

Traumatic renal arteriovenous fistula : a case report

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Post-traumatic renal arteriovenous fistula is an uncommon complication of great significance. In this report, an excretory urogram revealed that a 20-year-old woman, admitted to Chulalongkorn Hospital with gross hematuria after blunt trauma, was found to have a non-functioning left kidney. Computerized tomography revealed evidence of a left perirenal hematoma and a non-functioning left kidney. Renal arteriography showed a left renal arteriovenous fistula as an early venous filling in the arteriographic phase. A thrombus in the left main renal artery was also found. The patient was managed by left nephrectomy.

Key words : Arteriovenous fistula, CT, Arteriography.

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อาเทอร์ริโอวินัสฟิสตุล่าของไต (*arteriovenous fistula*) เป็นภาวะแทรกซ้อนหลังจากเกิดอุบัติเหตุ ซึ่งพบได้ไม่บ่อย การตรวจพิเศษทางรังสีวิทยาของไตโดยการฉีดสารทึบแสงเข้าหลอดเลือดดำ ในผู้ป่วยหญิงไทย อายุ 20 ปี ซึ่งเข้าอยู่โรงพยาบาลจุฬาลงกรณ์ ด้วยอาการปัสสาวะเป็นเลือดหลังอุบัติเหตุ พบว่าไตข้างซ้ายไม่ทำงาน เอกซเรย์คอมพิวเตอร์พบว่ามีเลือดคั่งรอบไตซ้าย และไตข้างซ้ายไม่ทำงานเช่นกัน การตรวจหลอดเลือดแดงของไตซ้าย พบว่า มีอาเทอร์ริโอวินัสฟิสตุล่า (*arteriovenous fistula*) โดยเห็นเส้นเลือดดำของไตทึบแสงตั้งแต่วินาทีแรก ซึ่งควรมีแต่การทึบแสงของเส้นเลือดแดงเท่านั้น นอกจากนี้ยังพบว่าลิ่มเลือดอยู่ในหลอดเลือดแดงใหญ่ของไตซ้ายผู้ป่วยได้รับการรักษาโดยการผ่าตัดไตข้างซ้าย

Arteriovenous fistula rarely occurs in the kidney. More than 200 cases have been reported in the urological literature since the first case was reported in 1928 by Varela from necropsy.⁽¹⁾ The number of reports of this condition has increased because of the increasing use of renal arteriography, the popularity of percutaneous needle biopsy of the kidney and an increase in the incidence of renal trauma due to violence.^(1,2) When diagnosis and treatment are delayed, renal arteriovenous fistula may cause complications such as impaired renal function, renal hypertension which sometimes causing high output cardiac failure.^(2,3) Proper CT imaging enabled us to make an accurate clinical diagnosis, located the fistula and plan proper therapeutic management.⁽⁴⁾ We report herein our experience with renal arteriovenous fistula of traumatic origin.

A case report

A 20-year-old female patient was hospitalized

at Chulalongkorn Hospital on November 25, 1990 with gross hematuria and pain at the left flank. She had suffered a severe abdominal contusion as a result of a train crash two days previously.

On physical examination, her vital signs were normal. She had tenderness at the left side of the abdomen and left flank, with skin abrasion at that region. There was gross hematuria from the use of a Foley's catheter. White blood cell count was 23,400 cells per cu mm with 86% neutrophils, 8% lymphocyte and 6% mononuclear cells; hemoglobin was 10.7 gm%. Urine examination revealed numerous red blood cells.

An excretory urogram showed non-visualization and a non-functioning left kidney, with the right kidney having a normal appearance. Figure 1 shows obliteration of the left psoas shadow, with ill-defined soft tissue mass at the left mid-abdomen.

