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CASE REPORT

Complex Uretero-arterial Fistula Following a Gunshot Wound

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RESUMEN

Objetivo

Ilustrar y discutir la manifestación, diagnóstico y manejo de una fístula ureteroarterial compleja secundaria a un traumatismo penetrante.

Introducción: Las fistulas ureteroarteriales son conexiones raras pero peligrosas que suelen instaurarse entre el uréter y la arteria ilíaca. Las heridas de bala abdominales generalmente ocasionan lesiones en varias estructuras intraabdominales.
A pesar de que el uréter parezca normal, se puede producir necrosis tardía y posterior fistulización tras un traumatismo penetrante. Los pacientes pueden presentar hemorragias de riesgo vital, y el diagnóstico a menudo es impreciso.

Descripción del caso: Se informa del caso de un paciente del sexo masculino de 52 años de edad que presentó herida por arma de fuego en el abdomen inferior izquierdo y a quien se le diagnosticó múltiples enterotomías además de una lesión en la vena ilíaca derecha. Aunque el uréter no parecía lesionado durante la evaluación intraoperatoria, el paciente desarrolló una fuga de orina dos semanas después de sufrir la herida. Se le colocó una endoprótesis ureteral y una sonda de nefrostomía para facilitar la curación y desviar la orina. No obstante, el paciente reingresó 46 días después de la lesión inicial por presentar hematuria importante y diagnóstico de fístula ureteroarterial.

Conclusiones: Los traumatismos penetrantes, y en particular las lesiones por fuente explosiva como las heridas por arma de fuego, conllevan un mayor riesgo de lesiones tardías secundarias a la desvascularización de tejidos o necrosis. La irrigación vascular ureteral es particularmente frágil, y los clínicos deben tener un alto nivel de sospecha de complicaciones ureterales tardías cuando se produce una lesión por fuente explosiva en tejidos adyacentes. Es importante mantener un umbral bajo en el criterio para la colocación preventiva de endoprótesis ureteral o la extirpación y reparación de un segmento en riesgo, incluso cuando el uréter parezca intacto durante la inspección inicial.

Palabras Clave: Fistula urinaria, fistula vascular, Hematuria, Heridas penetrantes.

ABSTRACT

Aim: To highlight and discuss the presentation, diagnosis and management of a complex uretero-arterial fistula following a penetrating trauma.

Background: Uretero-arterial fistulas are a rare but dangerous connection, usually between the ureter and iliac artery. Gunshot wounds to the abdomen usually result in injuries to multiple intraabdominal structures. Despite a normal appearing ureter, delayed necrosis and subsequent fistulization can occur following a penetrating trauma. Patients may present with life-threatening hemorrhage and diagnosis is often imprecise.

Case description: We report the case of a 52-year-old male who presented with a single gunshot wound to the right lower abdomen and was found to have multiple enterotomies as well as a right iliac vein injury. Although the ureter appeared uninjured during the intraoperative assessment, the patient developed a urine leak two weeks after the injury. A ureteral stent and nephrostomy tube were placed to facilitate healing and divert urine. However, the patient re-presented 46 days after initial injury with significant hematuria and diagnosis of a uretero-arterial fistula.

Conclusion: Penetrating traumas, especially blast injuries such as gunshot wounds, have a higher risk for delayed injuries secondary to tissue devascularization or necrosis. Ureteral vascular supply is especially delicate and clinicians should have a high suspicion for delayed ureteral complications when a blast injury occurs nearby. It is important to maintain a low threshold for pre-emptive ureteral stenting or excision and repair of an at-risk segment even when the ureter appears intact on initial inspection.

Clinical significance: Uretero-arterial fistulas can be fatal, especially as its presentation often occurs suddenly, with large volume blood loss, and diagnosis can be difficult. Prompt and appropriate treatment requires a high level of suspicion and awareness of its potential.

Keywords: Hematuria, Penetrating wounds, Urinary fistula, Vascular fistula.

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BACKGROUND

A uretero-arterial fistula (UAF) is a rare connection between the ureter and the iliac artery, which can present with life-threatening hematuria. The condition, which was first reported in 1908 by Moschowitz[1] has been associated with chronic indwelling stents, a history of pelvic irradiation, pelvic surgery, vascular aneurysm and inflammatory diseases of the bowel.[2] The incidence of UAF has grown since the 1990s, with the rise thought to be related to increased rates of ureteral stent use, pelvic surgery, and pelvic radiotherapy.[3,4]

While UAFs were initially treated with open surgical repair, endovascular treatment has become the more common approach used for stable patients since the 1990s.[2] Despite recent advances in imaging, diagnosis of UAFs remain challenging, with diagnostic sensitivities reportedly as low as 38 to 50% for angiogram-computed tomography (angio-CT),[3,5] 25 to 50% for arteriography,[6] and 45 to 60% for cystoscopy.[7]

We report a rare case of a right-sided uretero-iliac arterial fistula, which presented 46 days following a right lower quadrant gunshot wound.

