

Experience with Managing Renal Trauma

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OBJECTIVE: *The purpose of this study was to analyze cases of renal trauma encountered in our hospital in the last 2 years and review the literature regarding the appropriate management of renal trauma to ensure better treatment in future practice.*

MATERIALS AND METHODS: *From April 1998 to May 2000, a total of 10 patients with renal trauma was admitted with an average age of 44.1 years. Patients were equally classified as having minor (grades I and II) or major injury (grades III-V). 5 patients with minor injury were treated conservatively. 2 patients with grade IV injury underwent renorrhaphy with a mesh bag. Nephrectomy was inevitable in 3 patients with 2 of grade V injury and 1 of grade III but with an associated polycystic kidney whose bleeding source was difficult to identify.*

RESULTS: *Of the 5 patients with minor injury and nonoperative treatment and the 2 cases with grade IV injury who underwent renorrhaphy with mesh bag repair, all recovered uneventfully and were discharged without sequelae. Both IVU and color Doppler ultrasonography at 3-month intervals showed satisfactory results in all 5 patients who underwent conservative treatment and the 2 with vicryl mesh repair.*

CONCLUSIONS: *Preserving kidneys with conservative treatment in patients with minor injury is often successful, and vicryl mesh bag repair is rapid and effective in our experience for major injury. (J Urol R.O.C., 12:171-175, 2001)*

Key words: renal trauma.

INTRODUCTION

In patients with abdominal trauma, approximately 10% have an associated injury to the urinary tract. Renal injury, occurring in 1%-5% of all traumas, is due primarily to blunt injury [1]. The decision for surgical exploration depends not only on severity (grades IV-V), but most crucially, on the presence of life-threatening bleeding. Preservation of the kidney either through conservative treatment or reconstruction is an increasingly important management strategy. We hereby analyzed the cases encountered in our hospital in the last 2 years and reviewed the literature regarding the appropriate management of renal trauma to ensure better treatment in future practice.

METHODS AND MATERIALS

From April 1998 to May 2000, a total of 10 patients with renal trauma was admitted, and their records were retrospectively reviewed. There were 8 males and 2 females with the average age of 44.1 (range, 16-68) years. Regarding the etiology of injury, 9 had suffered

from blunt injury in which 4 were hit by a motorcycle, 4 by a car and 1 was assaulted by a person wielding a baseball bat. The remaining case experienced a penetrating injury by a knife through the abdomen.

The basic demographics and the degree of injuries are illustrated in Table 1. 6 of them had stable vital signs on arrival. The most common symptom encountered was pain (flank, abdominal, or back). Only 2 patients had associated gross hematuria, while the other 8, instead, presented with microscopic hematuria. Emergent abdominal computerized tomography (CT) scan was performed in all but 1 with multiple traumas and massive internal bleeding. Patients were equally classified as minor (grades I-II) or major injury (grades III-V) according to the 'Renal Injury Scale of the American Association for the Surgery of Trauma'. 5 patients with minor injury were treated conservatively. Of the 2 patients with grade IV injury, 1 underwent immediate renorrhaphy with a mesh bag (Fig.1), while the other underwent delayed mesh repair on the second day owing to urinary extravasation. Nephrectomy was inevitable in 3 patients including 2 with grade V injury and 1 with grade III but associated polycystic kidney whose bleeding source was difficult to identify.

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Table 1. Characteristics of renal injury patients

No.	Sex	Age(yr)	Vital signs/ remarks	Symptoms/ signs	Grade	Associated injuries
1	M	47	stable	right flank pain, hematuria	IV	subarachnoid hemorrhage
2	M	23	BP: 73/47, whole blood 4 U => BP: 98/56	left flank pain; dyspnea	IV	head injury (scalp)
3	M	42	BP: 78/55, whole blood 2 U, PRBC 4 U => BP: 92/67	abdominal pain	III	splenic laceration
4	F	50	BP: 64/40, whole blood 4 U, PRBC 4 U => BP: 82/65	pallor, restlessness	V	hemothorax, diaphragm rupture, hepatic and IVC laceration, bone fractures
5	M	68	BP: 83/66, PRBC 4 U => BP: 94/72	abdominal stab wound	V	stomach, duodenum perforation
6	M	30	stable	abdominal pain	II	none
7	M	16	stable	abdominal pain	I	none
8	M	46	stable	back pain	II	none
9	F	52	stable	abdominal pain	II	lung contusion
10	M	67	stable	back pain, hematuria	II	none

PRBC: packed red blood cells; IVC: inferior vena cava.

