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## *Case Report*

# Page Kidney: A Rare but Surgically Treatable Cause of Hypertension

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**ABSTRACT.** The Page kidney is a rare phenomenon. External renal parenchymal compression is the culprit. We report two cases of young males with flank pain, renal mass, and hypertension with history of blunt abdominal trauma. Initially, hypertension was controlled by angiotensin-converting enzyme (ACE) inhibitors but gradually became refractory to medical treatment. Laparoscopic nephrectomy was performed in both patients. We emphasize the Page kidney as a cause of hypertension in young patients, presenting with flank pain and renal mass with or without complications of hypertension. Management is aimed to control blood pressure by ACE inhibitors, aspiration of the hematoma, open hematoma evacuation, or nephrectomy.

## Introduction

The Page kidney phenomenon is any external compression of the renal parenchyma, leading to hypoperfusion and ischemia and activation of the renin–angiotensin–aldosterone axis. The Page kidney usually affects young patients presenting as hypertension and its complications, renal mass lesions, and flank pain. Conservative management involves starting the patient on antihypertensive drugs, preferably angiotensin-converting enzyme (ACE) inhibitors. Drainage of the subcapsular renal hematoma and nephrectomy is reserved for refractory cases. Our cases are unique in presentation. Two young patients presented with renal mass and hypertension with history of trivial trauma. Both cases were managed with laparoscopic nephrectomy although renal conservation was attempted in one patient by laparoscopic perinephric hematoma evacuation. The Page kidney should be considered in the differential diagnosis of young patients presenting with hypertension, renal mass, and flank pain.

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## Case Reports

Written informed consent was obtained from both patients before reporting.

*Case 1*

A 24-year male patient presented with history of having had a motor vehicle accident six years back, for which he did not seek any medical

Figure 1. Contrast-enhanced computed tomography scan of the abdomen (case 1) showing large subcapsular hematoma surrounding the left kidney with minimal renal parenchyma.

advice at that time. He presented with intermittent left flank pain for six months and headache for the past one month. No past or family history of hypertension was present. General physical examination revealed pulse rate of 86/min and blood pressure of 168/94 mm Hg. On local examination, a nontender, bimanually palpable mass was found in the left flank region. Blood and serum biochemistry values, coagulation profile, urine analysis, and echocardiography were within normal limits. On ultrasound abdomen, he was found to have a left perirenal mass or hematoma and normal right kidney. Plasma renin level was 26 ng/mL/h (0.6–4.3 ng/mL/h) with a plasma aldosterone level of 31 ng/mL. Contrast-enhanced computed tomogram (CECT) abdomen revealed 18 cm × 12 cm subcapsular hematoma surrounding the left kidney, which had minimal parenchyma (Figure 1). Diethylene-triamine-penta-acetic acid renal scan demonstrated no tracer uptake in the left kidney with the total effective renal plasma flow (ERPF) being 352.19 mL/min (Figure 2). In view of nonfunctioning kidney and unresponsive hypertension, the patient was managed by laparoscopic simple nephrectomy after proper counseling. Intraoperatively, a fibrotic capsule covering remnant renal parenchymal tissue, which was densely adherent to the psoas muscle and surrounding structures, was found. The postoperative period was uneventful. Blood pressure was 122/78 mm Hg on the 7th postoperative day.

*Case 2*

A 21-year-old male patient presented with a chief complaint of right flank pain for the past one year and palpitation for three months. He had history of fall from height two years earlier. At that time also, he had history of right flank pain which was relieved by over-the-counter medications. There was no past or family history of hypertension. On general physical examination, blood pressure was 166/92 mm Hg and pulse rate was 72/min. On local examination, a nontender, uniformly smooth, firm, bimanually palpable mass was found in the right flank region. Routine blood

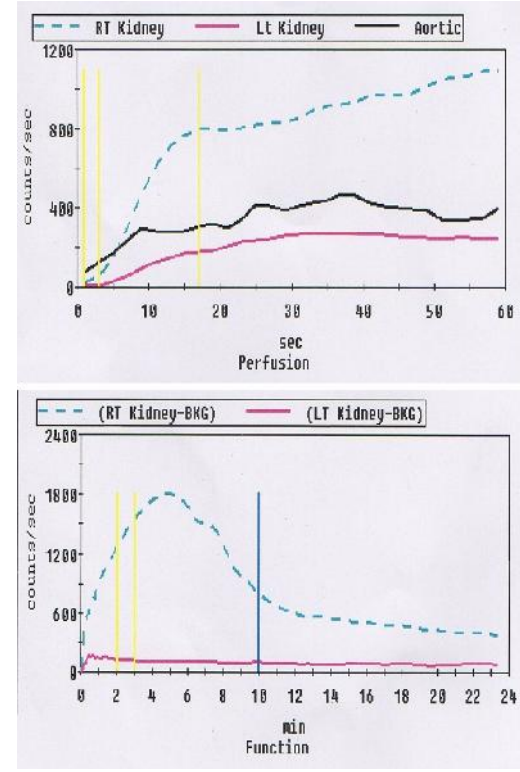


Figure 2. Preoperative diethylene-triamine-penta-acetic acid renal scan demonstrated no tracer uptake and poor perfusion of the left kidney with normal right kidney tracer uptake.

