CASE REPORT

Percutaneous transcatheter super-selective embolization of a tributary of an accessory renal artery to control traumatic haematuria from a horseshoe kidney-a case report

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Abstract

Objectives: The most experienced clinicians could easily miss serious renal injury at surgery. We report a case of a recently diagnosed bleeding from a lacerated horseshoe kidney with a review of the literature.

Methods: The clinical and imaging records and laboratory results of a patient with blunt abdominal trauma were reviewed who initially underwent splenectomy for splenic injury, but a renal injury was missed at laparotomy. We also carried out a review of published reports of renal artery injuries.

Results: A thirty-year-old man was admitted as an emergency to a hospital after he had sustained blunt abdominal trauma in a go-carting accident. He underwent splenectomy for splenic injury following which he was discharged. A few days later, he was seen in another hospital complaining of left loin pain where, a provisional diagnosis of urinary tract infection and possible haematoma around his splenic bed was made. He discharged himself against medical advice before further imaging could be undertaken. He presented to a third hospital with abdominal pain and then developed haematuria severe enough for him to be transfused. Ultra-sound scan and CT-scan of the abdomen and pelvis showed injury to a horseshoe kidney with haematoma which was initially drained percutaneously. Post contrast axial CT scans showing the transacted kidney and active renal bleeding are shown in Figures 1 & 2. A selective renal artery angiogram confirmed bleeding from a tributary of an accessory descending left renal artery that was successfully treated by super-selective embolization (Figures 3, 4, 5 and post embolization CT Figure 6).

Conclusions: Ultrasonography and Computed Tomography are instrumental in the diagnosis of a horseshoe kidney. Both ultrasound and CT scans confirm a renal/peri-renal haematoma resulting from renal trauma. Selective renal artery angiography not only confirms the source of bleeding but also allows superselective arterial embolization as a definite or stopgap treatment.Super-selective embolization of renal haemorrhage is comparatively non-invasive and preferred to open surgery.

Key words

Horseshoe kidney, Transection, Haematuria, Super-selective, Renal artery embolization, Go-karting accident

1 Introduction

About 3% of all trauma hospital admissions involve renal trauma but 10% of all traumas involve the kidneys. The presence or absence of haematuria is not a reliable indicator of genitourinary traumatic injury [1]. In one study, 13% of renal gunshot victims had no haematuria [1]. Renal injuries may not be obvious initially, hidden by other structures. We report a case of a late presentation of severe haematuria following traumatic transection of a partial horseshoe kidney – a complication of a go-karting accident, which was missed at laparotomy and splenectomy for ruptured kidney.

We have discussed the investigation and diagnosis of renal injuries as well as reviewed the literature regarding selective and superselective renal artery embolization in renal trauma.

2 Case report

A 30-year-old man was admitted as emergency complaining of a left sided abdominal pain. Thirteen days prior to his admission, he was involved in a go-carting accident and was admitted to another hospital where he underwent laparotomy and splenectomy for a lacerated spleen (details of the operative findings were not known). After an uneventful recovery, he was discharged home on long-term prophylactic penicillin v. A day prior to his current admission, he was admitted to another hospital (2nd hospital) with increasing left sided abdominal pain and felt hot, cold, and shivery. He was diagnosed provisionally as having urinary tract infection and was put on antibiotics, and ultrasound scan of his abdomen and renal tract was requested, but he discharged himself against medical advice and stated he would prefer to have his scan on an outpatient basis. He presented to our hospital the next day.

On examination, he was found to be afebrile (with a temperature of 36.4^{o}c) and stable. His pulse rate was 86 per minute, and his blood pressure was 140/82 mmHg. His chest moved well with respiration and was clinically clear. There was evidence of a healed laparotomy scar on his abdominal wall and a small amount of ooze was seen coming out of a previous drain site in the left upper quadrant of his abdomen. He was tender on the left side of his abdomen without any evidence of guarding or rebound tenderness.

The results of his initial investigations were as follows:

- Haemoglobin: 12.0 g/L (normal range 11.5 -16.5 g/dl)
- White cell count: 17.3 × 10^9/L (normal range 4.0-11.0 × 10^9/L)
- Platelets: 138 × 10^9 / L (normal range 150 – 450 × 10^9/L)
- INR: 1.0 (normal range 0.9-1.1)
- C-Reactive-Protein (CRP): 39 mg/L (normal range < 10.0 mg/L)
- Na^+: 136 mmol/L(normal range 136-145 mmol/L)
- K^+: 4.3 mmol/L(normal range 3-5.4 mmol/L)
- Creatinine: 107 umol/L (normal range 53-97 u-mol/L)
- Urea: 5.8 mmol/L (normal range 2.5-6.7 mmol/L)
- Urinalysis: Normal

A conventional abdominal radiograph was unremarkable.

