

## MANAGEMENT OF RENAL TRAUMA – ASSIUT EXPERIENCE

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**Objective** To conform a rational approach for diagnosis and treatment of renal injuries with either conservative or interventional treatment.

**Patients and Methods** The study included 36 male and 6 female patients (total 42) with renal trauma. The patients' age ranged from 6 to 65 years. Thirty-one patients (73.8%) presented with blunt renal trauma, while eleven patients (26.2%) presented with penetrating renal trauma. Haematuria was the commonest presenting symptom accounting for 98%. All patients were thoroughly evaluated clinically and by abdo-

minal ultrasonography, while excretory urography and abdominal computerized tomography were required in some patients only.

**Results** Conservative treatment was successful in 10 patients with minor blunt trauma, while immediate exploration was done for 26 patients and late exploration was required in 6 patients.

**Conclusion** For renal salvage, the traumatized kidney is to be explored in all cases of penetrating and major blunt renal trauma.

**Keywords** renal trauma, contusion laceration, rupture, renorrhaphy

### INTRODUCTION

Trauma accounts for the majority of deaths in men and women less than 40 years of age. Approximately 10% percent of abdominal injuries involve the genitourinary tract. Renal injury occurs in 1-5% of all trauma<sup>1</sup>.

The majority of blunt renal injuries caused by traffic accidents are limited in extent, however 5 to 10% of blunt injuries and as many as 70% of penetrating renal injuries can be classified as major<sup>2</sup>. Accurate staging is mandatory for maximal preservation of the renal function with minimal complications.

We herein report the results of immediate surgical and conservative management of patients with blunt and penetrating renal injuries.

### PATIENTS AND METHODS

This prospective study was carried out between January 1998 and June 1999 and included 36 male (85.7%) and 6 female (14.3%) patients with renal injuries who had presented to the Trauma Center of Assiut

University Hospital. The patients' age ranged from 6 to 65 years. Sixteen patients (38%) were in the third decade of their life.

Thirty-one patients (73.8%) presented with blunt and 11 patients (26.2%) with penetrating renal injuries. The causes of blunt trauma were falls in 21 patients (67.7%), traffic accidents in 8 patients (25.8%) and assault in 2 patients (6.5%), while in the patients with penetrating injuries gun shot was reported in 6 patients (54.6%) and stab wounds in 5 patients (45.4%). Gross haematuria was found in 41 patients (97.6%), while flank pain was found in 21 patients (50%) and flank mass in 11 patients (26.2%). Shock was reported in 5 patients (11.9%).

The patients' assessment was started by careful history taking with special emphasis on the mechanism of trauma.

After a thorough clinical examination and resuscitation, urinalysis, complete blood picture, blood grouping and cross matching were done for all patients. Abdominal ultrasonography was done as an extended physical examination for all patients using a real-time B-mode 3.5 MHz convex transducer. Renal

**Table 1:** Radiological Findings

Radiological Finding	No. of Patients	Percent
Normal IVU	10	33.3%
Delayed visualization	12	40.0%
Incomplete filling	4	13.3%
Extravasation	2	6.7%
Pre-existing pathology	2	6.7%
<b>Total</b>	<b>30</b>	<b>100%</b>

**Table 2:** Associated Injuries

Associated Injuries	Blunt		Penetrating	
	No. of Patients (31)	Percent	No. of Patients (11)	Percent
Liver	2	6.5%	1	9.1%
Spleen	5	16.1%	2	18.2%
Bowel	-	-	2	18.2%
Retroperitoneal haematoma	2	6.5%	1	9.1%
Fracture ribs	5	16.1%	-	-
Fracture spine	1	3.2%	-	-
Fracture pelvis	2	6.5%	-	-
Fracture extremities	5	16.1%	-	-
<b>Total</b>	<b>22</b>	<b>71.0%</b>	<b>6</b>	<b>54.6%</b>

imaging was indicated in all patients with penetrating trauma to the flank, back or abdomen, in adult blunt trauma patients with gross haematuria or microscopic haematuria plus shock and also in patients with severe deceleration injuries<sup>3</sup>. A high-dose (2 mg/kg) excretory urogram (IVU) was done for 30 haemodynamically stable patients. Computerized tomography (CT) with and without enhancement was done for 26 patients for confirmation and accurate staging. The renal injuries were classified into 5 grades using the classification criteria of the Organic Injuries Survey Committee (OIS) of the American Association of Surgery in Trauma (AAST): 1) Renal contusion, 2) Cortical laceration, 3) Deep parenchymal laceration, 4) Laceration involving the

collecting system with or without devascularized segment and contained vascular injury, 5) Avulsion of the renal pedicle, renal artery thrombosis and shattered kidney<sup>4</sup>.