and urine investigations were unremarkable. The coagulation profile was normal. Ultrasound abdomen revealed a cystic mass in the right renal fossa with eccentric solid component and normal left kidney. On further imaging work-up with CECT abdomen, a 12 cm × 8 cm subcapsular hematoma was found over the right kidney which had minimal parenchyma (Figure 3). Ethylene cysteine (EC) renogram demonstrated 14% split function of the right kidney (ERPF – 36.51 mL/min) with total ERPF of 215.66 mL/min (Figure 4). Plasma renin level was 48 ng/mL/h (0.6–4.3 ng/mL/h), and the plasma aldosterone level was 57 ng/mL. The patient was planned for renal conservation after proper counseling. He underwent laparoscopic perirenal hematoma evacuation. Intraoperatively, after incomplete hematoma evacuation, remnant renal parenchyma was visualized which had fibrous plastic surrounding capsule. We removed approximately 250 mL of fibrogelatinous material mixed with blood. Postoperative period was uneventful. Blood pressure was 146/88 mm Hg on postoperative day 7. On follow-up visit at three months, the patient presented with complaints of headache and palpitation. His blood pressure was 194/92 mm Hg. He underwent a repeat ultrasound of the abdomen, which demonstrated a solid-cystic mass in the right renal fossa with eccentric solid component and normal left kidney. EC renogram demonstrated nonfunctioning right kidney (Figure 5). After preoperative counseling, the patient was planned for laparoscopic simple nephrectomy. Intraoperatively, a fibrous capsular shell densely adherent to the wall of the inferior vena cava and duodenum with eccentrically placed kidney having minimal parenchyma was found.


Figure 3. Contrast-enhanced computed tomography scan of the abdomen (case 2) showing subcapsular hematoma of the right kidney with no active bleeding with eccentric renal parenchyma.

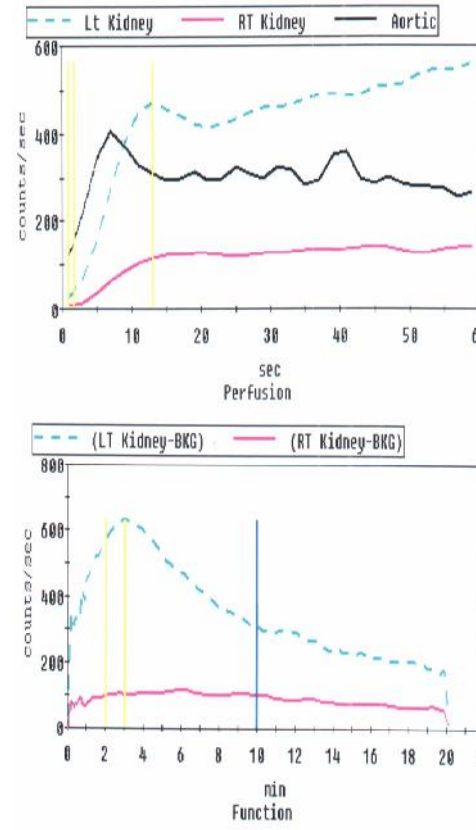


Figure 4. Preoperative ethylene cysteine renogram demonstrating compromised perfusion and function of the right kidney.

Gross examination of the specimen showed thick capsule with surrounding fibrous reaction with fibrous whitish eccentric renal tissue (Figure 6). Histopathological findings were consistent with the Page kidney, and the renal parenchyma was replaced by necrotic fibrocollagenous eosinophilic material with compressed glomeruli and tubules (Figure 7).

