bullet's location and entry wound. The bullet was lodged in the right pelvic sidewall, determining severe beam-hardening artifact (yellow arrow). Foci of gas and surrounding stranding within the subcutaneous fat were detected in the left gluteal region associated with the defect of the cutaneous plane, indicating the entry wound.

A laparotomy was done in an emergency. Three bowel perforations were discovered during the laparotomy, 1 meter from the ileo-cecal valve in the sigmoid colon, one on the extra-peritoneal portion of the medium rectum, and one in the ileum connected to a tiny amount of hemoperitoneum. There were no indications of active bleeding when the uterine wall was lacerated longitudinally (3 cm whole thickness) at the level of the cervix. The bullet was lodged above the peritoneal reflection, and it was removed and handed over to the judicial authority (Fig. 7). The rectum, the sigmoid colon and the ileum were resected, and Hartmann's procedure and ileal anastomosis were performed; the uterine laceration was repaired.

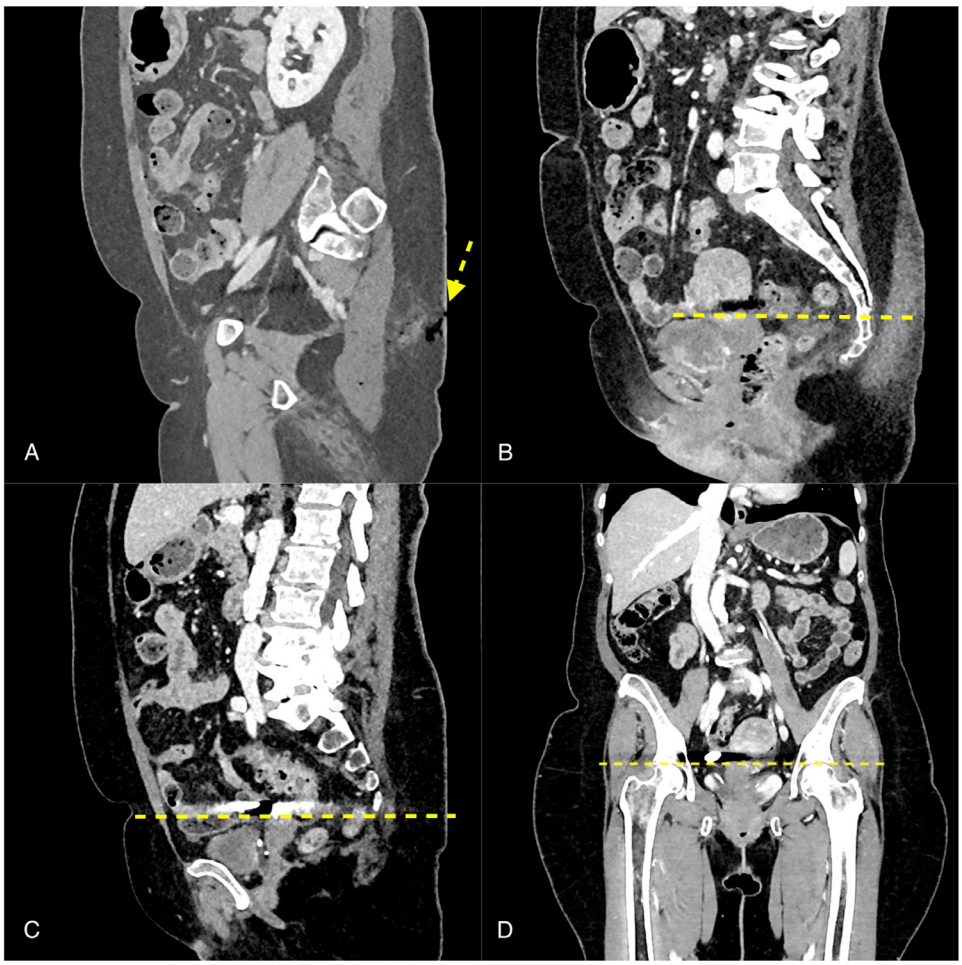

Fig. 2 – (A-D) Sagittal CT scout show bullet's trajectory analysis and its track (dashed yellow line): (A) the entry wound in the left gluteal region (yellow arrow) and (B, C) its progression through the uterus (dashed yellow line), the sigmoid colon and the ileum (dashed yellow line). (D) Curved coronal MPR view reconstructions of the bullet's trajectory analysis and its track (dashed yellow line).

Despite the presence of bullet close to the iliac vessels, no vessel injury was appreciated. There was no injury to the other abdominal viscera.