CASE DESCRIPTION

The patient is a 52-year-old male with a past medical history of nonischemic cardiomyopathy secondary to methamphetamine and other substance use (ejection fraction of 50%), diabetes, hypertension, and previous exploratory laparotomy for a stab wound. He presented to the emergency room as a major trauma after sustaining a single gunshot wound entering just right of midline into his right lower abdominal with a second wound, likely exit, seen in the posterior mid-sacrum. On arrival, he was tachycardic and hypotensive but alert and oriented with Glasgow coma scale of 14 (eye 4, verbal 4, motor 6). Given his hemodynamic instability and the mechanism of injury, he was taken emergently to the OR before imaging was obtained.

Laparotomy revealed dense intra-abdominal adhesions from his prior surgery. Seven enterotomies were identified, which were resected in three different segments, and an inferior zone 1 retroperitoneal hematoma was seen tracking down to the sacrum. The lateral posterior wall of the common right iliac vein was injured and the vein was ligated. The ureter was seen and intravenous methylene blue was given to evaluate for extravasation. Methylene blue was seen in the urine output through the Foley catheter, but none was seen in the abdomen.

Postoperatively, he underwent CT imaging of his abdomen and pelvis with a 5-minute delay, which did not show any new injuries or findings. The patient's postoperative care was complicated by right leg compartment syndrome requiring fasciotomy, the development of subsegmental pulmonary emboli treated with anticoagulation and an abdominal fascial dehiscence requiring an abdominal washout and second closure.

Shortly after the second closure, on post-op day (POD) 17, the patient started having increased yellow fluid draining from his abdominal wound which was confirmed to be urine. CT intravenous pyelogram (IVP) and cystogram were performed which revealed a right mid-ureteral extravasation (Fig. 1). The intraoperative retrograde pyelogram confirmed extravasation (Fig. 2) and a ureteral stent was successfully placed to stent the injury and a catheter was left in the bladder to maximally drain the bladder.

There was a persistent urinary leak from the ureter and a nephrostomy tube was placed on the post-op POD 26 for maximal urinary diversion. He was discharged on POD 41 with a right nephrostomy tube, ureteral stent, and foley catheter to drainage.

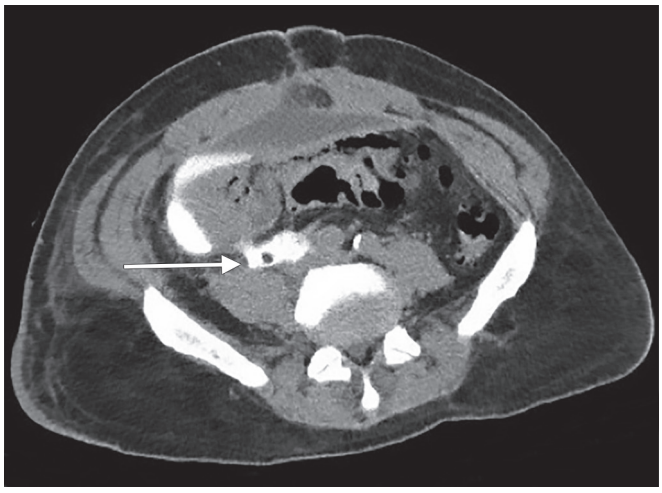

Fig. 1: Axial view of CT IVP on POD 18 after wound drainage showed Creatinine of 22.2 mg/dL. The arrow shows the ureter lumen (in black) with the white contrast extravasation around it

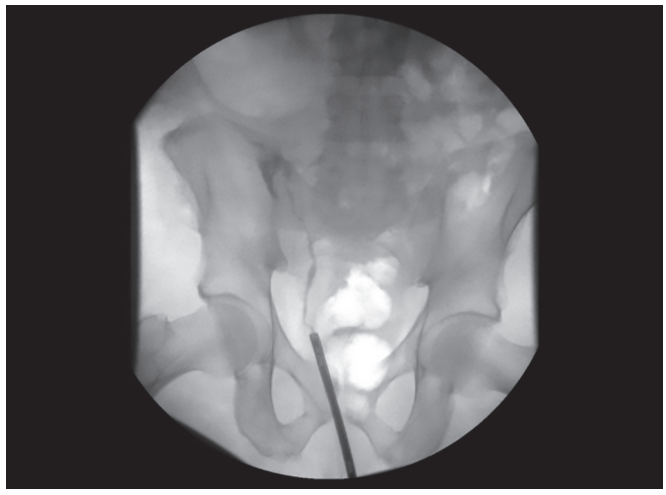

Fig. 2: Retrograde pyelogram done in the operating room on POD 19 for placement of right ureteral stent with retrograde pyelogram. There is visible contrast extravasation