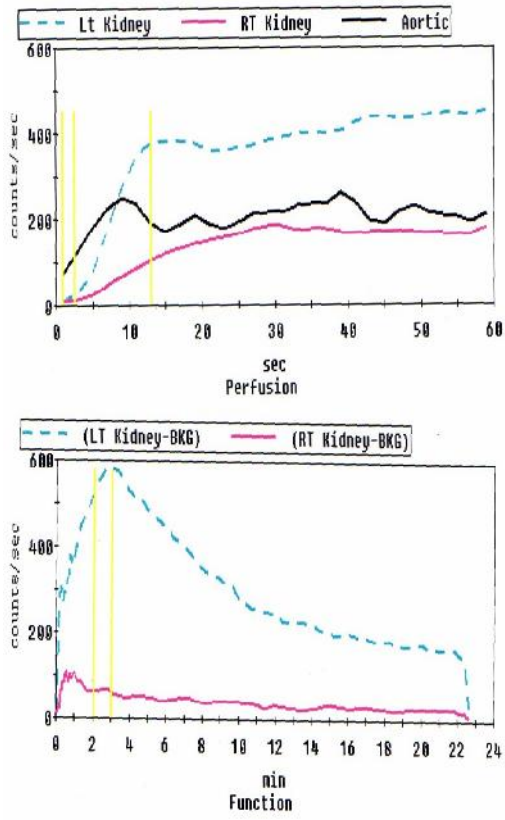


Figure 5. Ethylene cysteine renogram demonstrating compromised perfusion and nonfunctioning status of the right kidney with normal perfusion and tracer uptake of the left kidney.

Figure 6. Gross specimen showing thick fibrous capsule, surrounding fibrous reaction with fibrous whitish eccentric renal tissue.

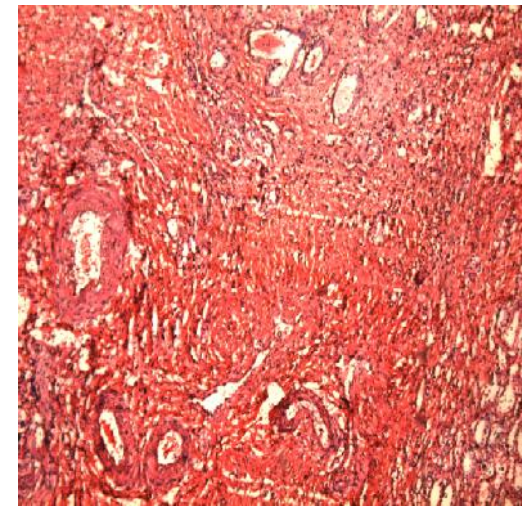

Figure 7. Histopathological findings consistent with the Page kidney showing renal parenchyma replaced by necrotic fibrocollagenous eosinophilic material with compressed glomeruli and tubules (Hematoxylin and Eosin, 40 ×).

## Discussion

In 1939, Irwin Page demonstrated the occurrence of hypertension by wrapping kidneys in cellophane in canine animal models. Cellophane wrapping caused constrictive perinephritis by inducing inflammatory response and formation of fibrocollagenous and eosinophilic hull resulting in renal ischemia.[1] Page kidney model was similar to Goldblatt renovascular hypertension model,[2] in which stenosis or compression of major vessels was the etiology. Anything causing external compression of the kidney, such as retroperitoneal or subcapsular hematoma, tumors or cyst,[3] lymphocele, or postrenal biopsy hematoma[4] may cause the Page kidney. We report two cases of the Page kidney caused by blunt abdominal trauma which sometimes remains unnoticed. Both patients presented with flank pain and loin mass and hypertension. Perirenal hematoma causes renal parenchymal compression and fibrous reaction leading to hypertension and permanent renal parenchymal destruction. It results in activation of the renin–angiotensin–aldosterone system, which induces hypertension and deterioration of global renal

function. Recent clinical trend supports medical therapeutic approach with ACE inhibitors and minimal access intervention such as ultrasound or CT-guided aspiration, but persistent refractory cases may require open hematoma evacuation, capsulotomy, or open or laparoscopic nephrectomy.[5,6] We managed both the index cases with laparoscopic nephrectomy in view of nonfunctioning kidneys and uncontrolled hypertension; however, laparoscopic hematoma evacuation was attempted in one patient without success. Failure of hematoma evacuation was presumably due to long duration of the inciting event and subsequent fibrous reaction. Recently formed hematomas of <3 weeks' duration usually resolve spontaneously, but in cases of old organized hematomas, percutaneous drainage is usually unsuccessful, and open or laparoscopic nephrectomy or capsulectomy is required.[7] The differential diagnosis of a young patient presenting with renal mass with or without hypertension includes hydronephrosis, benign or malignant renal masses.

In conclusion, the Page kidney may lead to nonfunctioning kidney or may present with hypertensive crisis and its complications. Page kidney should be considered in the differential diagnosis of young patients presenting with renal mass and hypertension with possibility of past abdominal trauma. Delayed presentation and having an old organized hematoma need open or laparoscopic hematoma evacuation or nephrectomy in nonfunctioning kidney.

## Acknowledgment

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