Journal of the Association of General Surgeons of Thailand under the Royal Patronage of HM the King
วารสารสมาคมศัลยแพทย์ทั่วไปแห่งประเทศไทยในพระบรมราชูปถัมภ์
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Case Report

Avoiding Pandora's Box: Endovascular Management of Penetrating Iliac Vascular Injury with Concomitant Bowel Injury: A Case Report

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ABSTRACT

Background: Penetrating iliac vascular injuries are rare but highly lethal, particularly when associated with concomitant venous injury and intra-abdominal organ damage. The coexistence of bowel injury has traditionally favored open or hybrid repair because of concerns about contamination, infected hematoma, graft infection, and sepsis. However, accumulating evidence supports an expanding role for endovascular techniques in managing traumatic iliac vascular lesions. We report a case of penetrating internal iliac arteriovenous fistula associated with bowel injury that was successfully managed using a staged endovascular approach while avoiding formal exploration of a stable retroperitoneal hematoma.

Case Presentation: A 20-year-old man sustained a gunshot wound to the right flank and presented with transient hemorrhagic shock. Initial computed tomography demonstrated a retroperitoneal hematoma associated with suspected right internal iliac venous injury, hepatic injury, bowel injury, and a retained pelvic bullet. Following transfer to a tertiary care university hospital, exploratory laparotomy revealed ileal and sigmoid injuries requiring resection and primary anastomosis. A stable retroperitoneal hematoma with a palpable thrill was identified. To preserve retroperitoneal tamponade and avoid extensive pelvic dissection in a contaminated field, the hematoma was not explored; limited irrigation through the bullet tract and closure of the peritoneal defect were performed instead. Subsequent multiphasic computed tomography confirmed a right internal iliac arteriovenous fistula, which was treated by endovascular occlusion using a vascular plug. The postoperative course was uneventful apart from transient paralytic ileus, and the patient was discharged without hemorrhagic or infectious complications.

Submission 9 September 2026 | Revised 15 October 2026 | Accepted 24 October 2026 | Published online 31 October 2026

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Conclusion: This case demonstrates that concomitant bowel injury should not be regarded as an absolute contraindication to endovascular management of penetrating iliac vascular injury. In selected patients, a strategy that prioritizes hemorrhage control, preserves retroperitoneal tamponade, and selectively manages infectious risk may provide an effective, less invasive alternative to extensive open vascular reconstruction.

Keywords: penetrating iliac vascular injury; arteriovenous fistula; gunshot wound; bowel injury; endovascular management; retroperitoneal hematoma; case report.

Introduction

Penetrating iliac vessel injuries are uncommon, accounting for less than 2% of all vascular trauma cases, yet they carry mortality rates ranging from 25% to 80%.[1,2] Mortality varies significantly by injury pattern: isolated iliac venous injuries carry a 30-day mortality of 16.5%, isolated arterial injuries 19.3%, and combined arteriovenous injuries 48.7%.[3] Over 90% of iliac vascular injuries involve adjacent intra-abdominal or pelvic structures, contributing to substantial post-injury complications, including infection and fistulization.[1] When concomitant bowel injury is present, open or hybrid repair has traditionally been considered mandatory due to concerns regarding infected hematomas, graft infection, and sepsis.[1,4]

Despite these historical concerns, endovascular repair has emerged as a key modifiable predictor of improved survival in traumatic iliac injuries. National database analyses show that endovascular management yields lower overall mortality than open repair (18% vs. 26%) and significantly reduces the odds of in-hospital death in penetrating trauma (adjusted OR, 0.067).[5] Furthermore, endovascular repair has been identified as the sole modifiable risk factor independently associated with decreased mortality (OR, 0.34).[6] Data from the PROOVIT registry confirm that endovascular intervention is now the most common treatment modality for traumatic iliac artery injuries, offering shorter operative times and lower reoperation rates.[7]

These findings support expanding endovascular options to complex cases, including traumatic iliac arteriovenous fistulas with concomitant bowel injury—specifically via a combined approach where the vascular lesion is addressed endovascularly alongside exploratory laparotomy for visceral repair. Herein, we report a case of a gunshot-induced internal iliac arteriovenous fistula with concomitant bowel injury successfully managed using an endovascular approach.