The postoperative course was uneventful without complications and the patient was discharged from hospital on the 21st postoperative day.

Discussion

Pelvic traumas from civilian gunshot wounds are the second cause of injury-related deaths in adolescent after vehicle accidents [4,5] and often require emergent surgery for vascular, visceral, and urogenital injuries [4,6,7]. Transpelvic gunshot wounds represent a unique diagnostic and therapeutical challenge that requires an emergent multidisciplinary management [7].

Physical examination starts by inspection of the skin surface to identify the entry and exit wounds and determining the number of bullets [6]. Physicians who treat patients in emergency rooms and surgeons should be aware that preliminary clinical examinations can yield incomplete or deceptive results. Although subcutaneous adipose tissue and complex anatomy of pelvic musculoskeletal structures act as a shield to pelvic structures, gunshot wounds may determine visceral and vascular injuries.

Pelvic traumas from civilian gunshot wounds are the second cause of injury-related deaths in adolescent after vehicle accidents [4,5]. These wounds frequently necessitate emergency surgery to treat vascular, visceral, and urogenital injuries [4,6,7]. Gunshot wounds to the transpelvic area provide a distinct diagnostic and treatment challenge that necessitates immediate interdisciplinary attention [7].

The physical examination begins with a skin surface check to determine the number of bullets [6] and to identify the entry and exit wounds. Emergency room doctors and surgeons should be mindful that first clinical evaluations can produce misleading or insufficient results. Gunshot wounds may cause visceral and vascular damage, even though the complex anatomy of the pelvic musculoskeletal tissues and subcutaneous adipose tissue act as a shield to pelvic structures.

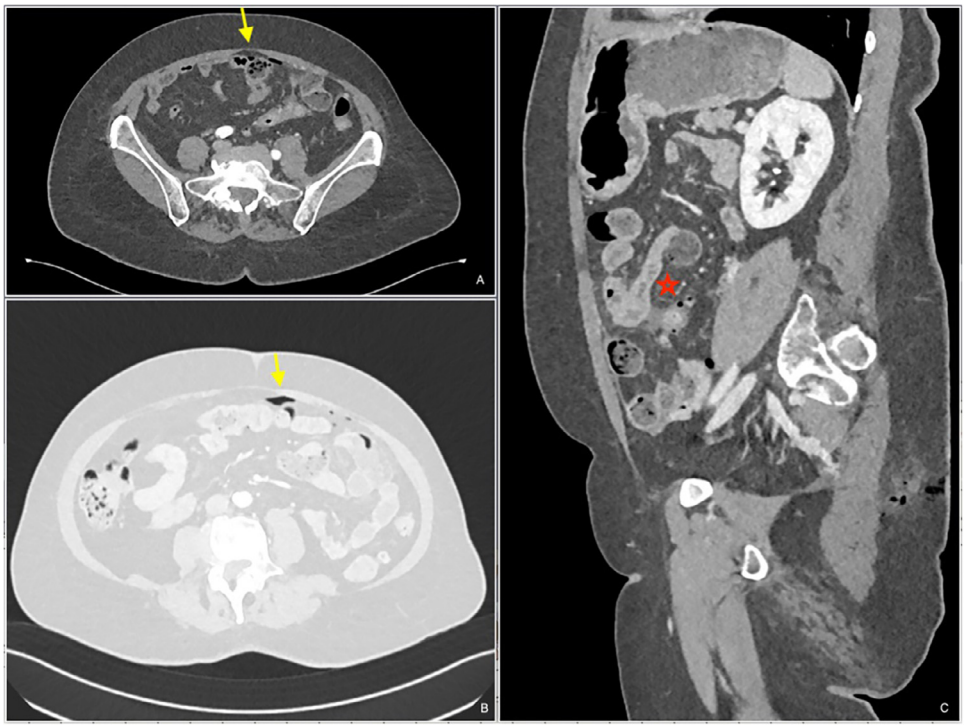

Fig. 3 – (A-C). Axial (an arterial phase, [B] lung window) and sagittal (c) CT images. Small air bubbles (yellow arrows) were detected close to anterior peritoneal reflection. An hyperdense pocket of fluid was appreciated close to a small bowel loop (star). Findings were diagnostic of bowel perforation.