The provisional differential diagnoses were (1) Urinary tract infection following renal trauma at surgery or (2) Intractable collection of haematoma / infected haematoma at his splenectomy site.

His initial management included intravenous fluids, antibiotics (Ciprofloxacin and erythromycin), analgesia, bed rest, Ted stockings and observation. Abdominal ultrasound scan and CT scan were performed on the day of his admission and the findings were as follows:

An ultrasound scan depicted a large left flank fluid collection. The kidney configuration was that of a horseshoe anomaly. The liver and pancreas were normal, and there was evidence of previous splenectomy.

Contrast enhanced CT scans showed a retroperitoneal collection associated with a left kidney laceration. The kidneys were of a horseshoe configuration with good renal function. Delayed scans depicted contrast leak within a septate fluid collection which was provisionally presumed to be organized haematoma or urinoma (Grade 4 Renal injury) (see Figures 1 & 2).

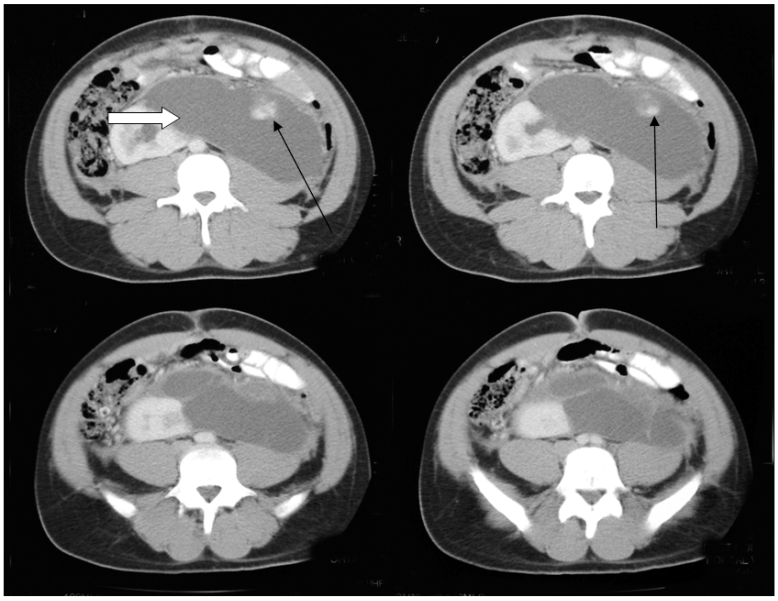

Figure 1. Contrast enhanced axial CT scans showing a large septate fluid collection in the region of the left component and the isthmus of a horseshoe kidney (White arrow). The septate nature of the collection suggests a haematoma rather than urinoma. There is an active point of bleeding within the left extremity of the organized haematoma (Black arrows).

In view of the CT scan finding, a 10 F locking pigtail catheter drain was inserted into the collection over a guide wire after initial needle puncture with a 19G IVS needle through a left posterolateral approach. Through this procedure, 500 mls of blood stained fluid were drained and connected to a drainage bag. No complications were recorded.

He remained stable for four days after insertion of the drain, and the drainage remained serosanguineous. However, on the 4th day of his admission, 17 days after his initial injury, he developed frank haematuria and supra-pubic discomfort. Ultrasound scan of the abdomen and pelvis was performed on the same day , and this showed a large haematoma in the bed of the spleen (splenectomy site) and a horse shoe kidney as well as a large solid round mass like-structure in the bladder which was considered to be most likely a blood clot. A CT scan was recommended. He was catheterized, and 200ml of bloody urine with some blood clot was drained and a bladder-wash out performed. The catheter was connected to an hourly urine bag. Blood was cross matched for 4 units. His management continued to be conservative/expectant, and he remained stable but still had some continuing haematuria. On the 5th day of his admission, his haemoglobin dropped to 8.5 but he remained stable. He was transfused with 4 units of blood over the next two days and remained stable.

