

# Update in the classification and treatment of complex renal injuries

## *Atualização da classificação e tratamento das lesões renais complexas*

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### A B S T R A C T

The "Evidence-based Telemedicine – Trauma & Acute Care Surgery" (EBT-TACS) Journal Club performed a critical review of the literature and selected three up-to-date articles on the management of renal trauma. Our focus was on high-grade renal injuries, defined as AAST injury grades III-V. The first paper was the propose substratification of the AAST grade IV renal injury into grades IVa (Low Risk) and IVb (High Risk). The second paper was a revision of the current AAST renal injury grading system, expanding to include segmental vascular injuries and ureteral pelvic injuries and to establish a more rigorous definition of severe grade IV and V renal injuries. The last article analyses the diagnostic angiography and angioembolization in the acute management of renal trauma using a national data set in the USA. The EBT-TACS Journal Club elaborated conclusions and recommendations for the management of high-grade renal trauma.

**Key words:** Therapeutics. Wounds and injuries. Kidney. Tomography. Trauma severity indices.

### INTRODUCTION

In trauma patients the haemodynamic situation is the benchmark for the diagnostic and therapeutic algorithm, and the selective nonoperative management (SNOM) of blunt abdominal solid organ injury has become a well-established practice around the world.

Despite an absent standardized protocol to determine when to intervene in the setting of active renal bleeding, whenever the patient is stable enough to undergo imaging, a helical computerized tomography (CT) scan is the best option to stage the trauma<sup>1</sup>.

Based on CT scan anatomic disruption, the original renal injury staging classification (RISC), created by the Organ Injury Scaling (OIS) Committee of the American Association for the Surgery of Trauma (AAST - 1989), reflects clinically relevant, increasingly severe renal injuries, on which prognostication and therapeutic decision-making could be based.

While during over two decades the renal trauma management has changed significantly in terms of how, when and whether to intervene, with the aim of reducing the high rates of potentially unnecessary nephrectomies, the AAST renal injury grading system has not been modified accordingly.

In addition, renal surgery is an independent predictor of a worse late renal function, which is likely to be related to the non-conservative type of surgeries performed. In this scenario, angioembolisation is a suitable alternative to surgical exploration, allowing a conservative approach even in the case of active bleeding<sup>2,3</sup>. However, the features of injuries most suitable for angiographic embolization remain to be defined<sup>2</sup>.

Evidence-based guidelines help physicians to select the best treatment and are considered to be an important method to standardize and optimize medical care. However, guidelines are often not followed in daily practice, mainly in trauma management<sup>4</sup>.

**EBT-TACS Journal Club: July 30rd, 2013, with the participation of the Following Institutions:** St. Michael 'Hospital and Sunnybrook Health Science Centre, University of Toronto, Toronto, Canada; Disciplines Trauma Surgery and Urology, Department of Surgery, Faculty of Medical Sciences, State University of Campinas (Unicamp), Campinas, SP, Brazil; Emergency Service of the Brotherhood of Santa Casa de São Paulo, São Paulo, SP, Brazil; Division of Urology, Department of Surgery, Denver Health Medical Center, Denver, CO, USA.

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The participants of the "Evidence Based Telemedicine – Trauma and Acute Care Surgery" (EBT-TACS) Group conducted a critical review of the literature on the management of high-grade renal injuries.

Three recent articles were selected after an extensive literature search to address three critical issues related to the management of renal trauma: 1) The impact of the AAST grade IV renal injury substratification<sup>5</sup>; 2) The impact of a more rigorous definition of severe grade IV and V renal injuries<sup>6</sup>; 3) The role, indications and outcomes of angioembolization and its impact on renal function<sup>7</sup>.

Based on the discussion of the most up-to-date, relevant literature, recommendations were elaborated for the management of high-grade renal trauma.

## STUDY 1

"American Association for the Surgery of Trauma Grade 4 Renal Injury Substratification into Grades 4a (low risk) and 4b (high risk)"<sup>5</sup>

### Rationale

Although today most renal injuries are managed nonoperatively, identifying CT findings (outside of those described in the original renal OIS) indicative of the need for urgent hemostatic intervention after intermediate and high-grade renal injuries is warranted.

### Question

Can extrarenal radiographic findings be pivotal to guide current management for renal injury?

### Main findings

A Renal Trauma Risk Score (RTRS) was proposed based on three variables: PRD (perirenal hematoma distance) 3.5 cm or greater, ICE (intravascular contrast extravasation) and complex laceration. The likelihood of intervention increased dramatically with an increasing number of risk factors. Those with 0 or 1 risk factors were deemed a low risk group (grade III or IVa) and those with 2 or 3 risk factors were deemed a high-risk group (grade IVb). Those with grade III injuries remain grade III if they have 0 or 1 risk factors but are increased to grade IVb with 2 or 3 risk factors.

Patients with high-risk injuries (grade IVb, RTRS 2 or 3) had 26-fold higher odds of intervention, and in those with all three radiographic risk factors, the odds of intervention increased to 122-fold higher.

### Strengths

1. Use of the same standardized helical abdominal CT with intravenous contrast material within two hours after admission to the emergency department and before invasive intervention, although the time from injury to CT was not standardized.

2. All images were interpreted by a staff radiologist and urologist blinded to clinical outcomes.

3. Well-defined and standardized radiographic indicators (Renal Trauma Risk Factors): 1) perirenal hematoma size, 2) intravascular contrast extravasation in the perirenal hematoma; and 3) the site/complexity of lacerations in the parenchyma.