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Case Presentation

A 20-year-old man presented to the first hospital 20 minutes after sustaining a gunshot wound to the right flank from a pistol. On primary survey, he was found to be in hemorrhagic shock but responded to 500 mL of warmed crystalloid infusion. The initial evaluation identified a retained bullet in the left pelvic cavity on anteroposterior pelvic radiograph, with no evidence of intrathoracic or intra-abdominal bleeding on eFAST and chest radiograph (Figure 1A). Secondary survey revealed a single gunshot entrance wound measuring approximately 1 cm, without an exit wound (Figure 1B).

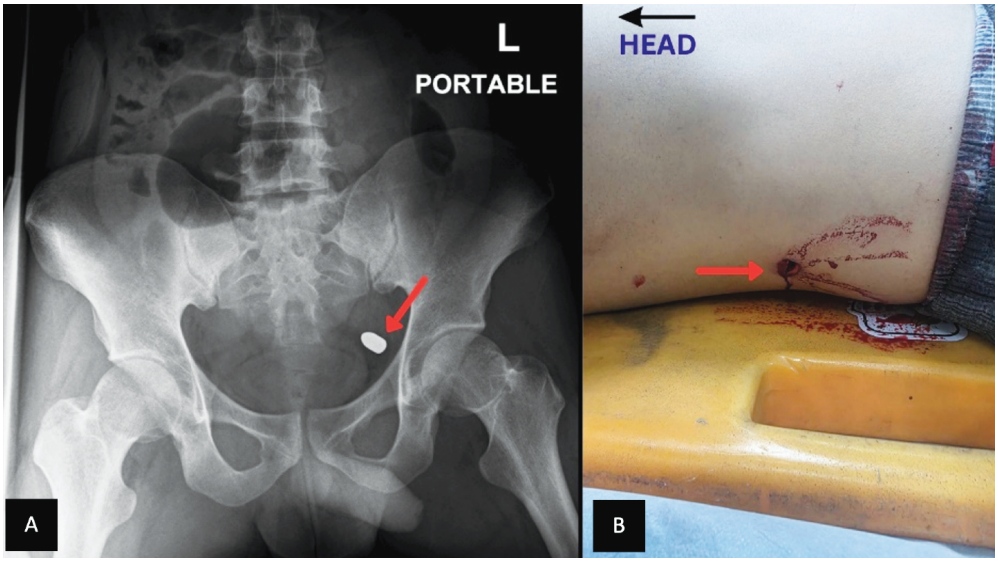


Figure 1 Anteroposterior pelvic radiograph demonstrating a retained bullet within the left hemipelvis (red arrow) (A); clinical photograph showing the gunshot entrance wound at the right flank (red arrow) (B).

Initial computed tomography (CT) at the initial hospital was limited to a venous-phase evaluation without arterial-phase contrast imaging. The results were as follows:

1. Laceration of hepatic segment VI with ischemic changes.
2. Right internal iliac vein wall defect adjacent to the bifurcation of the right common iliac vein tributary with intraluminal thrombus, associated with retroperitoneal hematoma (Figure 2).
3. Sigmoid colon wall thickening with minimal free intraperitoneal air.
4. Retained metallic foreign body in the left pelvic region.

