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Delayed Haemorrhage from a Lower-Pole Renal Artery Pseudoaneurysm Complicating Grade III Blunt Renal Trauma in a Solitary Kidney: A Case Report

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Case Report

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Abstract

Background: Blunt renal trauma in children with a solitary kidney poses a distinct management challenge, as the imperative for nephron preservation must be balanced against the risk of delayed vascular complications. Renal artery pseudoaneurysm is an uncommon but potentially life-threatening sequela of blunt renal injury and may present days after the index event, once the patient has been de-escalated from intensive monitoring.

Case presentation: A 9-year-old boy with a congenital solitary right kidney sustained a grade III right renal injury with retroperitoneal haematoma following a road traffic accident. He was resuscitated for compensated haemorrhagic shock (lactate 4.8 mmol/L) and managed initially with blood transfusion and non-operative care, with a two-day period of intensive care unit monitoring before transfer to the ward. On day five of admission he developed gross haematuria with a pelvic blood clot on ultrasound, managed with tranexamic acid and transfusion. This progressed to acute urinary retention from bladder clot obstruction requiring suprapubic catheterisation, accompanied by a rising serum creatinine. Computed tomography angiography, performed as part of nephrology-directed work-up for the deteriorating renal function, demonstrated a lower-pole arterial pseudoaneurysm with active bleeding. Following further transfusion requirements and a peak creatinine of approximately 600 µmol/L, a multidisciplinary decision was made to proceed with digital subtraction angiography and coil embolisation. The immediate post-procedural course was complicated by anuric acute kidney injury requiring 72 hours of haemodialysis, with recovery of urine output on the fourth post-procedural day and normalisation of renal function by post-operative day twelve. Follow-up ultrasound at two weeks showed parenchymal changes in the solitary kidney. The child was discharged on the fifteenth post-procedural day with planned surgical and nephrology follow-up.

Conclusions: Children with a solitary kidney and moderate-to-severe blunt renal trauma remain at risk of delayed haemorrhagic complications, including pseudoaneurysm formation, even after apparent early stabilisation. A high index of suspicion for delayed bleeding, low threshold for repeat imaging when haematuria recurs, and early angiographic intervention are essential to achieve nephron-sparing haemostasis. Superselective embolisation is effective but may be followed by transient acute kidney injury in a solitary kidney, for which close nephrological support and dialysis readiness are required.

Background

The kidney is one of the most commonly injured solid organs in paediatric abdominal trauma, accounting for approximately 10–20% of blunt abdominal injuries in children [1, 2]. Children are disproportionately susceptible to renal injury compared with adults because of reduced perinephric fat, a more horizontally oriented and less protected kidney, and an underdeveloped thoracic cage [2]. Non-operative management is now the accepted standard for the majority of blunt renal injuries in haemodynamically stable children, including many grade IV and V injuries, reflecting a strong emphasis on nephron preservation [1, 2].

A congenital solitary kidney is present in approximately 1 in 1000–2000 individuals and, when injured, magnifies both the clinical stakes of conservative management and the consequences of any intervention that might jeopardise the remaining renal mass [3]. Current guidelines specifically recommend that, in haemodynamically stable patients with a solitary kidney and moderate (AAST grade III) or severe (grade IV-V) renal trauma, angiography with superselective embolisation be considered as a first-line option when active arterial extravasation is demonstrated, in preference to open surgical exploration [3].

Renal artery pseudoaneurysm is a rare but well-recognised delayed complication of blunt renal trauma, with an incidence reported at under 1% of blunt renal injuries in the paediatric literature, and classically presents with secondary gross haematuria days to weeks after the index injury, once the patient has clinically stabilised and been stepped down from close monitoring [4–6]. We report a child with a solitary kidney who developed a lower-pole pseudoaneurysm and clot-related urinary retention five days after grade III blunt renal trauma, successfully managed with coil embolisation, and discuss the diagnostic and management considerations this scenario raises.