In cases with renal contusion, IVU showed a normal kidney on the injured side in the presence of a sub-capsular haematoma on abdominal ultrasound or CT. Abnormal IVU findings of extravasation, non-excretion or distortion of the calices and findings of incomplete filling or delayed excretion will be demonstrated by CT or renal exploration, if a laparotomy for associated injury is in progress. In those patients explored immediately, assessment of the contralateral kidney was done by laboratory investigations (blood urea nitrogen

**Table 3:** Pathology of Renal Injuries

Pathology	Blunt	%	Penetrating	%
Contusion	11	35.5%	-	-
Laceration	9	29.0%	8	72.7%
Polar disruption	5	16.1%	2	18.2%
Shattered kidney	5	16.1%	-	-
Pedicle injury	1	3.3%	1	9.1%
Total	31	100%	11	100%

**Table 4:** Treatment

Treatment	Blunt	%	Penetrating	%
<u>Early:</u>				
1. Conservative	10	32.3%	-	-
2. Exploration				
- Renorrhaphy	4	12.9%	8	72.7%
- Partial nephrectomy	5	16.1%	2	18.2%
- Nephrectomy	6	19.3%	1	9.1%
<u>Late:</u>				
1. Nephrectomy	2	6.5%	-	-
2. Evacuation of haematoma	4	12.9%	-	-
Total	31	100%	11	100%

and serum creatinine) and radiography (abdominal ultrasonography).

Radiological findings of extravasation of contrast medium within or outside the kidney, a deficient large devascularized segment or a vascular injury of the main renal vessel necessitated renal exploration with repair of the defect or a partial or complete nephrectomy depending on the pathological condition found. Immediate laparotomy was done by a midline transperitoneal approach, while delayed exploration was done by a supracostal flank approach<sup>5</sup>.

Laparotomy was done through a generous midline transperitoneal approach to allow rapid

access of the renal vasculature by incision of the posterior peritoneum over the aorta to retract the renal vessels by a vessel loop. After medial reflection of the colon, all-dead, devitalized tissues and intrarenal haematoma were debrided.

## RESULTS

Abdominal ultrasound examination was done for all patients, while excretory urography was done in 30 patients (71.4%) (Fig. 1) and computerized tomography (CT) in 26 patients (61.9%) (Fig. 2). The radiological findings are shown in Table 1.

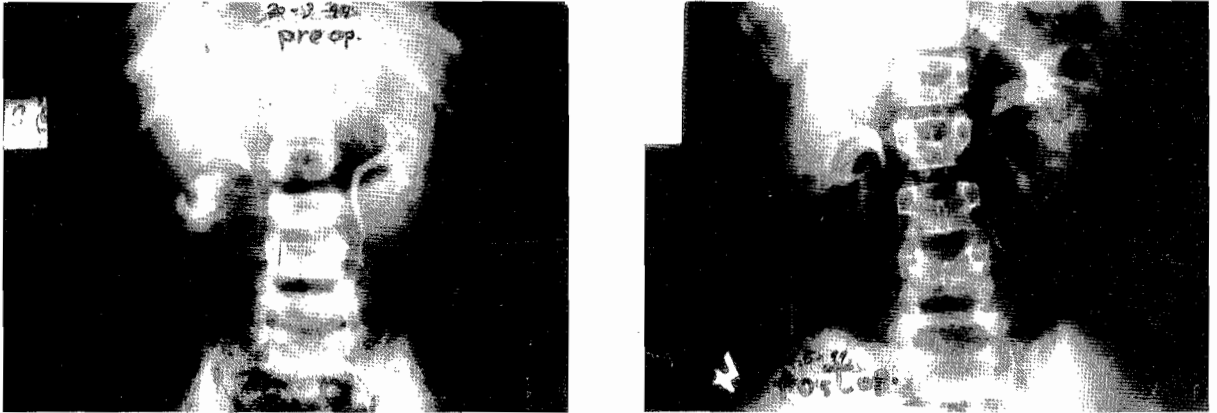


Fig. 1: A: Preoperative excretory urography of a male 5-year-old child after blunt trauma to the right kidney demonstrating extravasation. B: Follow-up excretory urography 6 months after surgical repair showing a normal right kidney.