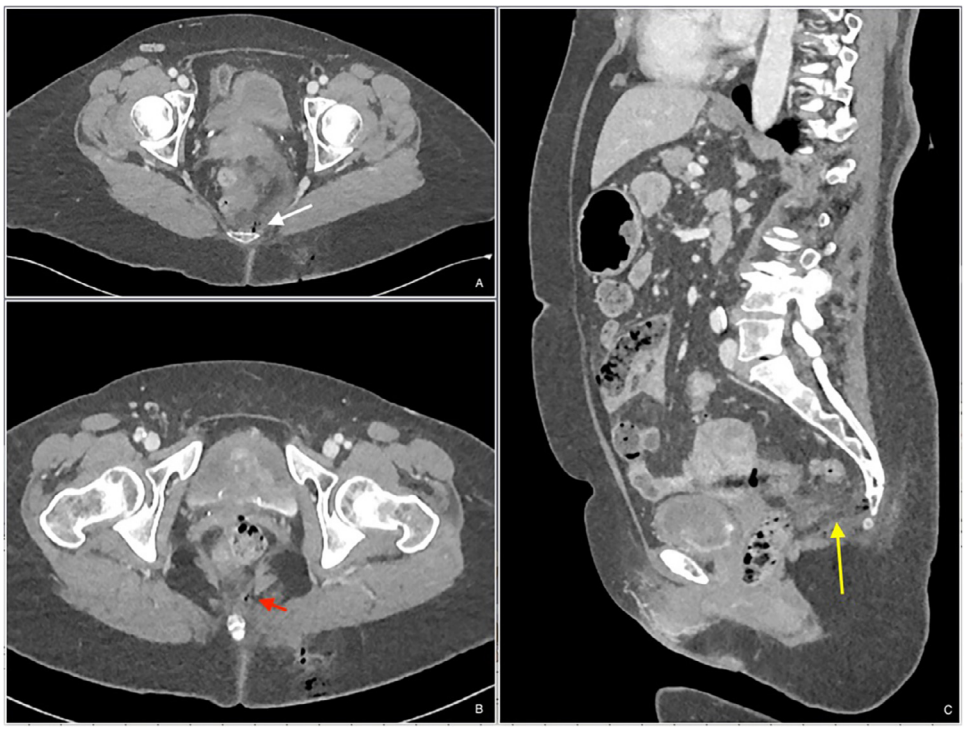

Fig. 4 – (A-C). Axial CT images (parenchymal phase). The air within the entry wound extended into the retroperitoneum in presacral space (A) (white arrow) and at level the lateral border of the elevator ani muscle (B) (red arrow). Perirectal fat stranding was appreciable (yellow arrow). CT findings were suggestive of extraperitoneal rectal perforation.

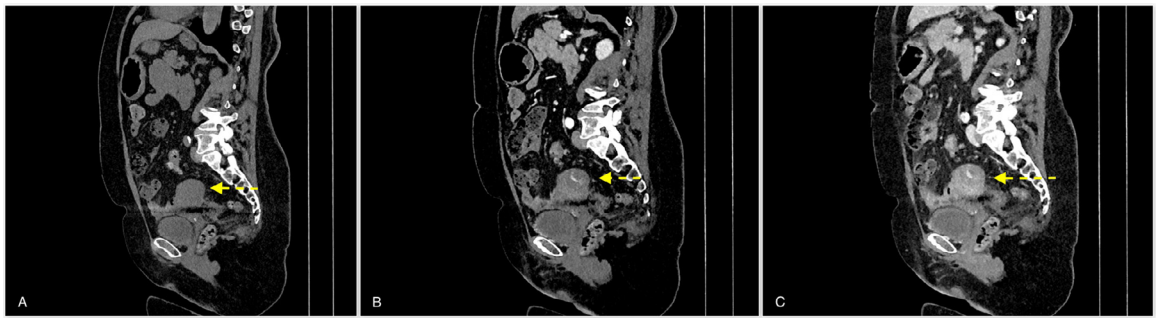

Fig. 5 – (A-C). Sagittal unhananced fase (A), arterial phase (B) and portal venous (C) phase CT images show a focal and tiny area of blush at level the uterine fundus, compatible with vascular injury; The absence of hyperattenuating material on noncontrast images (A) (yellow arrow) in the same location of contrast extravasation on postcontrast images (B, C) (yellow arrows) helped us to confirm active bleeding. This finding was no appreciated at exploratory laparatomy.

