Long-Term Renal Function Assessment With Dimercapto-Succinic Acid Scintigraphy After Conservative Treatment of Major Renal Trauma

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Abbreviations and Acronyms

AAST = American Association for the Surgery of Trauma

CT = computerized tomography

DMSA = dimercapto-succinic acid

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Purpose: The management of high grade blunt renal injury has evolved with time to become increasingly conservative with the ultimate objective of renal preservation. We evaluated relative renal function with dimercapto-succinic acid renal scintigraphy 6 months after major renal trauma (grade IV or V).

Materials and Methods: This prospective observational study was done between January 2004 and April 2010. All patients who presented with grade IV or V renal trauma and were treated conservatively were included in analysis. Patient and trauma characteristics, and initial management were recorded. Relative renal function was evaluated by dimercapto-succinic acid renal scintigraphy 6 months after trauma.

Results: A total of 88 patients were included in the study. Conservative management was possible in 79 patients (90%), including 69 and 10 with grade IV and V trauma, respectively. Dimercapto-succinic acid renal scintigraphy was done at 6 months for 22 patients (28%). Mean relative renal function for grade IV and V injuries was 39% and 11%, respectively ($p = 0.0041$). The percent of devascularized parenchyma ($p = 0.0033$) and the vascular subtype of grade IV injuries ($p = 0.0194$) also correlated with decreased renal function. No complication or de novo arterial hypertension was noted.

Conclusions: Conservative treatment achieves the objective of renal function preservation for grade IV lesions. Grade V and specific subtypes of grade IV injury have a poor functional outcome. Further study must be performed to determine which patients will benefit from conservative treatment vs early nephrectomy to avoid a longer hospital stay and useless procedures.

Key Words: kidney; wounds, nonpenetrating; radionuclide imaging; succimer; nephrectomy

THE management of high grade blunt renal injury has evolved with time based on multiple series encouraging an increasingly conservative approach[1,2] in stable and even recently in unstable patients[3] with the ultimate objective of renal preservation. Based on the AAST Organ Injury Severity Score[4] the outcome of high grade (grades IV and V) renal injury has been well studied in children[5–7] but less in adults,[8,9] mostly with retrospective data and renal function evaluation by serum creatinine.

There has long been interest in quantitative DMSA renal scintigraphy for long-term evaluation of renal function after surgery or trauma.[10,11]

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Since winter sport accidents, among others, are a major cause of kidney injury,[12] we set up a prospective database at 8 centers of the Alpine range to evaluate our management of these major injuries and the outcome of this management based on the hypothesis that conservative treatment preserves renal function. The primary objective of this study was to use DMSA scintigraphy to evaluate relative renal function 6 months after conservative management of major blunt renal trauma (grade IV or V).

PATIENTS AND METHODS

Patients admitted to a center of the Alpine range who presented with major blunt renal trauma (grade IV or V), as confirmed on CT, were included in the study. Renal injury grade was based on imaging according to the AAST classification. Early evaluation consisted of recording patient characteristics (age, gender, nationality, etc), trauma (grade, lateralization, retroperitoneal hematoma size, etc) and initial hospital management (surgery, embolization, drainage, etc).

Management began according to our institutional policy of first line conservative treatment, resorting to surgical (hematoma/collecting system drainage or nephrectomy) or endovascular (embolization, angioplasty or stenting) procedures only when needed for clinical or radiological findings.

Repeat evaluation was scheduled 6 months after the trauma to assess the relative function of the injured kidney by DMSA renal scintigraphy as well as the clinical outcome. These results were collected using a standardized form and entered into a numerical database.

Statistical analysis was performed with StatView® using univariate analysis with the Mann-Whitney U test and the Spearman rank correlation. The CI was set to 95% and significance was considered at $p < 0.05$.

RESULTS

Patient and Trauma Characteristics

A total of 88 patients were admitted to a center from January 2004 to April 2010 with grade IV or V renal trauma, as confirmed on initial CT. Conservative treatment was possible in 79 patients (90%). Nine patients (10%) underwent nephrectomy at various times during treatment while 79 were treated conservatively. Table 1 lists details on the 2 cohorts. Mean ± SD patient age was 27 ± 3 years and 80% of the patients were male.

Of the 79 patients treated conservatively 69 (87%) had grade IV trauma, including 39 (57%) with isolated urinary extravasation, 18 (26%) with an isolated vascular or parenchymal lesion and 12 (17%) with an association of vascular and parenchymal lesions. Ten patients (13%) had grade V trauma, including shattered kidneys in 7 (70%) and proximal renal artery dissection in 3 (30%) with renal devascularization on initial CT. Of the patients 41 (52%) had associated lesions, mostly intra-abdominal. Of the trauma cases 59% were due to winter sport accidents.

Table 1. *Conservative treatment and nephrectomy cohorts*

	No. Conservative Treatment	No. Nephrectomy	p Value
Age:			0.647
Less than 18	19	1	
18 or Greater	60	8	
Gender:			0.565
M	64	6	
F	15	3	
Grade:			<0.0001
IV	69	2	
V	10	7	
Side:			0.954
Rt	32	3	
Lt	47	6	
Associated lesions:			0.016
Yes	41	9	
No	38	0	
Trauma cause:			0.61
Winter sport	47	4	
Other	32	5	
% Devascularized:			<0.0001
0–25	45	0	
25–50	20	1	
50–100	14	8	

Conservative management of 79 trauma cases required a total of 21 endoscopic procedures (27%) for urinary drainage using ureteral or Double-J® stents when there was late persistent urinary extravasation and/or sepsis, 9 selective arterial embolizations (11%) for active bleeding and 3 endovascular revascularizations (4%) for renal artery dissection (angioplasty with or without a stent).

Renal Function

The second evaluation at 6 months was available for 33 patients (38%), including 7 after nephrectomy and 1 after trauma of a solitary kidney. DMSA renal scintigraphy was available for the other 22 patients (28%). Table 2 lists patient characteristics.

Mean relative function of the injured kidney was 34%, 39% and 11% for all grades, grade IV and grade V, respectively. Univariate analysis revealed a significant relationship between AAST grade and relative renal function ($p = 0.0041$).

The percent of devascularized parenchyma on CT significantly correlated with the decrease in renal function ($p = 0.0033$). Subanalysis of grade IV injuries showed better renal function for isolated collecting system lesions ($p = 0.0194$).

All other factors, including patient age, gender, side, associated lesions and trauma cause, did not significantly correlate with decreased renal function. Table 2 lists results and sample characteristics. No complication developed during followup and no de novo arterial hypertension was noted at 6 months.