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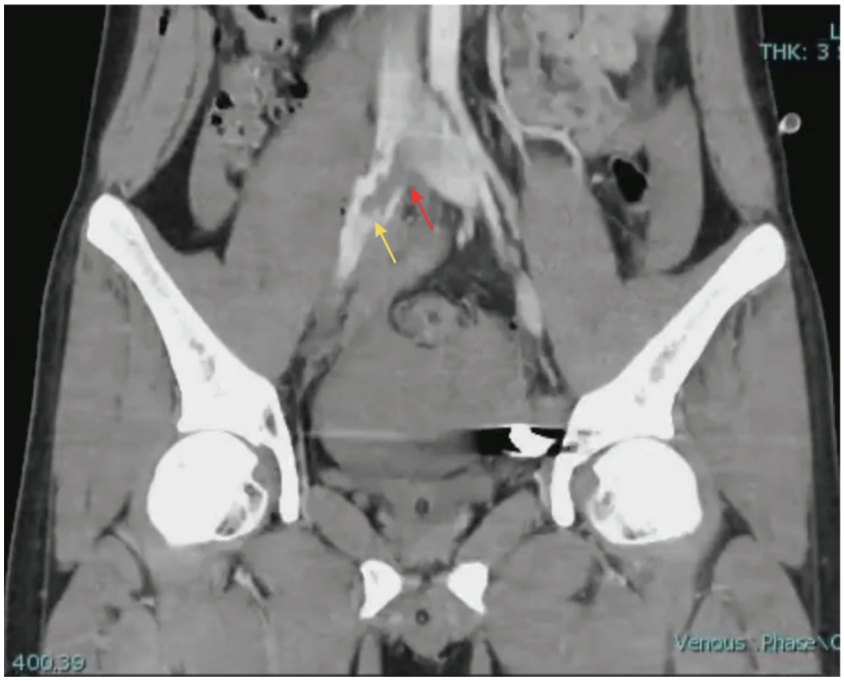


Figure 2 Contrast-enhanced abdominal CT (venous phase) demonstrating a wall defect of the right internal iliac vein (red arrow) with intraluminal thrombus (yellow arrow) associated with a retroperitoneal hematoma, findings suspicious for right internal iliac vein injury. Anticoagulation therapy was scheduled for postoperative initiation to treat the intraluminal thrombus.

Based on these findings, concomitant internal iliac venous and bowel injuries were suspected. The patient was subsequently referred to a tertiary care university hospital for definitive management.

On arrival at the second hospital, 4 hours and 30 minutes post-injury, the patient was hemodynamically stable. Tertiary survey revealed positive FAST findings at the cul-de-sac and splenorenal recess, without clinical signs of peritoneal irritation. Empirical intravenous ceftriaxone and metronidazole were initiated. Emergency exploratory laparotomy was performed to evaluate retroperitoneal bleeding and control contamination. Intraoperatively, no expanding hematoma was observed; however, a thrill was palpated at the suspected right internal iliac vein injury site (Figure 3). The presence of a palpable thrill was discordant with initial CT imaging, which had demonstrated isolated venous injury. Due to the unpreparedness of hybrid endovascular operation facilities and the patient's ongoing hemodynamic stability, the surgical team elected to continue other procedures and proceed with formal CTA and delayed venous-phase imaging.

Then, the retroperitoneal hematoma was irrigated through the peritoneal bullet defect, and that defect was closed with absorbable sutures to prevent further contamination. Subsequently, resection of the injured ileum and sigmoid colon was performed, followed by primary stapled anastomosis. The retained bullet was removed from the left pelvic space. Regarding the segment of ischemic liver tissue secondary to laceration, non-viable parenchymal resection was performed, with meticulous hemostasis achieved via electrocautery.