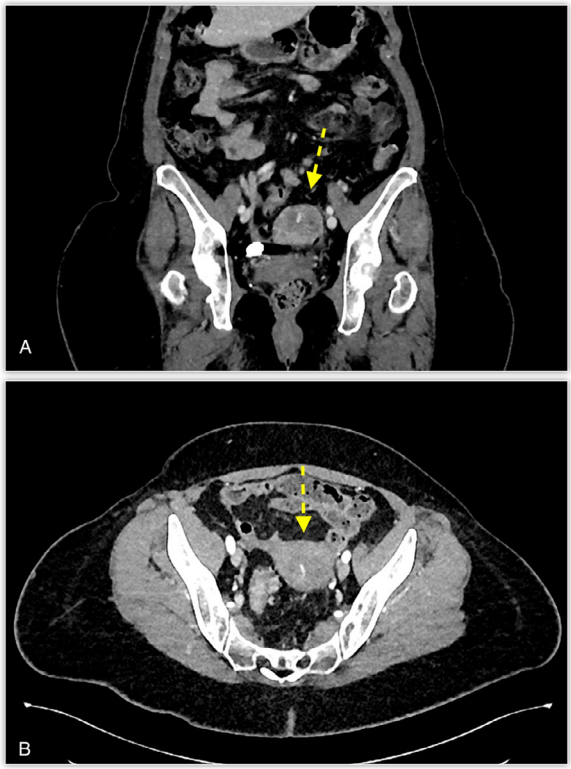

Fig. 6 – (A, B). The intra-uterine bleeding was visualized on CT using axial (A) images and on CT images was visualized curved coronal MPR (B) (yellow arrows).

Pelvic structures are extremely close with intraperitoneal and extraperitoneal location, making the evaluation of this region quite difficult with significant risk of potentially life-threatening outcome [8].

Lunevicius et al. [9], in an analytical review of 664 cases of penetrating buttock trauma, demonstrated that 95.4% of patients were young males and that bleeding and penetrating lesions of small bowel, colon, or rectum were the most common injuries. Chong et al. [10] in a recent systematic review attempted to fill the gap that exists in the literature on penetrating injuries to the perineum and associated pelvic organs in the civilian setting, demonstrating that the anus-rectum, bladder, and scrotum are frequently injured with associated vascular injuries reported in 7.8% of patients. Chong et al. [10] reported that the injured organs in order of frequency were the small intestine (36.1%), colon (21.2%), anorectal (69.4%), bladder (32.4%), scrotal (27.7%), penile (20.8%), and testicular (16.9%). Clinicians face a great deal of difficulty while treating penetrating perineal trauma in the civilian population because of the possibility of multisystem injury, which necessitates the collaboration of various medical and surgical specialties [10]. The development of severe hemorrhagic shock, gross peritoneal contamination, multiple visceral injuries, delay in diagnosis and treatment, is cause of increased morbidity and mortality, accounting for one-half of associated deaths [11].

In unstable patients primary survey (X-rays and FAST ultrasound) may be performed prior to emergency laparotomy, although ultrasound accuracy is low in determining free fluid in the retroperitoneal spaces and generally ultrasound sensitivity is limited in abdominal penetrating trauma [12].

As CT is fast, easily accessible, and has high sensitivity and specificity for identifying and describing traumatic injuries, it is the best imaging modality for acute evaluation of gunshot injuries to the abdomen and pelvis [6,13–18].

Through its excellent anatomical and spatial resolution, it can clearly identify the viscera that are implicated, guiding stable patients toward either nonsurgical or operational treatment. It is not recommended, therefore, for patients who are hemodynamically unstable; in these instances, CT imaging should wait until the patient is stabilized, or alternative techniques of assessment should be used.

Faster acquisitions with use of the multidetector CT scanners, and more recently dual-source and dual-energy CT scanners, have expanded its role to even include select patients with a degree of hemodynamic instability immediately before surgery [19,20].

CT imaging protocol in penetrating pelvic trauma region is not so well defined [21,22]. The use of oral and rectal contrast in acute settings is still under debate and a recent meta-analysis of Alabousi et al. [23] did not support the use of enteric contrast media in penetrating trauma and this result were endorsed by the World Society of Emergency Surgery (WSES) [24].