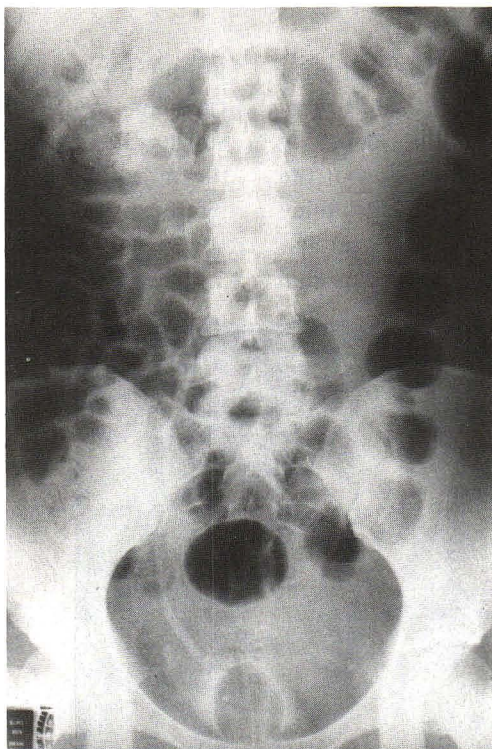


Figure 1. An excretory urogram shows a non-functioning left kidney. The ill-defined soft tissue density at the left mid-abdomen could be a left retroperitoneal hematoma.

Computerized tomography revealed evidence of a left subcapsular hematoma, posterior pararenal hematoma, and hematoma in the left psoas muscle. Thickening of the left gerota fascia was observed. A

non-functioning left kidney was noted. No extravasation of the contrast medium in the left renal region was demonstrated. The right kidney appeared normal. (Figure 2).

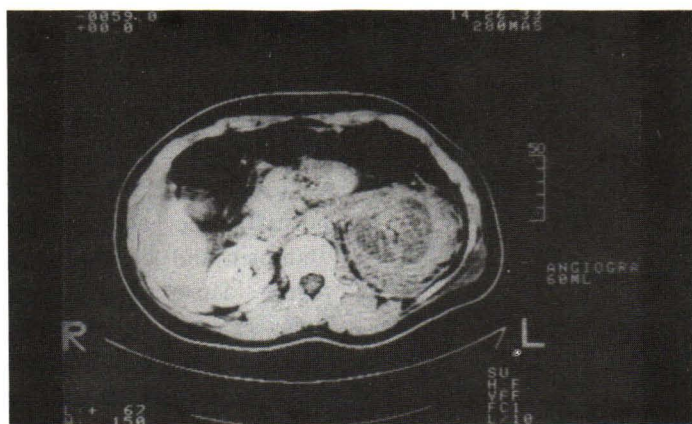


Figure 2. CT scans of the upper abdomen reveal a sub-capsular hematoma of the left kidney, hematoma in the left posterior pararenal space and thickening of the left Gerota fascia. Enlargement of the left psoas muscle was observed. Lack of left renal enhancement in the presence of normal renal contour was seen.

Left renal arteriography, using the Seldinger technique, demonstrated irregularity of the left renal artery, containing irregular tubular filling defect in the lumen of the main artery. Extravasation of the contrast medium in the upper pole of the left kidney was seen. There was crowding of the intrarenal vessels. Widening of the space between the capsular

artery and interlobar vessels, with stretching of the capsular artery, was noted; this represented a subcapsular hematoma. Early visualization of both the intrarenal and main renal veins in the arterial phase was demonstrated. (Figure 3) An additional aortogram showed no nephrogram of the left kidney in the nephrographic phase (Figure 4).

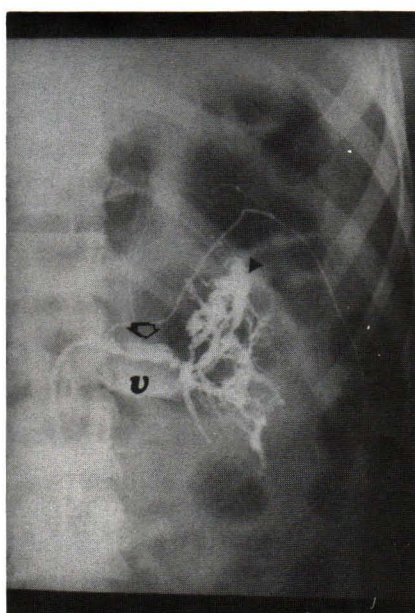


Figure 3. Left renal arteriography demonstrates early filling of the left renal vein in the arteriographic phase (V). Irregularity of the left renal artery containing a thrombus in the lumen of the main renal artery is observed (arrow). Extravasation of the contrast medium in the upper pole of the left kidney is seen (arrow head), with crowding of the intrarenal vessels. Widening of the space between the capsular artery and interlobar vessels, with stretching of the capsular artery, was noted.

