CASE REPORT

Traumatically shattered kidney without urine extravasation or vascular amputation

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SUMMARY

The American Association for the Surgery of Trauma (AAST) injury scoring scale is commonly used for genitourinary injuries. Normally, grade 4–5 lacerations of the kidney show involvement of the pelvicalyceal system (PCS) with urine extravasation (UE). We present a case of a 41-year-old woman who was hospitalised with macrohaematuria and retroperitoneal haematoma after severe blunt acceleration flank trauma. CT scan showed an extended laceration of the left kidney with separation of upper pole. This is the first case of an extended kidney laceration without UE due to rupture within the dichotomous PCS, which healed up after selective embolisation. If possible, severe renal bleeding should be treated with selective embolisation as an alternative to surgery. Any suspected involvement of the PCS should undergo retrograde ureteropyelography and urinary diversion.

(AAST) injury scoring scale.² Laceration through the corticomedullary junction into the urine-collecting system or segmental renal vascular injury with haematoma is described as grade 4. Shattered kidney is classified as grade 5.² Typically, grade 4–5 lacerations of the kidney show an injury of the urine-collecting system with urine extravasation (UE) and macrohaematuria.¹ Intravenous contrast CT is the best method for assessment of renal trauma.³ Patients who have no other indication for immediate abdominal surgery benefit from digital subtraction angiography (DSA) and possible selective embolisation.^{4,5} We report the first case of an extended kidney laceration grade 4–5 without UE or vascular amputation due to rupture within the dichotomous pelvicalyceal system (PCS).

BACKGROUND

A grade 4–5 laceration of the kidney normally involves the pelvicalyceal system (PCS) and urine extravasation (UE). In this very rare case, the anomaly of the dichotomous PCS and a rupture of the kidney between the upper and lower sections allowed us to avoid UE. Grade 4–5 lacerations are mostly treated surgically. In this case, a superselective embolisation of the arterial bleeding could preserve the kidney and renal function.

INTRODUCTION

The kidney is the most commonly injured genitourinary organ. Renal trauma, mainly blunt, occurs in approximately 1–5% of all trauma cases.¹ Sudden deceleration or a direct blow to the flank may result in contusion or laceration of the parenchyma. The most commonly used injury classification system is the American Association for the Surgery of Trauma

CASE PRESENTATION

A 41-year-old woman presented to our emergency room after suffering severe acceleration flank trauma in a city tram accident. She had fallen and the left side of her trunk had impacted with the edge of a tram seat. The medical history revealed arterial hypertension (WHO grade 1), adipositas (body mass index 29 kg/m²), smoking (20-pack years) and endogenous depression with suspicion of analgesics abuse but no urological disease, operations or allergies. The laboratory analysis was almost normal with lactate 3.1 mmol/L, haemoglobin 6.9 mmol/L, leucocytes 14.6 Gpt/L, C reactive protein <0.6 mg/L, myoglobine 58.1 µg/L, creatinine 75 µmol/L, estimated glomerular filtration rate (eGFR) 85 mL/min (chronic kidney disease epidemiology collaboration, CKD-EPI) and lactate dehydrogenase 4.62 µmol/sL. The physical examination showed normal results except for pressure and movement pain in the left flank and hemithorax, hypotonia (90/60 mm Hg), tachycardia (111 bpm) and macrohaematuria.

Figure 1 Intravenous three-phase contrast CT with CT urography (90 mL Imeron 300; 1 mm and 5 mm ST) on the day of trauma. Shattered left kidney in the centre with enhancement of the parenchymal fragments but without urine resp contrast extravasation.

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INVESTIGATIONS

Emergency intravenous CT indicated a retroperitoneal haematoma of 10×9 cm and fractured costal 9–12 without pneumothorax on the left side, an extended laceration of the left kidney with separation of upper pole with acute arterial bleeding (extravasate) at the middle segment, a normal perfusion of both kidney fragments by spread bifurcated renal artery close to the hilum, intact veins and no UE respectively contrast extravasation of the urinary tract (figure 1).

TREATMENT

Because of progressive loss of haemoglobin, hypotonia, arterial bleeding and the extended kidney laceration, an emergency DSA with superselective embolisation by coiling the bleeding renal middle segment artery was performed (figure 2). The haemorrhage stopped consecutively. Owing to the pronounced macrohaematuria and the possibility of undetected UE, a cystoscopy with retrograde contrast ureteropyelography under fluoroscopic guidance was performed (figure 3). On this, despite the bleeding from the left ureteric ostium, no UE was detected; however, an undilated dichotomous PCS with spreading at the bifurcation was seen. A protective mono-J ureteral stent was placed using Seldinger's technique and a Foley catheter was also placed (figure 3). Over time, the macrohaematuria stopped, the clinical parameters normalised, serum creatinine was not elevated and the patient was free of symptoms. The mono-J ureteral stent was changed into a double-J ureteral stent after 1 week.