He presented to the ED five days after discharge (46 days after the initial injury) with 300 cc of a blood clot in his nephrostomy tube, thick hematuria in the foley bag and hematocrit of 24.6%. His hematocrit at the time of discharge was 25.7%. A CT IVP showed a pseudoaneurysm in the right external iliac artery arising near the bifurcation that partially incorporated the adjacent right ureter (Fig. 3). The patient's hematocrit dropped to 16.6% the next morning and continued to downtrend, ultimately requiring 6 units of blood transfusions. The patient was taken to interventional radiology where an angiogram confirmed a ureter-iliac artery fistula. An endovascular stent of the common-external iliac was placed with concomitant embolization of the right internal iliac artery (Fig. 4).

The patient had full resolution of hematuria within days of the procedure and passed a voiding trial so the foley was removed. Weeks after the uretero-arterial fistula had healed, the ureteral stent was removed; however, the ureter became obliterated at the level of the injury on subsequent follow-up.

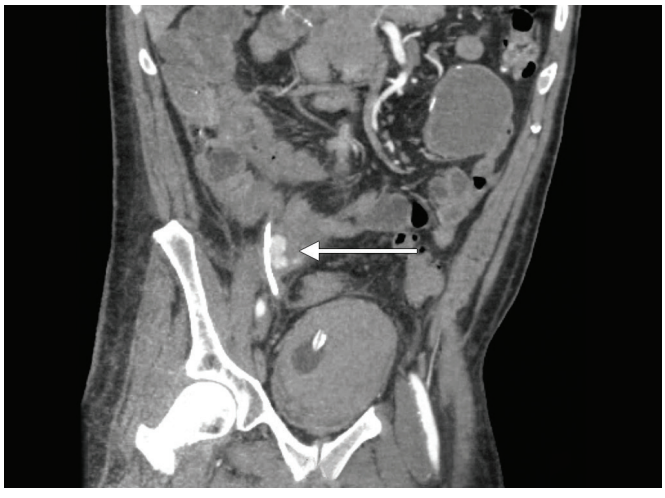

Fig. 3: CT IVP on POD 48 showing the pseudoaneurysm of the right external iliac artery with the right ureter with extravasation

The patient missed several follow-up visits with urology and general surgery after discharge and then re-presented with urosepsis. He was noted to have capped his nephrostomy tube against recommendations. During admission for urosepsis, he decided to undergo nephrectomy, and given his multiple enterotomies and frozen abdomen, the nephrectomy was done via a retroperitoneal approach.

DISCUSSION

This is a rare case of a delayed UAF with a right iliac pseudoaneurysm that presented 46 days following a right lower abdominal gunshot trauma. Though the patient did not have any visual evidence of ureteral injury on initial presentation, he did have an injury to his right iliac vein close to the ureter and developed a delayed partial ureteral injury secondary to devascularization from the blast injury of the bullet.[8]

This patient's unique presentation highlights several challenges in the prevention, diagnosis, and management of UAFs.

Although the sensitivity of immediate post-injury imaging studies in evaluating blast ureteral damage is poor, it is important to obtain adequate staging scans after traumas where there is high-risk of ureteral injuries. The gold standard is a 3 phase CT scan with contrast with a 15-minute renal delay to allow for full excretion down bilateral ureters.[9] Alternatively, if the patient is taken immediately to the operating room, a single shot IVP using a contrast dose of 2 cc/kg and 15 minutes wait-time before imaging can be obtained to evaluate for injury.[9] In this case, the patient was taken directly to the OR where the ureter was interrogated with intravenous methylene blue and direct vision. No obvious injury was