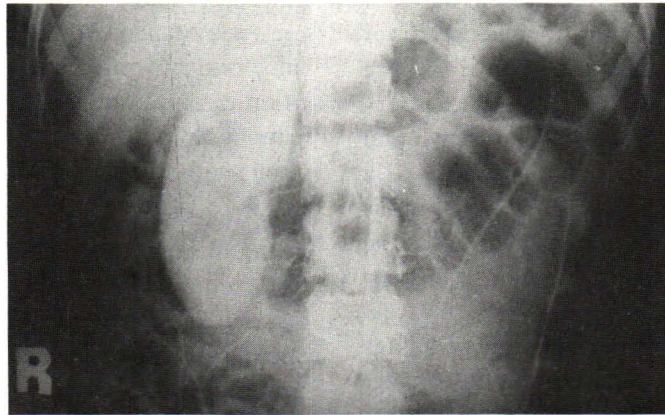


Figure 4. An arotogram reveals no nephrogram of the left kidney. Normal nephrogram of the right kidney was observed.

At exploration, a tear in the left renal artery, with thrombus occlusion, was noted. Ischemic left kidney with perirenal hematoma was found. Left nephrectomy was performed.

Pathological examination revealed a ruptured left kidney, a tear in the left renal artery and infarction of the left kidney.

Discussion

Renal arteriovenous fistula is an important clinical entity. Renal arteriovenous fistula can be classified as congenital, idiopathic and acquired in type.^(1,2) Congenital arteriovenous fistula has a cirroid appearance with multiple interconnecting fistulas.^(1,2) This type of fistula constitutes about 25% of all cases, occurring in young patients who may present with no symptom.⁽⁵⁾ Idiopathic fistulas are single, not cirroid and have no apparent cause, although it is thought that this type may be due to venous erosion by a preexisting arterial aneurysm.⁽¹⁾ The idiopathic type is rare. Messing et al. reported that it comprises about 3-5% of the cases.⁽⁶⁾ The patients are usually older, and there is no discernable etiology, specifically no predisposing renal arterial or parenchymal disease.^(1,6) Acquired fistulas may be iatrogenic, secondary to needle biopsy of the kidney, heminephrectomy or nephrolithotomy. They also may be seen following penetration or blunt trauma or in conjunction with renal neoplasms.⁽¹⁾ Renal biopsy is the most common cause of the acquired type, accounting for about 40-50% of the cases,^(1,2,4) and is more likely to occur in patients with nephrosclerosis and arterial hypertension. The incidence of renal arteriovenous fistula secondary to blunt and penetrating

trauma is variable. McAlhany et al. reported a 15% incidence secondary to trauma.⁽⁷⁾ O'Brien et al. were of the view that trauma was an increasingly important cause of renal arteriovenous fistulas.⁽¹⁾

Clinical manifestations of renal arteriovenous fistulas depend primarily on their size, location and etiology. Renal arteriovenous fistulas may present with acutely gross hematuria, hypertension or bruit in any combination. Spontaneous rupture of renal arteriovenous fistula may produce a mass in the flank, but this is exceedingly rare. Casgrove et al. reported that 11 of 12 patients with traumatic renal arteriovenous fistula presented with gross hematuria and one presented with diastolic hypertension.⁽⁴⁾ Congenital lesions, when symptomatic, may present with hematuria, flank pain and urinary retention caused by the presence of blood clots.⁽²⁾ Gross hematuria is the common presentation of renal trauma with suspected rupture and/or vascular injury. Renal hypertension or even cardiac failure due to large arteriovenous shunting may present later. Therefore, the appearance of hypertension after known trauma should alert the practitioner to the possibility of a persistent renal arteriovenous fistula. The possibility of hypertension, produced by renal ischemia resulting from a reduction of vascularization of the kidney in arteriovenous fistula, has been considered. So, even though the occurrence of renal arteriovenous fistula is uncommon, this condition must be included in the differential diagnosis. Early and prompt diagnosis may enable good management planning.