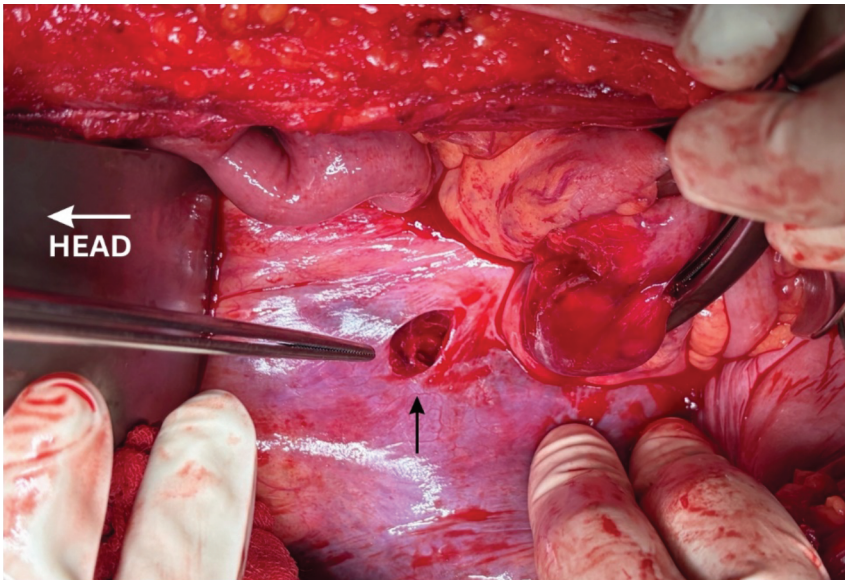


Figure 3 Intraoperative photograph demonstrating a retroperitoneal defect in the right iliac region caused by the bullet tract (black arrow). A palpable thrill was detected over a stable, non-expanding retroperitoneal hematoma.

Postoperatively, the patient was monitored in the intensive care unit for potential rebleeding. Anticoagulation therapy was initiated for the management of an intraluminal venous thrombus identified on prior CT. Intravenous ceftriaxone and metronidazole were continued. After 24 hours of observation, he remained hemodynamically stable without transfusion or vasopressor support. Follow-up CT of the abdomen with arterial and venous phases was performed to confirm the intraoperative thrill finding and revealed an arteriovenous fistula between the right internal iliac artery and vein, which had not been detected on the initial CT at the first hospital. The interventional radiology team performed right internal iliac arterial occlusion using a vascular plug (Figure 4).

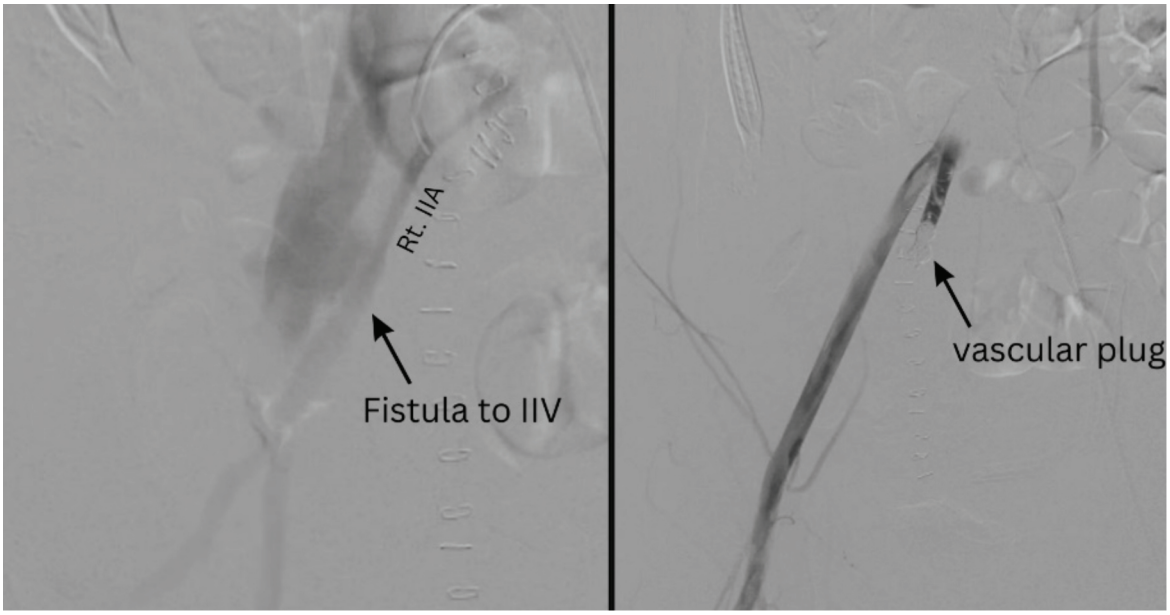


Figure 4 Angiography demonstrating a traumatic arteriovenous fistula between the right internal iliac artery (IIA) and right internal iliac vein (IIV). The right panel shows successful occlusion of the right IIA with a vascular plug following embolization. Post-embolization angiography demonstrated successful occlusion of the arteriovenous fistula with complete absence of residual inflow.

Following angioembolization, the patient was transferred to the trauma ward and advanced to a stepped diet, similar to postoperative management of elective colonic surgery.