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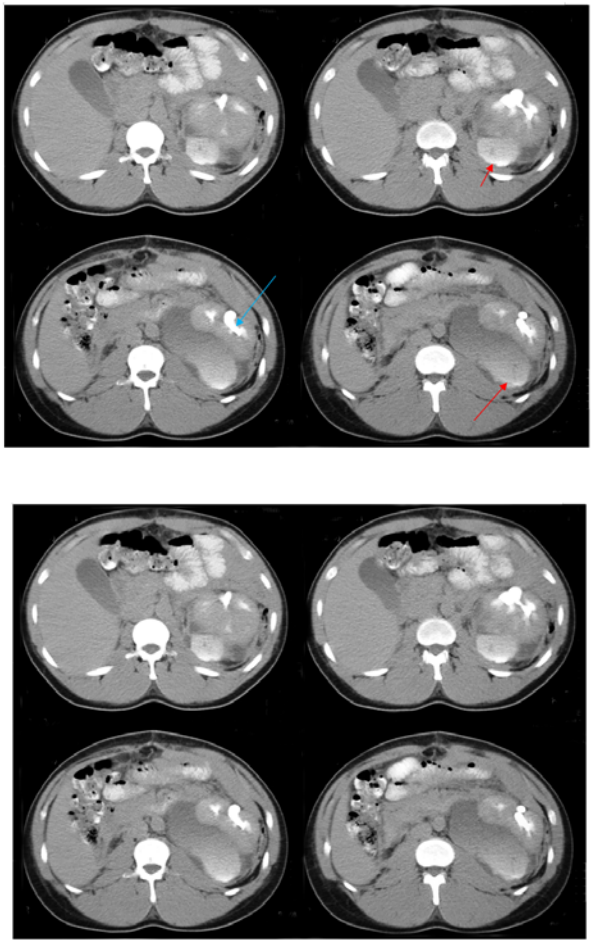

Figure 2. Further post contrast axial CT images (8 frames) show a large haematoma posterior to the left component of the horseshoe kidney with active bleeding (red arrow) displacing and compressing a functioning part of the kidney left anterolaterally. There is retention of the water-soluble contrast within the collecting system (blue arrow) implying a degree of obstructive uropathy either from compression/displacement of the kidney or an organized thrombus within the left ureter (not seen). Although a mild degree of hydronephrosis of a left, hydronephrosis of the left kidney is common in a horseshoe kidney.

On the 9th day of his admission (22nd day following his initial injury), a repeat CT scan was obtained, which showed collection of denser material in the retroperitoneal space, (haematoma) and that the drain was in a good position. The patient continued to be stable on conservative management but continued to have steady mild haematuria. On the 13th day of admission (26 days after the initial injury), an aortography and left renal arteriography was performed, which showed a small arterial bleeding arising from an accessory left renal artery (a tributary of the descending branch of the left renal artery). The bleeding source was super-selectively embolized successfully using PVA micro particles (Figures 3, 4 and 5). The haematuria gradually settled 6 days after the embolization (19th day of admission, 32 days after his injury) and he was discharged home.

A further contrast enhanced CT scan 10 weeks following the embolization (not shown) showed a reconstitution of the fractured horseshoe kidney, with no residual perinephric haematoma or hydronephrosis.

The patient had remained asymptomatic nine years and six months after his injury.

Figure 3. Flush aortic angiography shows poorly defined lower poles of the kidneys and a suggestion of a mass at the lower pole of the left kidney associated with compression and spasm of several left lower pole renal arterial tributaries.

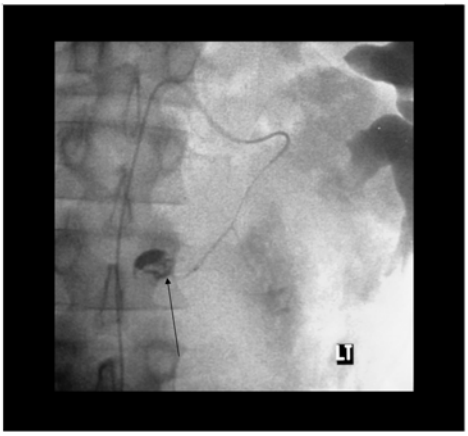

Figure 4. Selective angiogram of an accessory renal artery using a micro catheter shows a point of active bleeding, subsequently embolized with PVA particles (arrow). Note the dilated pelvicalyceal system to the left of the image.