Case presentation

A 9-year-old boy was brought to the emergency department following a road traffic accident with blunt abdominal trauma. On arrival he was in compensated haemorrhagic shock. Initial resuscitation with intravenous fluids and blood transfusion was commenced according to standard paediatric trauma protocol. Venous blood gas analysis showed an elevated lactate of 4.8 mmol/L, consistent with tissue hypoperfusion. Point-of-care abdominal ultrasound revealed a single kidney on the right side with sonographic features suggestive of renal trauma.

Contrast-enhanced computed tomography (CECT) of the chest and abdomen and non-contrast computed tomography (NCCT) of the brain were performed once the child was stabilised. Imaging confirmed a congenital solitary right kidney with a grade III renal injury (AAST) and an associated retroperitoneal haematoma. No additional intra-abdominal, thoracic, or intracranial injuries were identified. The patient was managed non-operatively with two days of intensive care unit monitoring for haemodynamic surveillance, followed by transfer to the paediatric surgical ward for continued observation.

On day five of admission, the child developed gross haematuria. Repeat ultrasound demonstrated a blood clot within the pelvicalyceal system/bladder region. This was managed with tranexamic acid and further blood transfusion. On the following day, he developed acute urinary retention with catheter blockage; attempted urethral catheterisation failed owing to a large intravesical blood clot, necessitating an emergency suprapubic catheterisation for bladder decompression.

Around this time, serum creatinine was noted to be rising (approximately 200 µmol/L), and the nephrology team was involved in view of the evolving renal impairment. Given the persistent gross haematuria and worsening renal indices, CT angiography was performed as part of the nephrology-

directed evaluation. This demonstrated a pseudoaneurysm arising from a lower-pole segmental branch of the right renal artery, with active contrast extravasation consistent with ongoing bleeding (Fig. 1). The child continued to require multiple transfusions for ongoing blood loss, and serum creatinine rose further to approximately 600 µmol/L following this imaging.

A multidisciplinary team comprising paediatric surgery, interventional radiology, and nephrology reviewed the case and elected to proceed with digital subtraction angiography (DSA) and coil embolisation of the pseudoaneurysm, given the solitary kidney, ongoing haemorrhage, and deteriorating renal function. Selective catheterisation of the lower-pole branch was performed and the pseudoaneurysm was successfully occluded with microcoils (Fig. 2), with angiographic confirmation of cessation of extravasation and preservation of flow to the remaining renal parenchyma.

Postoperatively, the child was managed in the intensive care unit. He became anuric with biochemical evidence of acute kidney injury, and haemodialysis was instituted for a total of 72 hours. Urine output resumed on the fourth post-procedural day, and the acute kidney injury subsequently settled. Serum creatinine returned to within the normal range by post-operative day twelve. Follow-up ultrasound at two weeks post-procedure demonstrated parenchymal changes within the solitary kidney. The child was discharged on post-operative day fifteen, clinically well, with a one-month review arranged at the surgical clinic and ongoing longitudinal nephrology follow-up for surveillance of renal function and blood pressure.

Discussion

This case illustrates two management principles that are especially important when blunt renal trauma occurs in a child with only one functioning kidney: the propensity of moderate-grade renal injuries to develop delayed vascular complications after apparent early stabilisation, and the value of a nephron-sparing, angiography-led approach to haemorrhage control in this setting.

The 2018 revision of the AAST Organ Injury Scale for the kidney placed greater emphasis on vascular injury as an independent determinant of severity, reflecting growing recognition that arterial pseudoaneurysm and arteriovenous fistula formation can occur even after injuries initially graded as low or moderate severity [7, 8]. Grade III injuries, defined by parenchymal laceration exceeding 1 cm without involvement of the collecting system, are usually managed successfully with observation alone; nevertheless, as in this case, they can be complicated by delayed pseudoaneurysm formation once the initial clot retracts and previously tamponaded vessels are exposed to arterial pressure [4, 6]. This typically manifests as secondary or recurrent gross haematuria in the first one to three weeks after injury, precisely the pattern seen here on day five, and should prompt urgent reimaging rather than reassurance that the child has already ‘stabilised’ [4–6].