4. Blindly correlated outcome and radiographic characteristics.

5. Primary outcome events were limited to nephrectomy, renal surgery to repair injury (renorrhaphy) and transarterial embolization, excluding minor urological interventions, such as percutaneous drainage of hematoma/urinoma and ureteral stent placement.

### Limitations

1. Retrospective design, with a small sample conducted in a single center.

2. Although 90% of the cases were blunt injuries, blunt and penetrating renal injuries were analyzed together.

3. Most injuries were grade III (71.6%).

4. The total number of events was small, with only 19 cases of bleeding requiring intervention (nine embolizations, five renorrhaphies and five nephrectomies).

5. A PRD of 3.5 cm was empirically chosen.

6. Several urologists were involved in deciding how, when and whether to intervene during a decade when renal trauma management changed significantly.

7. Must be validated in other cohorts. Furthermore, penetrating trauma remains uncertain and likely requires validation in separate stab wound and firearm injury cohorts.

8. The study does not provide data on the reasons for failure of SNOM. Transfusion requirements, hemoglobin levels, presence of associated injuries, or development of hemodynamic instability were not provided.

9. Mean follow-up period after injury and when interventions were performed were not provided.

## STUDY 2

"Revision of Current American Association for the Surgery of Trauma Renal Injury Grading System"<sup>6</sup>

### Rationale

The goal of the article is to expand the actual grading system.

### Question

Can the proposed system improve language and classification of renal lesions?

### Main findings

No changes for grades I to III injuries. The grade IV and V were revised. The grade IV includes all urinary

collecting system injuries and segmental vascular injuries. Vascular thrombosis was added in grade V. The nephrectomy rates between grading systems were not significantly different ( $p=0.3727$ ).

### Strengths

1. The revision eliminates existing confusion and inaccurate renal staging between centers.
2. The renal injury staging classification facilitates research and guides clinical management.
3. Includes venous and arterial thrombosis.

### Limitations

1. No statistical difference between the two systems.
2. The study is retrospective.

## STUDY 3

"Analysis of Diagnostic Angiography and Angioembolization in the Acute Management of Renal Trauma Using a National Data Set" <sup>7</sup>

### Rationale

Routine use of diagnostic angiography (DA) and angioembolization (AE) in severe renal trauma is desirable.

### Question

Will routine DA/AE decrease the nephrectomy rate in severe renal trauma?

### Main findings

The study analyzed more than 18,000 trauma patients between 2002 and 2007, of whom more than 9,000 had kidney injuries. In this large population of trauma patients, only 88 had angiography for diagnosis (DA) and 77 were embolized by angiography (AE). While AE prevented nephrectomy in 78% and 83% of kidney damage grade IV and V, respectively, the first AE had a low success rate, requiring additional procedures in 88.3% of cases to avoid nephrectomy. Victims of penetrating trauma had a greater propensity to failure of embolization.

### Strengths

1. The study included a large number of hospitals and patients and shows that, between 2002 and 2007, the vast majority of patients with renal trauma in the U.S. have not been diagnosed or treated with angiography.

2. It identifies a high success rate of AE, avoiding nephrectomy but also demonstrating that in most cases AE had to be repeated to be successful.

3. It helps to clarify the role of AE in severe renal trauma (grades IV and V).

### Limitations

1. Retrospective design.
2. No description about the injury mechanism, patient hemodynamics and abdominal examination.
3. Low number of penetrating trauma, impeding results generalization.

## CONCLUSIONS

The present review included three up-to-date studies on selective nonoperative management of renal trauma addressing issues such as the impact of the AAST grade IV renal injury substratification, a more rigorous definition of severe grade IV and V renal injuries, and the role, indications and outcomes of angioembolization and its impact on renal function.

The following conclusions were drawn:

1. Extrarenal radiographic findings may be pivotal to guide current management for renal injury.
2. AE prevented nephrectomy in 78% and 83% of renal lesions Grades IV and V, respectively, though additional procedures were necessary in 88.3%.

### Recommendations

The recommendations for the management of high-grade renal injuries are:

1. The classification system of the AAST-OIS renal trauma, published more than 20 years ago, should be revised and improved, differentiating minor injuries (grades I and II) from lesions requiring radiologic evaluation (CT) and possible intervention;
2. The clinical and radiographic findings remain the most important tools in defining the best treatment for patients with kidney injury;
3. AE is becoming increasingly important in the treatment of renal trauma;
4. Patients with severe renal lesions should preferably be treated in trauma centers with necessary human and technological resources.

\* The authors emphasize that these recommendations do not apply to services that do not have adequate resources to perform SNOM.

## R E S U M O

A reunião de revista "Telemedicina Baseada em Evidência - Cirurgia do Trauma e Emergência" (TBE-CiTE) realizou uma revisão crítica da literatura e selecionou três artigos atuais sobre o tratamento do trauma renal definido como graus III a V pela classificação da Associação Americana de Cirurgia do Trauma (AAST). O primeiro trabalho propõe subestratificação da lesão renal AAST grau IV em 4a (baixo risco) e 4b (alto risco). O segundo trabalho revisa o atual sistema de classificação de lesão renal AAST para incluir lesões vasculares segmentares e estabelecer uma definição mais detalhada dos graus IV e V. O último artigo analisa a angiografia diagnóstica e angioembolização na fase aguda do trauma renal utilizando dados americanos. A reunião de revista TBE-CiTE elaborou as conclusões e recomendações para o tratamento do trauma renal de alto grau.

**Descritores:** Terapêutica. Ferimentos e lesões. Rim. Tomografia. Índices de gravidade do trauma.

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