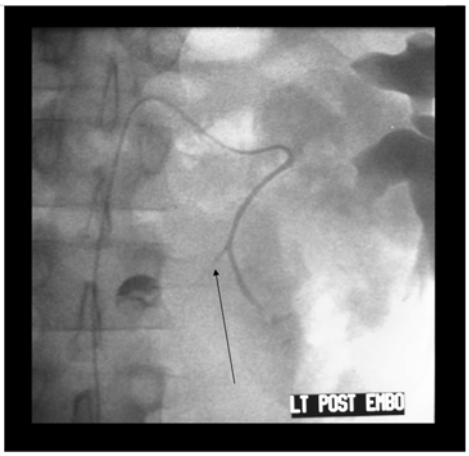

Figure 5. Post embolization angiogram shows shows a complete occlusion of the embolized artery excluding the point of bleeding (arrow). Note that the arterial spasm has been relieved and the embolized artery is now considerably larger/fuller.

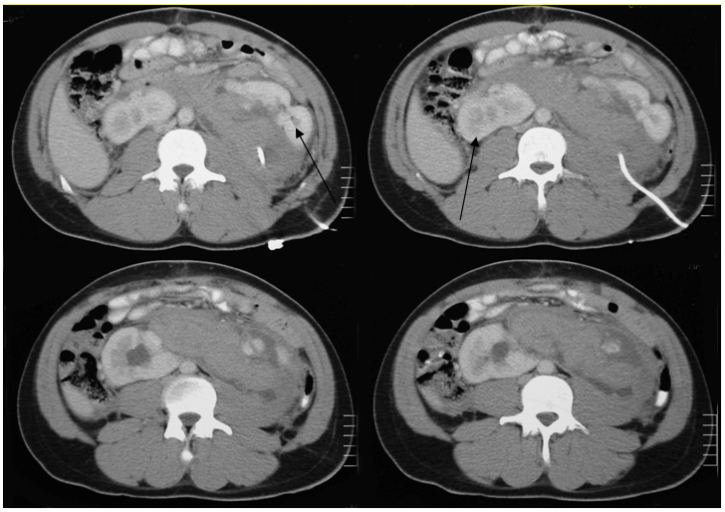

Figure 6. CT scans showing the recovered kidney following percutaneous arterial embolization

3 Discussion

Horseshoe kidney is the most common example of renal fusion. Its prevalence is 1 in 400 and the male to female ratio is 2:12. The kidneys lie parallel to the spine (instead of obliquely) and are joined at their lower poles (in 95%) by midline renal parenchymal tissue (the isthmus). Most patients with horseshoe kidneys remain asymptomatic; however, infection and calculi may develop and cause symptoms.

Renal trauma may be blunt or penetrating injury. Blunt renal injuries may result from a direct blow or acceleration / decelerating injuries (Road traffic accident, falls from heights, falls onto flank). Penetrating injuries of the kidney may be a result of stab wounds, gunshot or may be iatrogenic (e.g. percutaneous nephrolithotomy).

The proportion of all renal injuries which are blunt varies geographically – Europe 95%, USA 90%, South Africa 25 – 85%. The proportions vary in urban or non-urban communities [3].

The clinical and radiological assessment of a patient with renal trauma depends upon whether the patient is haemodynamically stable or unstable. In the case of a haemodynamically stable patient, the history of the injury would indicate the nature of the injury (blunt or penetrating injury). Examination of such a patient should include pulse rate, systolic blood pressure, respiratory rate, position (s) of the entry and exit wounds, flank bruising and size of bruise, rib fractures. The lowest recorded blood pressure dictates the need for renal imaging.

Indications for renal imaging in the stable patient include [3]:

1) Penetrating abdominal and chest wounds
2) Macroscopic haematuria
3) Microscopic (greater than 5 RBCs per high-powered field) or dipstick haematuria in a hypotensive patient (systolic blood pressure of less than 90mmHg recorded at any time since the injury). However, it should be borne in mind that in children and young adult, hypotension is a late manifestation of hypovolaemia and blood pressure may be maintained until there has been substantial loss of blood.

4) A history of a rapid acceleration or deceleration (e.g. fall from a height, high speed motor vehicle accident). Sometimes falls from a low height can result in serious renal injury in the absence of shock (systolic blood pressure less than 90mmHg) and of haematuria (pelvi-ureteric disruption prevents blood reaching the bladder).