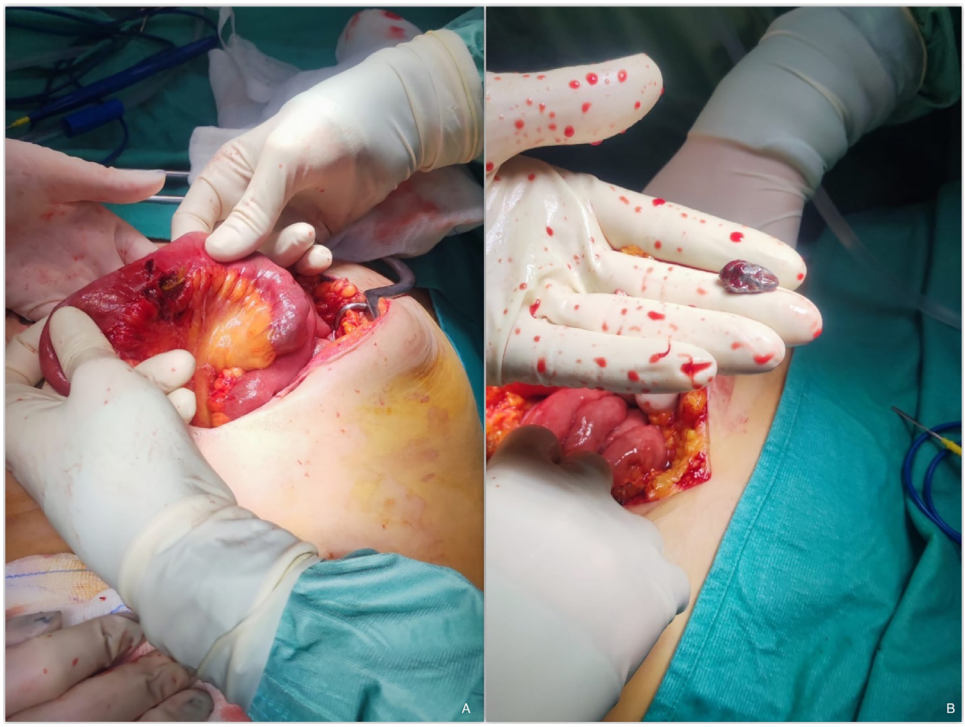

Fig. 7 – (A, B). Intraoperative photograph of the ileum gunshot injury (A) and the bullet extracted (B) showing ileum perforation.

MRI has a limited role in gunshots penetrating trauma due to its limited availability in acute penetrating trauma setting, the speed of evaluation, and safety and concerns related to the presence of metallic ballistic fragments [25]. In addition, multiple diagnostic second line imaging are available, such as urethrocystography, rectosigmoidoscopy to assess visceral damage.

Radiologists may encounter a ballistic injury during their careers, an understanding this unique mechanism of injury and its complications is necessary for imaging interpretation and patient care [7,26].

CT trajectory analysis is the first step but radiologist should consider that the trajectory is not linear in most cases because of the interaction between the bullet and tissue that can modify its speed and direction, moreover it may fragment due to impact with bone segments [4]. Trajectography CT images, generated in nonstandard planes along the wound tract, are highly accurate in the detection, localization, and delineation of penetrating injury [7]. CT report should include bullet trajectory, the location of the retained bullet and presence and location of fragments.

All the organs and structures along the bullet trajectory may have been affected by shock waves created around that path and images should be carefully analyzed [13].

Although a deep analysis of CT image, CT diagnostic accuracy in penetrating trauma is high for solid organs instead the detection of hollow organ and diaphragmatic wounds remains a challenge with a risk of over- and underdiagnosis [27].

At our institution, the trauma team is activated for every major trauma, blunt or penetrating and there is no "one-size-fits-all" protocol for trauma. The trauma CT protocol is tailored to the patient and in our experience we found this extremely important especially in gunshots trauma where additional phases may be required at the time of examination (CT cystography, vaginal distension [3], rectal or oral contrast). The CT protocol and images are discussed during the acquisition in the control room between radiologist, surgeons, urologist, vascular surgeons, orthopedics, and anesthesiologists in order to the define CT trajectory and need of additional scan.

We begin with a noncontrast scan and subsequently with contrast-enhanced CT scan of abdomen and pelvis. To better screen for parenchymal injuries, imaging of the abdomen and pelvis is done relatively early in the portal venous phase, and throughout the arterial phase to assess for vascular injuries. Although it comes at the "cost" of increased radiation exposure to the patient, performing both the arterial and portal venous phases of CT increases the interpreting radiologist's confidence and improves the detection of active bleeding and its source(s), as well as revealing other vascular injuries and parenchymal injuries. The acquired images are then immediately reviewed by the attendant radiologist on the scanner's work terminal, and delayed phases are added as needed. These can include a 6-8-min delayed urography phase if the projectile passes close to the expected course of a ureter (or through a kidney) or CT cystography in case of hematuria or of findings suspicious for bladder injury. There has been much debate as regards the administration of oral and rectal contrast in patients with penetrating trauma [28,29], at our institution, oral and rectal contrast are not routinely administered, and the decision to administer rectal contrast is made on a case-by-case basis in consultation with the trauma surgery team.