Our case report presented with gross hematuria after trauma, which is a common presentation of renal trauma with suspected ruptured and/or vascular

injury. Diagnostic imaging is indicated in cases of penetrating or blunt trauma with gross hematuria or in combination with shock after trauma.⁽⁸⁾ The diagnostic evaluation should include excretory urography with nephrotomography. This may reveal a non-functioning kidney or non-visualization of a portion of the affected kidney if the fistula is extrarena.^(2,3) An irregular filling defect in the affected renal pelvis or calyx may occur because of compression from dilated vessels and calyceal distortion.⁽¹⁻³⁾ Even abnormal radiographic findings are often non-specific for renal arteriovenous fistula. Only a non-functioning kidney and urinary extravasation seem to be reliable radiographic findings for major or pedicle injury.⁽⁸⁾ Case found that unilateral non-appearance of the kidney on urography after external trauma indicated serious damage to the kidney, because traumatic main renal artery occlusion was the most common cause of this finding.⁽⁸⁾ In our patient, we also found non-appearance of the left kidney by urography, which was caused by the thrombus in the main left renal artery.

Ultrasound is a non-invasive method which is very popular in the evaluation of various organs. Ultrasound in evaluation of renal trauma has been reported elsewhere^(10,11) Ultrasound seems to be both sensitive and specific in experienced hands. Doppler ultrasound is currently a widely used non-invasive technique capable of providing much information about the condition of blood vessels and the flow within them throughout the body.⁽¹²⁾ Doppler ultrasound can be used during an operation to search for the location of a fistula. Very turbulent, high velocity Doppler flow may present in the renal vein and branches at the fistula.⁽²⁾ Unfortunately, we had no opportunity to study Doppler ultrasound in this patient.

Computerized tomography (CT) would seem to be the imaging technique of choice for renal trauma that is thought to be extensive or incompletely assessed with urography. CT accurately assesses the extent of injury, showing lacerations, extravasation, surrounding hemorrhage and vessel injury.⁽⁸⁾ Bretan et al. retrospectively reviewed CT findings in 85 patients with blunt and penetrating renal trauma and found that CT was sensitive and specific in showing pre-renal hematoma (29.4%), intrarenal hematoma (24.7%), parenchymal disruption (17.6%) and extravasation (13.5%). Importantly, 17% of the patients were found to have associated non-renal injuries on CT.⁽¹³⁾ Carroll et al. suggested that CT may effectively stage renal pedicle injuries.⁽⁸⁾ Arterial occlusion may be manifested on CT as a lack

of renal enhancement or excretion, usually in the presence of a relatively normal renal contour, rim enhancement, central hematoma and abrupt cut-off of an enhanced renal artery.^(14,15) However, unlike arteriography, CT is not specific in the diagnosis of renal arteriovenous fistula.

Renal arteriography and aortography are specific in the diagnosis of renal arteriovenous fistula. Arteriograms enable an accurate clinical diagnosis, and help in locating the fistula and estimating its size and in planning an intelligent therapeutic course. The characteristic finding of renal arteriovenous fistula is early renal vein-filling in the arteriographic phase.^(1-4,16)

The ideal treatment of renal arteriovenous fistulas depends upon the cause of the fistulas as well as size and clinical manifestations. Once the diagnosis is made, it becomes a question of operative versus non-operative treatment. Congenital renal arteriovenous fistulas in the majority of cases are asymptomatic and require no intervention.⁽⁵⁾ In small arteriovenous fistulas resulting from trauma, idiopathic types and those developing after percutaneous needle biopsy of the kidney, spontaneous closure was reported after conservative treatment.^(1,2,17) Indications for operation in the management of renal arteriovenous fistulas include cardiac decompensation, progressive renal failure, fistulas secondary to neoplasm, pain, hematuria and hypertension, particularly if it is not easily controlled with medications.⁽²⁾ When an operation is indicated, parenchymal sparing procedure is preferable to nephrectomy. In our case, severe rupture of the renal parenchymal and multiple fistulas required a quick procedure and parenchymal preservation could not be done. The use of selective renal artery embolization is being increasingly used recently in an attempt to conserve more of the renal parenchymal and function.^(2,18,19)

Conclusion

This article presented a 20-year-old woman with gross hematuria from renal arteriovenous fistula of the left kidney following blunt trauma. Non-appearance of the left kidney by excretory urography and a non-functioning left kidney by computerized tomography were found. These findings are non-specific for renal arteriovenous fistula. Diagnosis of renal arteriovenous fistula is established by renal arteriography as early venous filling in the arterial phase. Renal arteriovenous fistula may be congenital, or idiopathic, or acquired. Leading

manifestations are hematuria, bruit in the flank and diastolic hypertension. Conservative treatment is indicated in cases with a small fistula. Therapeutic intervention is indicated for persistent and symptomatic fistulas.

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