Associated injuries were found in 22 patients with blunt trauma (71%) and in 6 patients with penetrating trauma (54.6%). (Table 2). Preexisting renal lesions were present in 2 patients with blunt renal trauma, in the form of hydronephrosis in a horseshoe kidney and hydronephrosis due to multiple renal stones.

The pathology of the renal injuries included contusion, laceration, polar disruption, shattered kidney and pedicle injury (Table 3).

Conservative treatment was successful in 10 patients (32.3%) with minor blunt renal trauma, as proved by abdominal ultrasonography and excretory urography in all 10 patients. Abdominal CT was done only for 6 out of these patients to confirm the minimal sub-capsular haematoma (Table 4).

The indications for renal exploration in trauma patients were uncontrolled bleeding manifest as hemodynamic instability even without imaging studies for control of life-threatening hemorrhage; other indications were major urinary extravasation and evidence of nonviable parenchyma.

Immediate laparotomy was done in 26 patients, 15 patients (48.4%) of them with blunt renal injury and in all 11 patients (100%) with penetrating renal injuries. Those 6 patients (19.3%) with neglected blunt trauma and presented late were explored at the time of presentation (Table 4).

## DISCUSSION

The topic of renal trauma has offered many substantial issues of debate over years, such as classification, imaging preferences and management techniques.

Imaging of the kidney in critically traumatized patients may be undertaken using one of several available modalities. Ultrasound evaluation is often the first choice of imaging modalities as it is quick, non-invasive and often available for urgent assessment as a bedside examination. However, in our study it underestimated seven of our patients (16.7%). Two of them had pedicle injuries and five had shattered kidneys. Similar data have been reported by Lopez et al.<sup>6</sup>; they noted that the sensitivity of renal ultrasound decreased from 100% in renal contusions and lacerations to 0.0% in pedicle injuries and shattered kidneys. These limitations of abdominal ultrasound are due to its inability to identify vascular injuries, and to distinguish fresh blood from extravasated urine. On the other hand, it has to be mentioned that the accuracy of ultrasound is highly operator-dependent<sup>7</sup>.

In our study, immediate excretory urography (IVU) for staging of patients with renal injuries resulted in a definitive diagnosis in 10 patients with renal contusions, in 2 patients with urinary extravasation and in 2 patients with a pre-existing renal pathology, while the sensitivity of IVU decreased in 12 patients with