5) Any child with microscopic haematuria or dipstick haematuria who has sustained trauma

It has been stated that adults with a history of blunt trauma and dipstick or microscopic haematuria do not need to have their kidneys imaged provided there is no history of acceleration/deceleration and no shock as chance of a significant renal injury is less than 0.2% [3].

With regard to the degree of haematuria and severity of injury, while it is true that significant renal injury is more likely with macroscopic haematuria in some cases of severe renal injury haematuria may be absent. In view of this the relationship between absence, presence and degree of haematuria is not absolute [3]. Generally speaking, in blunt trauma macroscopic haematuria predicts the likelihood of significant renal injury. On the contrary, in penetrating trauma, haematuria may be absent in severe renal injury. In blunt renal trauma, the chance of significant renal injury occurring in relation to the degree of haematuria and systolic blood pressure has been reported to be as follows: (a) 0.2% in cases of dipstick or microscopic haematuria and a systolic blood pressure greater than 90 mm Hg; (b) 10% in cases of macroscopic haematuria and systolic blood pressure greater than 90 mmHg; and 10% in cases of renal injury associated with macroscopic haematuria and systolic blood pressure less than 90 mm Hg (see Table 1) [3]:

Table 1. Degree of haematuria: systolic blood pressure mm Hg and incidence of significant renal injury [3]

Degree of haematuria: systolic blood pressure mm Hg	Significant renal injury
Dipstick or microscopic haematuria, systolic blood pressure greater than 90 mm Hg	0.2%
Macroscopic haematuria; systolic blood pressure > 90 mmHg	10%
Macroscopic haematuria systolic blood pressure < 90 mmHg	10%

In haemodynamically unstable patient, the instability may preclude standard imaging such as CT scan as time is of the essence and the patient needs to be transferred to the operating theatre immediately to control bleeding. In such situations, an on-table intravenous urography (IVU) is indicated [3], which may reveal a retroperitoneal haematoma and/or renal injury. The latter may require a nephrectomy. Intraoperative ultrasound is being used increasingly in this clinical scenario.

We presently have a variety of imaging modalities available to deal with patients with renal trauma/haematuria, which include conventional radiographs, ultrasound including color Doppler and intraoperative ultrasound, an IVU, CT, MRI and angiography. The choice of imaging depends on geography and local expertise. IVU and ultrasonography are universally available and may not require a radiologist. An IVU may indicate the type and severity of renal injury and assesses renal function in the contralateral kidney. Where available a contrast enhanced CT scan has replaced an IVU, which is the imaging of choice in suspected renal trauma. With contrast CT scan, an arterial-venous phase scan is done within minutes of contrast injection, followed by a repeat scan 10 to 20 minutes after contrast administration to allow time for contrast to reach the collecting system [3].

Ultrasound scan can show the presence of two kidneys and identify blood flow in the renal vessels (power Doppler scan) but it cannot accurately identify parenchymal tears, collecting system injuries or extravasation of urine until a later stage when a urine collection has had time to accumulate [3].

The objectives of imaging in renal trauma include to:

- grade the injury
- document presence and function of contralateral kidney

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- identify associated injuries
- identify pre-existing renal pathology in affected kidney

In a contrast enhanced CT scan one looks for the following: (1) the depth of parenchymal laceration; (2) parenchymal enhancement (absence of enhancement is suggestive of renal artery injury); (3) presence or absence of extravasation of urine (medial extravasation of contrast is suggestive of disruption of renal pelvis or pelviureteric junction; (4) presence, size, and position of retroperitoneal haematoma (haematoma medial to the kidney is suggestive of a vascular injury); (5) presence of injuries to adjacent organs (spleen, bowel, liver, pancreas, and other injuries); (6) presence of a normal contra-lateral injuries

In the rare situation of shock and need for immediate laparotomy when a patient is transferred immediately to the operating theatre without having had a CT scan and a retroperitoneal haematoma is found, a single shot abdominal X-ray, taken 10 minutes after contrast administration (2ml/kg of contrast), can establish absence/presence of a renal injury and the presence of a normally functioning contra-lateral kidney where the ipsilateral kidney is likely to necessitate a nephrectomy [3].

Various surgical incisions are available for exploring the kidney. However, midline incision is the technique of choice for renal exploration in such situations because it allows:

- Easy-exposure of renal pedicle and allows early control of the renal artery and vein.
- Inspection for injury to other organs in the abdominal cavity.