Several paediatric case series have described renal artery pseudoaneurysm as a rare but important cause of delayed haemorrhage after blunt renal trauma, with early reports estimating fewer than twenty published cases and more recent series continuing to describe it as uncommon [4, 5]. Halachmi et al.

described an 11-year-old boy with delayed pseudoaneurysm bleeding managed successfully with selective embolisation, establishing this as an effective alternative to open surgery even outside the solitary-kidney context [5]. In children with two functioning kidneys, nephrectomy or partial nephrectomy remains an option if embolisation fails; in a solitary kidney, however, every effort to preserve functioning renal parenchyma becomes paramount, and superselective coil embolisation targeting only the bleeding segmental branch, as performed in this child, is preferred over more proximal or surgical control whenever technically feasible [3, 9].

Current WSES-AAST guidelines explicitly recommend angiography with superselective embolisation as the first-line intervention in haemodynamically stable or stabilised children with a solitary kidney and grade III-V renal trauma with contrast extravasation, reserving surgery for main renal vein injury or failure of embolisation [3]. This case supports that recommendation: embolisation achieved durable haemostasis and avoided nephrectomy, preserving the child's only kidney despite the severity of the presentation.

The clot-related complications seen in this child – gross haematuria, an intravesical clot causing outlet obstruction, and the need for suprapubic vesicostomy after failed urethral catheterisation – are a recognised, though under-reported, consequence of upper tract bleeding into the bladder and should be anticipated in any child with ongoing haematuria after renal trauma. Tranexamic acid was used as an adjunct to transfusion for the initial clot-related bleeding; while antifibrinolytic therapy is used pragmatically in this setting, it does not address an underlying arterial source, and persistence or recurrence of bleeding despite such measures should lower the threshold for angiographic evaluation, as occurred in this case.

The post-embolisation anuric acute kidney injury requiring temporary haemodialysis in this child likely reflects a combination of pre-existing haemodynamic insult, contrast-associated nephropathy, and the physiological burden of injury and reintervention on a solitary kidney with no contralateral reserve to buffer a transient reduction in function. This underscores the need for close nephrology involvement and dialysis readiness whenever embolisation or other renal intervention is undertaken in a child with a single kidney, even when the procedure itself is technically successful. The subsequent recovery of urine output and normalisation of creatinine within two weeks, alongside residual parenchymal scarring on ultrasound, is a reassuring but incomplete picture, and long-term surveillance for hypertension, proteinuria, and progressive loss of function is warranted, as has been reported after renal trauma managed both operatively and non-operatively [1, 3, 9].

This report is limited by its single-case design, which does not permit generalisation, and by the absence of longer-term functional imaging (e.g., nuclear renography) to quantify the split renal function achieved after injury and embolisation; such data would strengthen future follow-up of this child and comparable cases in the literature.

Conclusions

Delayed haemorrhage from a renal artery pseudoaneurysm should be considered in any child with recurrent or secondary gross haematuria after blunt renal trauma, particularly beyond the first week of injury. In a child with a solitary kidney, superselective angioembolisation offers an effective, nephron-sparing means of haemostasis and should be favoured over surgical exploration where feasible, but clinicians should anticipate and be prepared to manage transient post-procedural acute kidney injury with close multidisciplinary, including nephrological, support.

Declarations

Ethics approval and consent to participate: Not applicable.

Consent for publication: Informed consent for publication of this case report and accompanying imaging was obtained from the patient's parent/legal guardian.

Availability of data and materials: The datasets used and/or analysed during this case are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: VHJS: clinical management, literature review, manuscript drafting. MS: clinical oversight, manuscript review and editing, final approval. Both authors read and approved the final manuscript.