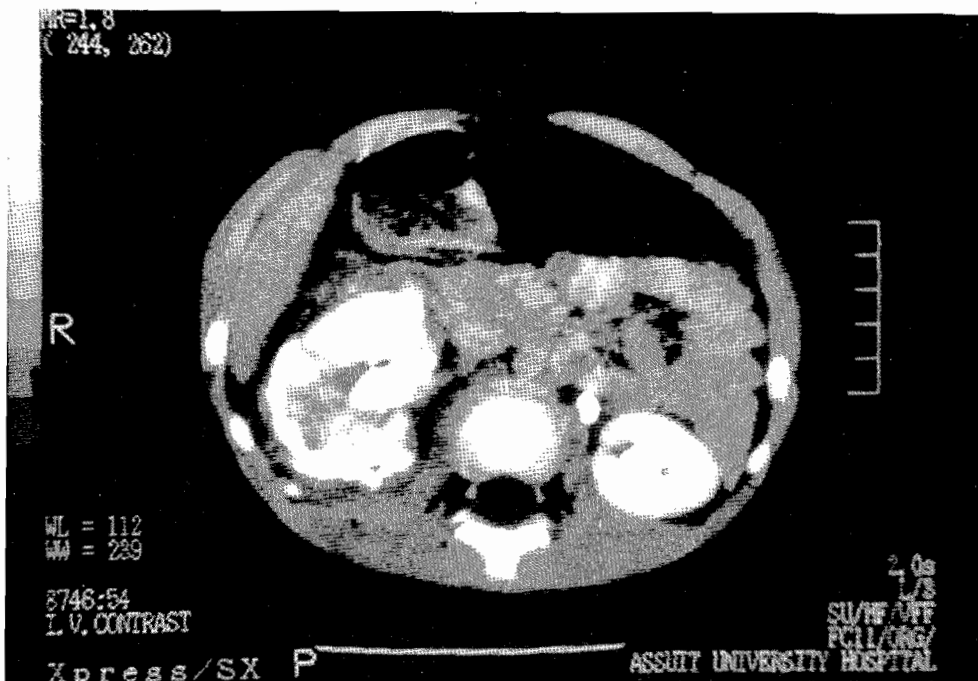


Fig. 2A: CT scan of an 8-year-old patient done immediately after blunt trauma. It shows dye extravasation and a deep laceration of the right kidney.

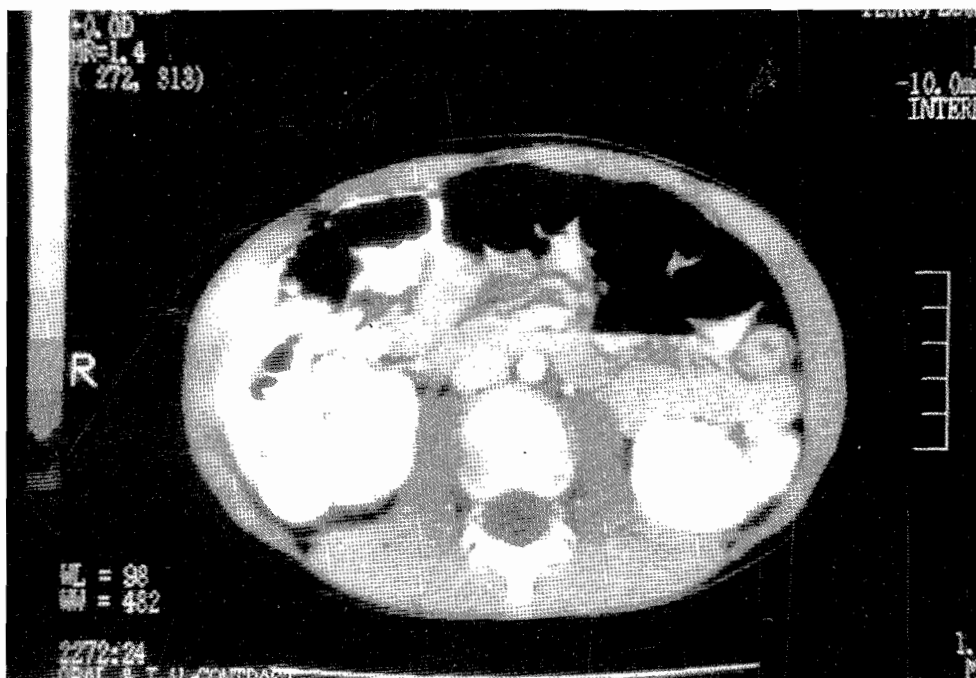


Fig. 2B: Follow-up CT of the same patient 3 months after renorrhaphy showing a normal right kidney

delayed visualization and in 4 patients with incomplete filling due to severe renal lacerations. These data correspond to those reported by Carroll and McAninch<sup>8,9</sup> about the sensitivity of IVU in detecting blunt renal injuries. In their study, the sensitivity of IVU reached 100%, but it was not specific as a normal urogram does not exclude major renal injuries in 20% of patients with severe lacerations and shattered kidneys. Also, they reported that its sensitivity in detecting penetrating renal injuries was less than 80%, as up to 20% of patients with normal urograms may have significant renal injuries.

Computed tomography was essential in stable patients with a delayed visualization or incomplete filling on excretory urography and in those patients with associated injuries as it provides physiological as well as anatomical information and can provide three-dimensional imaging for severe renal injuries<sup>10</sup>.

In our study, enhanced computed tomography was ideal for staging renal contusions, lacerations and ruptures, but its sensitivity in renal pedicle injuries was not evaluated, because those 2 patients with pedicle injuries were not subjected to CT. They were immediately explored to correct their haemodynamic status. Bretan and associates<sup>11</sup> reported that the results of CT in blunt and penetrating renal injuries were both sensitive and specific in comparison with those of immediate excretory urography.