OUTCOME AND FOLLOW-UP

The control examination by DSA on the 3rd day, and CT on the 3rd and 10th day, demonstrated arrested arterial bleeding and no venous bleeding. Renal duplex sonography 2 months later showed regular perfusion of the renal fragments. CT 5 months after the trauma presented a declining, organised 7×2 cm isochogenic retroperitoneal haematoma (figure 4), scarred condensation of the Gerota fascia and reactive enlarged perihilar lymph nodes. The laboratory analysis was normal with haemoglobin 7.8 mmol/L, leucocytes 7.9 Gpt/L, C reactive protein 2.8 mg/L, creatinine 67 µmol/L, eGFR 97 mL/min (CKD-EPI). After consecutively removing the double-J ureteral stent, sonography of the left kidney showed no hydronephrosis. One month later, that is, 6 months after trauma, Tc-99m MAG3 (mercaptoacetyl-triglycine) renal scintigraphy featured reduced function of the left kidney (tubular excretion rate (TER) 28%, 61 mL/min) in comparison to the right (TER 72%, 158 mL/min), with simultaneous perfusion, normal overall function (TER 219 mL/mL for body surface 1.73 m²; age-related lower cut-off 215 mL/min) and regular secretion O'Reilly type I.

Figure 2 Percutaneous digital subtraction angiography of the left kidney using a 5-F Cobra catheter. Embolisation of the middle segment artery using a microcatheter and eight coils on the day of trauma.

Figure 3 Cystoscopy with diagnostic retrograde contrast ureteropyelography on the left side without contrast extravasation of a dichotome-formed pelvicalyceal system and placement of a mono-J ureteral stent under fluoroscopic guidance on the day of trauma.

DISCUSSION

A parenchymal kidney rupture can occur spontaneously, iatrogenically, or after blunt or penetrating trauma.⁶ The most common cause of kidney injury is blunt abdominal or flank trauma. In minor trauma (AAST grades 1–2) low-grade kidney injury with microscopic intraparenchymal microcracks, ruptured tubules of the cortex and medulla, as well as arcuate and interlobular vessels, especially veins, causing haematuria, is relatively common.⁷ Several rare cases of spontaneous laceration due to toxic, tumorous and degenerative renal processes have been published.^{8–11} Normally, grade 4–5 lacerations of the kidney show an injury of the urine-collecting system with UE due to the normally uniform dendritic-formed PCS.⁶

Our case is very unusual in that the patient presented with a kidney rupture without UE. To the best of our knowledge, this situation has not been reported before. The described case of kidney injury should be classified as grade 4–5 AAST (figure 1).² We explain this unusual situation by the demonstrated disposition of a kidney duplex with dichotomous-like PCS and vascularisation (figures 2 and 3). This facilitated the extended laceration through corticomedullary junction with spreading of the dichotomous PCS without rupture of the PCS with UE and without vascular amputation of shattered major renal segments. The intermittent macrohaematuria most likely occurred due to the mucosal and submucosal distention of the PCS. The differential diagnosis for missing urinary extravasation in major kidney lacerations is the compression by a perirenal haematoma, but that would entail a deformation of the PCS. In conclusion, we report

Figure 4 CT of the left kidney 5 months after trauma showing coils (A and C), double-J stent memory in the renal pelvis (B and C).

the first case of an extended kidney laceration without UE due to rupture between dichotomous PCS that healed up after selective embolisation, without consequences. If possible, continuous renal parenchyma bleeding should be treated with DSA and selective embolisation as an alternative to surgery (figure 2).^{4–6} For that reason, knowledge about the renal artery branching pattern is very important.¹² Grade 4–5 injuries usually require additional procedures. Any suspected involvement of the urine-collection system with manifest or possible UE should undergo cystoscopy with diagnostic retrograde contrast ureteropyelography under fluoroscopic guidance and a temporary urinary diversion by ureteral stent and bladder catheter to prevent urinoma (figure 3).^{13 14} Follow-up should involve laboratory and physical examination, blood pressure control, as well as CT and nuclear scans (MAG3 renal scintigraphy) to assess post-traumatic and post-therapeutic chronic kidney failure.⁶

Learning points

- Anatomical anomalies can influence the therapeutic decision and clinical outcome.
- If possible, severe renal bleeding should be treated with selective embolisation as an alternative to surgery.
- Any suspected involvement of the pelvicalyceal system should undergo retrograde ureteropyelography and urinary diversion.

Competing interests None.

Patient consent Obtained.

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