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Clinical trial number: Not applicable

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Figures

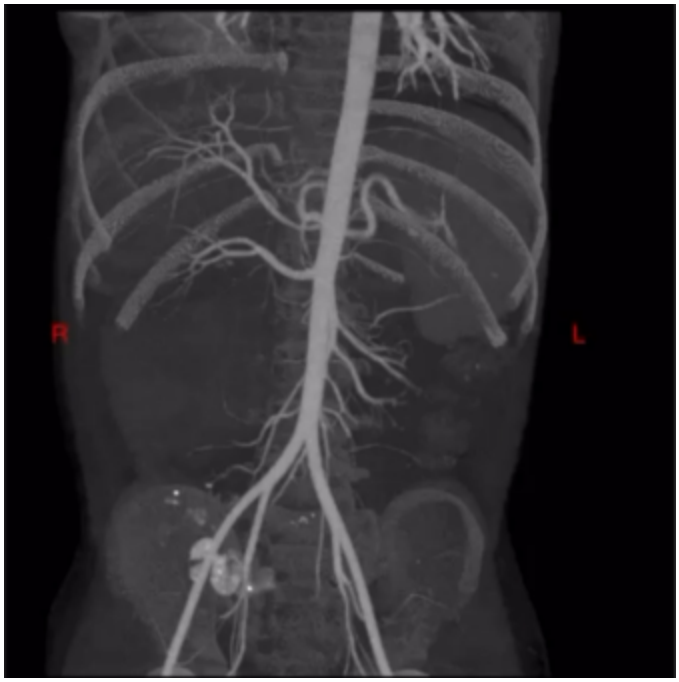


Figure 1

CT angiogram demonstrating the lower-pole right renal artery pseudoaneurysm with active extravasation.

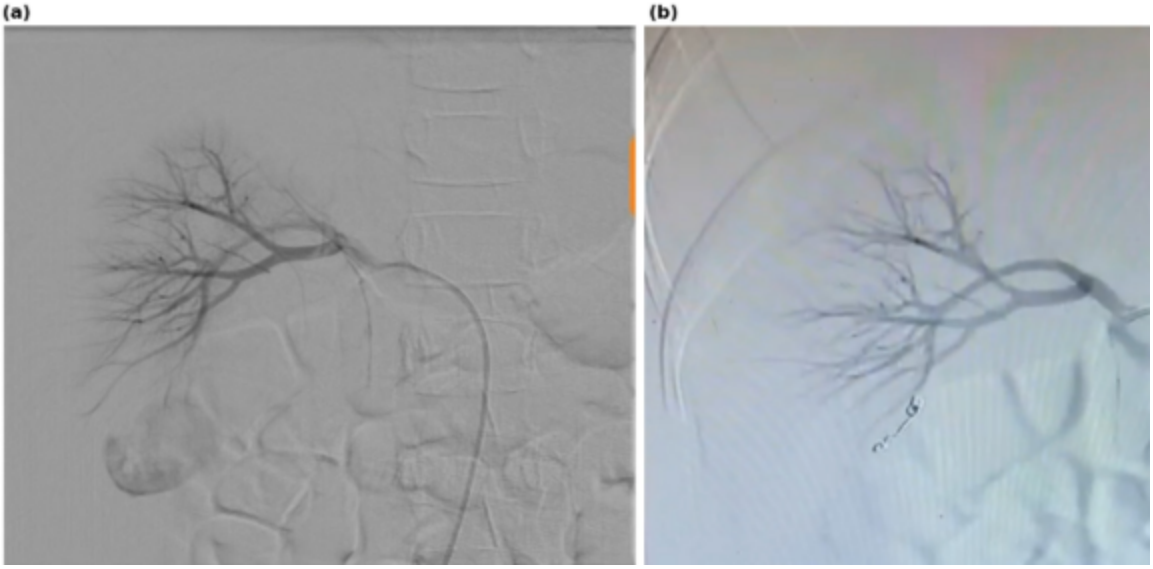


Figure 2

Digital subtraction angiogram (a) before and (b) after coil embolisation of the pseudoaneurysm.