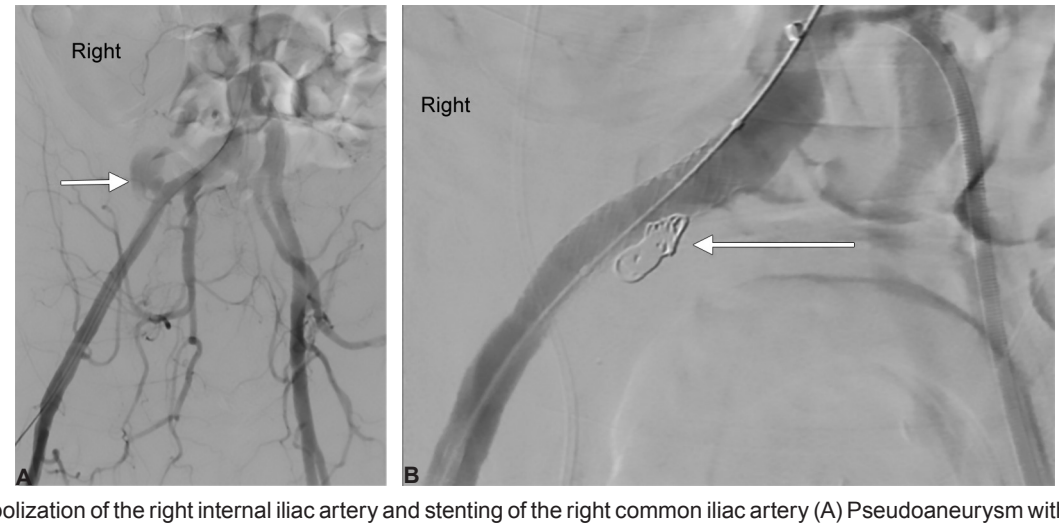

Fig. 4: IR embolization of the right internal iliac artery and stenting of the right common iliac artery (A) Pseudoaneurysm with extravasation at the arrow; (B) After placement of a stent as well as the coil emboli with retrograde filling with a resolution of extravasation

not metabolize methylene blue into a visible byproduct.[10] Additional post-operative CT with 5 minutes contrast delays did not show any additional ureteral injuries.

A blast injury can cause avascular necrosis of the tissue which may take several days after the injury to mature.[11,12] The degree of blast injury and magnitude of delayed effects to nearby tissue depends on the speed, caliber, and trajectory of the bullet.[13] This is especially important when the blast injury may involve the ureter, as it has a tenuous blood supply. In cases where there is concerning blast proximity to the ureter or signs of nearby thermal damage, protective interventions should be considered even when there is no demonstration of extravasation. Ureteral stenting or segmental ureteral excision and re-anastomosis with the placement of an interposition flap such as omentum or peritoneal can guard against fistula formation.

A continued high index of suspicion is necessary to diagnose a UAF as they most commonly present in a delayed setting, such as in this patient who subsequently developed large volume hematuria weeks after trauma. Clinicians must maintain a high suspicion of fistula formation even if imaging is inconclusive or negative, as a pseudoaneurysm or fistula may not be obviously apparent on studies focusing on the urinary tract such as an IVP and may require angiography for higher diagnostic sensitivity.

Multimodal evaluation is very important when initial diagnosis of UAF is inconclusive[14] as mortality rates associated with UAFs have been reported up to 64% in some studies with many diagnoses made only after the patient has been taken for laparotomy or discovered in postmortem autopsies.[15,16] The high mortality rates have been attributed more to delays in diagnosis, though some studies suggest that there is a lower mortality rate associated with endovascular interventions when compared to open repairs.[2] Timely diagnosis and early involvement of interventional radiology was especially important in this patient as his previous bowel resections, wound dehiscence and abdominal washouts created a hostile abdomen that strongly discouraged open repair at the time of UAF diagnosis.

Despite ureteral stent placement and successful control of the UAF with stenting and coil embolization, the patient subsequently developed a ureteral stricture likely secondary to devascularization from the blast injury. After discharge, the patient was non-compliant and missed several follow-up appointments. He was then hospitalized and required treatment for urosepsis due to infections from capping his nephrostomy tube against medical advice. Given the high risk of infection to his endovascular stent and non-compliance with nephrostomy drainage, he ultimately opted for a flank nephrectomy.

CONCLUSION

Uretero-arterial fistulas (UAF) are an uncommon but dangerous complication that can present in patients who have undergone pelvic surgeries, radiation, ureteral stenting and in this case, following a gunshot wound with damage to the iliac vessels near the ureter. Blast injuries are often associated with the delayed presentation of injuries that can result from devascularization and eventual necrosis. In cases where there is high suspicion of blast injury near the ureter, it is important to maintain a low threshold for pre-emptive ureteral stenting or repair and interposition flaps even when the ureter does not demonstrate extravasation or clear primary injury. It is also very important to continue monitoring for delayed presentation of complications including UAFs, which often require a multi-modal approach in order to have timely diagnosis and treatment.

CLINICAL SIGNIFICANCE

Uretero-arterial fistulas (UAF) are a rare but dangerous complication that can present in a delayed fashion following a penetrating trauma. UAFs can be fatal, especially as its presentation can be complex and diagnostic imaging can often be imprecise. Prompt and appropriate treatment requires a high level of suspicion and awareness.

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