Through a midline incision the small bowel is lifted upwards to allow access to the retroperitoneum. The peritoneum over the aorta is incised above the inferior mesenteric artery. If the correct site of the incision is obscured by a large peri-renal haematoma then an incision is made medial to the inferior mesenteric vein. Once on the aorta, the inferior vena cava may be exposed and this allows access to the renal veins and renal arteries. Slings are then passed around all these vessels. The kidney is then exposed by lifting the colon off the retroperitoneum. Bleeding may be minimised by applying pressure to the vessels via the slings. Bleeding vessels in the kidney may be controlled by the use of 4/0 monocryl or vicryl sutures. Defects in the collecting system may be closed with 4/0 vicryl. In the event that the sutures cut out, a strip of surgical or oxycel may be placed over the bleeding site and then the sutures are then placed through the capsule on either side of this, and then the sutures are tied over the surgical or oxycel. This should stop them from cutting through the friable renal parenchyma [3].

When at laparotomy there is evidence of an expanding and/or pulsatile retroperitineal haematoma, this will indicate a renal pedicle avulsion or laceration and it may be necessary to perform nephrectomy to stop further bleeding.

The correct management is controversial if there is a finding of a non-expanding, non-pulsatile retroperitoneal haematoma at laparotomy. On the whole most of such cases can be left alone. The point to remember in such situations is that exploration increases the chances of loss of the kidney because of bleeding which can be controlled only by nephrectomy. The guidelines which determine the decision to explore is based upon whether pre-operative or on-the table imaging has been done and is abnormal or normal. The recommended actions to be taken with regard to different scenarios include [3]: (a) in cases of normal pre-operative or intra-operative imaging the recommendation is to leave the haematoma alone; (b) if the injured kidney is abnormal and the contra-lateral kidney is normal then the recommendation is to explore and repair the renal injury; (c) if the injured kidney is abnormal and the contra-lateral kidney is abnormal or absent then the recommendation is to leave the kidney alone because of bleeding which can only be controlled by nephrectomy and this would be disastrous if the contra-lateral kidney is damaged or absent; (d) if a pre-operative or intra-operative imaging has not been done then the recommendation is to explore and repair the kidney (see Table 2). The aforementioned

recommendations are generally useful for the urologist who has to deal with cases of renal injury in the absence of an interventional radiologist who can perform selective renal angiography and super-selective embolization.

Table 2. Recommended Surgical Action to be taken based upon various scenarios of pre-operative or intra-operative imaging findings [3]

Pre-operative or intra-operative imaging	Recommended action to be taken
Normal	Leave haematoma alone
Abnormal; contra-lateral kidney normal	Explore and repair the renal injury
Abnormal; abnormal or absent contra-lateral kidney	Leave the kidney alone; exploration increases the chances of kidney loss because of bleeding which can only be controlled by nephrectomy and this would be a disaster if the contra-lateral kidney is damaged or absent.
None	Explore and repair kidney

Classification of renal injuries is based upon the American Association for the Surgery of Trauma Organ Injury Severity Scale as follows [3]:

- Grade 1. Renal Contusion – injury is bruising of renal parenchyma without true parenchymal destruction. An associated sub-capsular haematoma may be present, but the kidney is intact. Such types of injuries account for the majority of cases of blunt renal trauma.
- Grade 2. This type of injury involves ruptures or tears of the renal capsule and parenchyma that are less than 1 cm in length (-non expanding peri-renal haematoma may be present).
- Grade 3. This type of injury is the same as grade 2 except that it extends more than 1 cm and there is no urinary extravasation.
- Grade 4. This type of injury is a major laceration that extends into the collecting system and produces extravasation of urine. Segmental vessel involvement also qualifies as grade 4 injury.
- Grade 5. This refers to the most extensive renal injury. These include: severe multiple lacerations, fracture, shattering of the kidney, and avulsion of the renal hilum.

Grade 1 and 2 injuries are classified as minor injuries and account for 85% of all renal injuries. Grade 3, 4, and 5 injuries are classed as major injuries. Renal lacerations account for about 15% of blunt renal injuries and about 30% of penetrating injuries. Renal vascular injury includes thrombosis, occlusion or avulsion of renal artery, vein or one of their branches. This occurs in up to 10% of penetrating renal injuries and less than 1% of blunt renal trauma. Renal vascular injuries are difficult to diagnose quickly enough to prevent renal loss due to the fact that significant and reversible renal injury occurs within one hour if significant ischemia is present.