RESULTS

The mean hospital stay was 5.0 ± 0.8 (range, 4-6) days for the conservative group (those with minor injury) and 29.6 ± 15.5 (range, 11-52) days for the operative group (those with major injury). There was no mortality in our series (Table 2). For the 5 patients with minor injury who received nonoperative treatment and 2 cases with grade IV injury who underwent renorrhaphy with mesh bag repair, all recovered uneventfully and were discharged without sequelae. For the remaining 3 cases of nephrectomy, 1 with grade V had an uneventful recovery; another with penetrating injury was complicated by respiratory failure and was transferred to another hospital for respiratory support; while the remaining case with grade III and associated polycystic kidney, although complicated with pelvic abscess and wound dehiscence, recovered and was discharged smoothly. The mean follow-up time was 18.5 (range, 12-31) months. All patients received a CT scan or intravenous urography (IVU) (Fig. 2) and color Doppler (Fig. 3) at 3 - month intervals. Both IVU and color Doppler showed a normal renal collecting system and adequate renal blood flow in all 5 patients who underwent conservative treatment and the 2 with vicryl mesh repair.

DISCUSSION

All victims with blunt injury presented with gross hematuria, severe flank tenderness, rigid abdomen, or hypovolemic shock (SBP < 90 mmHg), although those associated with mere microscopic hematuria unquestionably underwent emergent radiographic assessment for a rapid diagnosis in our emergency department [2]. We preferred CT scan to IVU in the belief that CT staging for renal trauma is more sensitive and specific than excretory urography, and that it should be used primarily when multiple traumatic injuries are suspected and when clinical evidence of major trauma exists, regardless of what the IVU shows [3]. A previous study



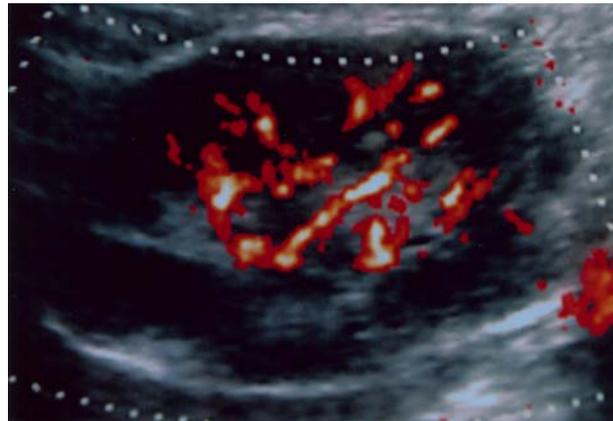
Fig. 1 Whole kidney wrapped with a vicryl mesh bag.

showed that IVU should be reserved for patients with macroscopic hematuria; for blunt abdominal trauma without significant hematuria, 1-shot IVU would be more appropriate and time saving [4]. Given such an alternative, 1-shot intraoperative IVU is recommended when CT scan is not readily available and for hemodynamically unstable patients who receive emergent exploration in our future practice.

We successfully managed 5 patients with minor injuries (grades I-1, II-4) using bed rest and hydration. Follow-up of these patients showed good renal function, except for 1 with grade I which resulted in a mildly contracted kidney. A similar complication rate was noted in Munk's series of grade II patients [5]. Another series from Taiwan showed that 10 of their 14 patients (with minor injury) with stable vital signs who received conservative treatment recovered without significant sequelae [6]. We believe that conservative management of incomplete blunt renal injuries is an effective treatment option with few complications. Conservative treatment can also be applied to patients with severe injury. Altman et al. had shown that patients with grade V injury who were treated nonoperatively had similar average hospitalization, fewer intensive care unit days,

Table 2. Outcome of patients with various injuries

No.	Management	Outcome	Remarks
1	right renal mesh repair	normal	
2	left renal mesh repair	normal	hemoperitoneum 4000 ml
3	left nephrectomy and splenectomy	wound dehiscence	pelvic abscess, polycystic kidney
4	right nephrectomy and adrenalectomy	normal	massive transfusion
5	right nephrectomy, failed suture ligation	ARDS	on tracheostomy
6	conservative	normal	
7	conservative	mild atrophy of kidney	
8	conservative	normal	
9	conservative	normal	
10	conservative	normal	