In our case, the entrance hole was located in the left buttock as demonstrated by the defect of cutaneous plane and the diffuse presence of air, subcutaneous and intramuscolar with dissection of the muscles of the posterior compartment of the pelvis (maximus glueus).

CT reconstructed images in nonstandard planes allowed to identify the bullet's trajectory: the trajectory was linear and followed a tangential path progressing between the rectum, at the level of its extraperitoneal part, and uterus, crossing the sigmoid colon and the ileum, and lodged in the right pelvic side wall, above the peritoneal reflection.

Our case demonstrated as the extension of bowel perforation was not underestimated because the presence of air in intra- and retro-peritonal spaces was indicative of a perforated retro- and intra-peritoneal viscus organ and the preoperative CT findings correlated well with intraoperative findings for all perforations sites except sigmoid colon that was not assessed at CT. Free air in the peritoneal cavity, hematoma in the mesenteric fat adjacent to the small bowel, and the location of projectile in close proximity to the ileum was strongly suggestive of ileal perforation. Likewise, the air extending from the buttock and continuing into the retroperitoneum (presacral space and at level the lateral border of the levator ani muscle) associated with perirectal fat stranding led radiologist to suspect a rectal perforation.

No extraluminal air collections were present adjacent to the sigma, so the diagnosis of perforation of sigmoid colon seemed less unlikely.

The presence of multiple perforation is typical in gunshots injuries opposite to stab wounds where they usually result in a single hollow-organ perforation. In gunshots injuries the bullet usually results in a pair of full-thickness injuries owing to passage of the bullet fragments through-and-through the injured organ [6,30]. In our case the presence of free air in the peritoneal cavity and in the retroperitoneum were diagnostic and no second line imaging was required such as rectal iodinated contrast material administration [4,31–37] and the patient was referred to emergent laparotomy.

CT is highly accurate in determining the need of laparotomy in penetrating abdominopelvic trauma [4,38,39], although negative CT result especially in stab wounds cannot replace repeated clinical evaluations and close observation because its positive predictive value ranges from 76% to 95% [4,40] and emergency surgery still fills the diagnostic gap in case of clinical suspicious.

Uterine trauma is most commonly found in association with pregnancy. Nongravidic uterus trauma is rarely reported. Nongravid reproductive organ trauma is reported in penetrating trauma [3] or blunt abdominal trauma in case of uterus enlargement due to underlying pathologies [41–43]. The force required to injure the relatively well protected intra-pelvic reproductive organs should be extremely high and in the few case reported uterus trauma was associated to other multiple abdominal injuries [44]. Gunshot wound of uterus is an exceptional event, in our case it was associated to multiple bowel bullet perforation reason why the patient was candidate to emergency laparotomy. Few reports are available in literature of nongravid uterus trauma and the need of intervention relies on vital signs and focused on "damage-control" technique [20,41]. According to uterus injury scale [45], nongravid uterus trauma are classified in 5 grades; I contusion/hematoma, II superficial laceration (<1 cm), III deep laceration (> or =1 cm), IV laceration involving uterine artery and V avulsion/devascularization. In our case we found a grade III lesion with a deep intramural laceration with no sign of active bleeding at exploratory laparatomy. The laceration of the uterine wall on the level of the isthmus of the uterus/in the region of isthmus appeared cauterized related to the high temperature of the bullet during the intrauterine path. Conservative management with absorbable suture was performed. In absence of contextual bowel trauma, this lesion could be managed conservatively [46].

Conclusions

Gunshot trauma to the pelvis is a serious and complex form of injury that can be associated with the involvement of multiple organ systems.

Radiologists play a critical role in the evaluation of ballistic trauma and must therefore be familiar with the patterns of ballistic injury. MDCT technology and multiplanar reformation postprocessing allow a meticulous trajectory analysis that aids in the definition of injuries along bullet's path. Nongravid uterus penetrating trauma is an exceptional event and lesion's grading is of fundamental importance because damage conservative treatment is the first option in low grades injuries. In our case, the multiple bowel perforation, typical of gunshot wounds, required an urgent laparotomy and the uterus laceration was sutured. Multidisciplinary trauma team and patient tailored CT protocol are necessary to reach a precise and prompt diagnosis and directly contributed to patient survival.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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