With regard to treatment of renal trauma, 95% of blunt injuries, 50% of stab injuries and 25% of gun-shot injuries can be managed non-operatively (by conservative management which include cross matching of blood, bed rest and observation as well as use of antibiotics to prevent infection). Surgical exploration is generally indicated (whether penetrating or blunt injury) in the event of [3]:

1) When the patient develops shock which does not respond to resuscitation with fluids and / or blood transfusion.
2) Significant decrease in haemoglobin (there are no strict definitions of what constitutes a ‘significant’ fall in haemoglobin.
3) An extravasation of urine and associated bowel, pancreatic or extensive splenic injury.
4) Expanding peri-renal haematoma (in this case the patient will almost invariably show signs of continued bleeding.

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5) Pulsatile peri-renal haematoma. (A pulsatile and or expanding peri-renal haematoma is suggestive of a renal pedicle avulsion. Haematuria is absent in 20% of such cases).

Urinary extravasation in itself is not necessarily an indication for surgical exploration because 80% to 90% of such injuries will heal spontaneously. In view of the fact that the mixing of bowel contents with urine is a recipe for severe sepsis, the threshold for operative repair is lower in the event of urinary extravasation associated with bowel and pancreatic injury. In such cases there is the need for the renal repair to be well drained and for omentum to be interposed between the kidney and the bowel/pancreas. In the event of a considerable amount of extravasation, one should consider inserting a JJ stent. If after this the patient develops a prolonged ileus or fever then there would be the need to repeat renal imaging because these signs may be suggestive of the development of urinoma which can be drained by the percutaneous technique. In the event of persistent leak renal exploration would be indicated. The patient did not develop any bowel injury; he only required insertion of a percutaneous drainage of haematoma under radiological control and the bleeding vessel which was identified by means of selective renal artery angiography was super-selectively embolized.

Toutouzas [4] suggested that exploration is usually not required for patients with devitalized segments of kidney and with urinary extravasation.

Pursuant to renal ischemia from renal artery thrombosis or injury or renal compression by fibrosis or haematoma excess renin excretion does occur. This may result in hypertension many months or years after the renal injury. Post traumatic hypertension may occur in less than 1% of cases [3].

Triller and associates [5] used a tracker-18 perfusion catheter and micro-coils to embolise a renal pseudoaneurysm caused by blunt trauma with rupture of the kidney, haemorrhage and persistent haematuria. They were of the opinion that conservative management can be employed to treat serious renal trauma provided the source of the bleeding can successfully be embolized with super-selective techniques.

More and co-workers [6], reported a case of a 9-year-old girl who presented with gross haematuria 2 weeks after renal exploration for a penetrating injury. The diagnosis of intra-renal pseudoaneurysm was made by Doppler ultrasound and was successfully treated by selective arterial embolisation.

Tzortzis and associates [7] reported that angiography and selective renal artery embolisation were performed in two patients with post-traumatic iatrogenic kidney lesions and intractable haematuria. One patient presented after a nephrolithotomy with rupture of segmental branch of the renal artery well demonstrated on selective angiography which showed intraparenchymal extravasation of contrast medium. The second patient presented after a renal biopsy with severe haematuria. Angiography performed 10 days later demonstrated an arteriovenous fistula at the site of puncture. Hyper-selective embolisation achieved immediate control of the haematuria in both patients, with maximal preservation of the renal parenchyma and maintenance of good renal function. At follow-up 12 months later, there had been no recurrence of the haematuria. Tzortzis and associates [7] were of the opinion that these results suggest that trans-catheter embolisation should be considered the method of first choice in renal trauma accompanied by intractable haematuria before any surgery is attempted.

Rosenbusch and co-workers [8] reported a successful embolisation with Gelfoam of renal haemorrhage caused by surgery. They reported that the kidney (a right kidney) had three arteries and that embolisation was made easier by the fact that bleeding originated from the smallest of the three arteries for the right kidney. They reported that there was no hypertonia. They also observed formation of intra-renally localised reno-renal collaterals.

With developments in interventional radiology it is now possible to identify the source of bleeding from any branch of the renal artery by means of selective renal artery angiography and when the bleeding vessel is found super-selective embolization can be carried out using various embolizing agents.