**Fig. 2 Postoperative IVU showing a normal left kidney 3 months after vicryl mesh repair.****Fig. 3 Postoperative color Doppler revealing adequate blood flow in the injured kidney.**

significantly lower transfusion requirements, and fewer complications during the hospital course [7]. Another report similarly stressed the safety of a conservative approach for most patients with major blunt renal lacerations for which most extravasation spontaneously resolved and minimally invasive techniques were able to deal with nearly all complications [8]. However in our 5 patients with major injury, no attempt at conservative treatment was made, but all underwent surgical exploration mainly because of unstable hemodynamics at presentation in 4, while the remained case had urinary extravasation, for which surgical exploration was relatively indicated. We certainly need more experience to justify the safety and efficacy of conservative treatment in blunt grade III-V patients [9]. An operation should only be considered for those with persistent and life-threatening renal bleeding and is only relatively indicated in those with renal pedicle injuries or urinary extravasation [10]. Perego et al. suggested that grade V injury with required transfusion of whole blood ≥ 4 U and lower initial hematocrits, i.e., $\leq 25\%$ were regarded as hemodynamically unstable [11]. Reconstruction was tried in 2 patients, while the remaining 3 had their kidneys removed. Analyzing the causes of inevitable renal sacrifice, 1 had a fragmented kidney floating in blood, 1 had uncontrolled severance of renal vessels with hypovolemic shock, while the last case was due to an unidentifiable bleeding source in a polycystic kidney.

Robert et al. had similar experiences in which open surgery usually resulted in nephrectomy [8]. However McAninch et al. declared a successful reconstruction rate in up to 90% in kidneys with major parenchymal laceration or vascular injuries, regardless of the mechanism by adhering to the principle of early proximal vascular control, followed by debridement and closure of the collecting system [12]. The 40% successful salvage rate shows that there is still room for us to try to preserve a traumatic kidney by reconstruction in our future practice.

We have noted the efficacy of kidney wrapping with vicryl mesh [13-14] using a double purse-string technique for control of hemorrhage and preservation of renal function in our 2 patients with grade IV injuries. It is an easy, rapid procedure which decreases the operating time and may allow the successful repair of major lacerations [15]. Both cases recovered uneventfully with no delayed urinary extravasation or abscess noted in the successive follow-up. Although our case numbers are limited, we believe such a technique can provide a good alternative for those who wish to try reconstruction.

Regarding the patient with penetrating injury with associated perforation of both the stomach and duodenum, we began surgical exploration without hesitation because in such a case, the depth and extent of the penetrating injury through the abdomen is always unexpectedly serious, as in this case where we had no

choice but to sacrifice his right kidney after a strenuous suture ligation of the severely lacerated renal vessels. Corriere et al. found that penetrating injuries, active hemorrhage, and major tissue destruction were reasons for mandatory renal exploration in their 66 penetrating traumas [16], which we also firmly believe. Close observation is required in cases if the staging has been completed, only minor injury is noted, and there is no associated intra-abdominal injuries or hemodynamic instability; this also proved promising in Thall's series in which 17 patients with grade III penetrating traumas were successfully managed conservatively without renal loss [17].

The possibility of preserving a traumatic polycystic kidney disease in our case raised a dilemma for us. The higher risks of both contrast medium-related nephropathy and persistent intracystic hemorrhage with extreme difficulty in locating the site of bleeding have often resulted in a nephrectomy. If the patient is hemodynamically stable, either desmopressin acetate administration [18] or selective angiographic embolization [19] might be helpful in controlling the bleeding.

A functional radiographic study (CT scan or IVU) at 3-month intervals was used to assess renal function and rule out silent obstruction. A radionuclide scan is more informative and can provide quantitative assessment for a preserved kidney [20], although it is not available in our hospital. Ultrasound examination during microbubble infusion can also be used to quantify total organ as well as regional nutrient blood flow to the kidney, which is quite promising in the future [21]. All 7 patients with preserved traumatic kidneys had normal renal function, which is quite an encouraging result to us.

CONCLUSION

Preserving kidneys with conservative treatment in patients with minor injury is often successful, and vicryl mesh bag repair is rapid and effective in our experience with major injury. We would choose to explore the kidney only in the presence of persistent and life-threatening renal bleeding or multiple organ injuries.

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