In our study, all patients (n=10) who had presented early with renal contusion were successfully managed by conservative measures without complications or delayed renal operations. There was some controversy as to whether conservative or surgical management should be applied in patients with major degrees of renal injuries such as lacerations, ruptures and pedicle injuries. Cass and Luxenberg<sup>12</sup> advocate conservative management for minor renal injuries, since they almost characteristically restore themselves.

Peterson<sup>13</sup> showed that clinical examination and radiological evaluation of patients with renal injuries as a method to determine which renal injury will heal spontaneously had resulted in a renal surgery rate of 13-68%, a renal loss rate of 3-33% and a complication rate of 13-76%.

In our study, those 15 patients who were explored early for blunt renal injuries showed a

nephrectomy rate of 40% (6/15), and a renal salvage rate of 60% (9/15). These rates are very similar to those mentioned by Cass et al.<sup>13</sup> who reported that immediate renal surgery for blunt renal injuries had resulted in a nephrectomy rate of 38.9% and a renal salvage rate of 61.1%. Contellini et al.<sup>14</sup> reported a nephrectomy rate of 23.5% and a renal salvage rate of 76.5% in 110 patients with blunt renal injuries and were managed by immediate exploration.

In our study, immediate laparotomy of all 11 patients with penetrating renal injuries resulted in a nephrectomy rate of 9.1% (1/11) and a renal salvage rate of 90.9% (10/11). Whitney et al.<sup>15</sup> reported a nephrectomy rate of 47% when doing early laparotomy for all patients with penetrating renal injuries.

Delayed exploration was done in 6 patients in our study. They were managed primarily outside our center and referred due to septic complications and non-healed renal injuries. The nephrectomy rate among this group was 33.3% (2/6) and the rate of evacuation of infected hematoma with renal salvage was 66.6% (4/6). Cass and Luxenberg<sup>12</sup> reported that renal injury did not heal spontaneously in 68% and that delayed operations were done in critically ill patients with a nephrectomy rate of 32%.

Regarding post-traumatic hypertension, our incidence was 0% which was the same like that reported by Cass and Luxenberg<sup>12</sup> in 30 patients with blunt renal injuries managed by immediate operation. In other studies reported in the literature, the incidences of post-traumatic hypertension ranged from 0.7 to 33%<sup>16</sup>.

In conclusion, for renal salvage computerized tomography (CT), once available, should replace standard IVU for an accurate assessment of the extent of renal injury and the determination of the function of the contralateral kidney in all haemodynamically stable patients after an urgent abdominal ultrasonography and plain X-ray of the urinary tract. CT is more accurate for staging and it is more cost effective, even in patients with contusions and minor lacerations. An incomplete staging necessitates immediate laparotomy.

Conservative management will be successful for minor grades (contusions and minor lacerations) of blunt renal injuries, while penetrating renal injuries and major grades of blunt

injuries should be explored aiming at renal salvage.

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#### RESUME

##### Prise en Charge des Traumatismes du Rein: Expérience d'Assiut

**Objectif :** Déterminer une approche rationnelle dans le diagnostic et le traitement conservateur ou interventionnel dans les traumatismes du rein. **Patients et Méthodes :** Il s'agit d'une série de 42 patients dont 36 hommes et 6 femmes présentant un traumatisme rénal. L'âge des patients variait de 6 à 65 ans. Trente et un (73,8 %) avaient un traumatisme fermé, tandis que 11 patients (26,2 %) avaient un traumatisme ouvert. Le maître symptôme était l'hématurie qui a été retrouvée dans 98 % des cas. Tous les patients ont été évalués par examen clinique, une échographie abdominale, une urographie intra-veineuse. Une tomographie abdominale n'a été requise que chez certains patients. **Résultats :** Un traitement conservateur a donné un bon résultat dans 10 cas, une exploration immédiate a été faite dans 26 cas et une exploration différée était nécessaire dans 6 cas. **Conclusion :** Pour préserver le rein, l'exploration rénale est de rigueur devant tout traumatisme ouvert du rein et devant tout traumatisme fermé grave.

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