Bora and associates [9] in 2007 reported the case of a young man who presented with painless haematuria. He was diagnosed with bilateral renal angiomyolipoma on ultra-sonography. The large bleeding lesions were identified by means of renal angiography and these were selectively embolized using polyvinyl alcohol particles. Bora and associates [9] stated that to the best of their knowledge isolated use of polyvinyl alcohol particles in the embolization of a bleeding renal angiomyolipoma had not been previously reported.

Mavili and associates [10] evaluated the effectiveness of percutaneous trans-arterial embolization for the treatment of renal arterial bleeding in patients with reno-vascular injury. They reviewed the archives of their angiography suite retrospectively, and they included 15 patients who had undergone renal embolization due to renal artery bleeding. In the study, Mavili and associates [10] recorded the site, number, the type of bleeding lesions, and the result of the embolization procedure. They also noted the technical and medical success as well as the technical and medical complications of the procedure. They reported that in renal digital subtraction angiography (DSA), 18 lesions were detected in 15 patients; in 13 cases bleeding was effectively controlled with embolization in a single session; in one case bleeding was controlled on the second attempt; They observed non-target embolization in two cases, one treated with polyvinyl alcohol (PVA) and the other with n-butyl cyanocrylate (NBCA) mixture, iatrogenic dissection of the segmental branch of the renal artery was seen in one patient. Puncture-site bleeding, post-embolization syndrome, peri-renal abscess or renal abscess and arterial hypertension were not observed in any of the patients. Mavili and associates [10] concluded that percutaneous trans-arterial embolization is an effective minimally invasive and tissue preserving treatment method for renovascular injuries. They recommended that endovascular embolization should be the first preferred treatment modality in such reno-vascular injuries.

Venyo and Bakir [11] reported a 64-year-old man who was admitted with haematuria and was catheterized. Flexible cystoscopy revealed a tumour in the left side of the patient's urinary bladder. Excretory urography showed a filling defect in the left side of the urinary bladder and left sided hydroureteronephrosis. The patient developed a stroke therefore his bladder tumour resection was postponed. His renal function subsequently deteriorated and ultrasound-scan showed bilateral hydronephrosis. Bilateral nephrostomies were inserted and the renal function improved. Two weeks after the nephrostomy insertion, the patient developed severe haematuria with a drop in haemoglobin of 4 grams per decilitre. Selective renal artery angiography confirmed a pseudo-aneurysm of the descending branch of the left renal artery which was successfully embolized with coils and the bleeding stopped. Venyo and Bakir [11] concluded that selective renal angiography to establish the source of bleeding followed by super-selective embolization of the source of bleeding is safe and effective. Venyo and Bakir [11] also suggested that this treatment modality should be the first choice treatment in preference over nephrectomy or partial nephrectomy.

Klamut and associates [12] reported 9 patients with life-threatening renal bleeding of non-malignant origin which included trauma, arterio-venous fistula, pseudo-aneurysm, and polycystic kidneys which were embolized after angiographic demonstrations of leakage. They reported that in all cases, the bleeding was stopped and in one case only, nephrectomy was necessitated 3 days after the initial embolization. They recommended that trans-catheter renal embolization should be performed as selectively as possible.

In 1993, Vonwerk and associates [13] reported that over a period of 15 years selective embolization of the renal artery was performed in 22 patients (15 men, 7 women, mean age 47.5 years (range 5 to 73 years), using a percutaneously introduced coaxial technique with a 3F catheter. They also reported that tissue glue (N-butyl-2-cyanoacrylate) was used in 18 cases, spiral wire in two cases, detachable balloon in three cases and gel-foam in one case. Vonwerk and associates [13] reported that the bleeding had been iatrogenic in 20 cases, in one it was the result of a road traffic accident, while in another the bleeding was from angioma. The procedure was successful in 21 patients, permanently arresting bleeding in 18. There were three reported complications transitory and not requiring treatment in two cases. In one patient gel-foam embolization went to a wrong site and nephrectomy had to be performed. They stipulated that this form of selective embolization is the treatment of choice in traumatic injury to a renal vessel.

4 Conclusions

Selective renal artery angiography to identify the source of bleeding from a branch of the renal artery followed by super-selective embolization is a useful attractive alternative to open surgery in the treatment for bleeding from a lacerated branch of the renal artery.

Super-selective angiography and embolization has advantages in that it avoids: the need for general anaesthesia, a large surgical incision/scar; long period of recovery following open surgery.

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