On postoperative day 4, the patient developed paralytic ileus. Repeat CT abdomen excluded intraperitoneal collections or retroperitoneal infected hematoma. The CT revealed resolution of the hematoma without signs of infectious complications, as well as complete resolution of the AVF (Figure 5). He recovered with conservative management and was discharged on postoperative day 6 in stable condition, without infectious complications. Oral antibiotics were prescribed to complete a 14-day course.

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Figure 5 By postoperative day 4, follow-up CT revealed resolution of the hematoma without signs of infectious complications, as well as complete resolution of the AVF with metallic embolization device (red arrow)

Discussion

Penetrating iliac vascular injuries are uncommon but are associated with substantial morbidity and mortality, particularly when combined arterial and venous injuries are present. Mortality rates approaching 50% have been reported in patients with concomitant iliac artery and vein injuries, reflecting the challenges of hemorrhage control and the frequent presence of associated visceral injuries.[3,8] Most penetrating iliac vascular injuries occur with concomitant damage to adjacent structures, increasing the risk of contamination, infection, and need for reintervention.[1]

The coexistence of bowel and vascular injury has traditionally favored open or hybrid management because it requires simultaneous control of hemorrhage and enteric contamination. Damage-control surgery remains an important strategy in physiologically compromised patients.[4] However, contemporary evidence suggests that contamination alone should not be considered an absolute contraindication to endovascular treatment. In patients with concomitant abdominal



vascular and gastrointestinal injuries, endovascular and prosthetic reconstruction have demonstrated acceptable outcomes without a significant increase in infectious or vascular complications compared with biologic repairs.[9] Therefore, treatment decisions should be guided by hemodynamic status, injury anatomy, and technical feasibility rather than the presence of bowel injury alone.

In the present case, rapid endovascular exclusion of the internal iliac arteriovenous fistula provided prompt hemorrhage control while avoiding extensive pelvic dissection in a contaminated operative field. This approach is supported by emerging evidence demonstrating increasing utilization of endovascular techniques in traumatic iliac vascular injuries, with shorter operative times and favorable perioperative outcomes compared with open repair in selected patients.[7] Although single-stage intraoperative angiography and intervention represents the ideal management approach for this scenario, decision-making in this instance was dictated by initial CT imaging showing only venous trauma alongside intraoperative constraints regarding endovascular facility preparedness, leading to procedural termination and subsequent CTA imaging.

Management of the associated retroperitoneal hematoma is also noteworthy. Current principles emphasize selective exploration, with intervention guided by hemodynamic instability or evidence of ongoing bleeding rather than routine evacuation of contained hematomas.[10] Disruption of a stable retroperitoneal hematoma may compromise tamponade and precipitate recurrent hemorrhage.[11] In our patient, limited irrigation through the bullet tract did not result in rebleeding, suggesting that cautious local decontamination can be performed without necessarily compromising hemostasis, although this observation remains specific to this case.

A potential concern after endovascular treatment in a contaminated setting is delayed infection of the retroperitoneal hematoma. If infection develops, image-guided percutaneous drainage provides an effective, minimally invasive option, with reported success rates of 75%-90% and low procedure-related morbidity.[12,13] This strategy may avoid reoperation in a hostile pelvic environment and serves as a valuable adjunct in the management of delayed infectious complications.[12,13]

The principal limitation of this report is its single-case design and short observation time. Furthermore, the available literature is largely retrospective and includes heterogeneous vascular injury patterns. Consequently, evidence supporting endovascular management of traumatic internal iliac arteriovenous fistula associated with bowel injury remains limited.[1,9] Nevertheless, this case suggests that concomitant bowel injury does not necessarily preclude endovascular treatment when hemorrhage control can be achieved safely,



and definitive management is guided by trauma surgery principles.

Conclusion

This case demonstrates that concomitant bowel injury should not be considered an absolute contraindication to endovascular management of penetrating iliac vascular injury. In carefully selected patients, a hemorrhage-first strategy incorporating endovascular exclusion of the vascular lesion, selective non-exploration of a stable retroperitoneal hematoma, and the availability of image-guided drainage for potential infectious complications may provide an effective and less invasive treatment pathway.

Consent for Publication

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

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