Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
1. Kansas BT, Eddy MJ, Mydlo JH, Uzzo RG. Incidence and management of penetrating renal trauma in patients with multiorgan injury: extended experience at an inner city trauma center. *J Urol* 2004; 172(4 Pt 1):1355-1360.	3b	93	Review the incidence and management of penetrating renal injuries in patients with multiorgan trauma during a 6-year period.	Isolated penetrating trauma to the kidney is rare. Most patients with penetrating renal trauma have associated adjacent organ injuries that may complicate treatment. In the absence of an expanding hematoma with hemodynamic instability, associated multiorgan injuries did not increase the risk of nephrectomy.	2
2. Santucci RA, Wessells H, Bartsch G, et al. Evaluation and management of renal injuries: consensus statement of the renal trauma subcommittee. *BJU Int* 2004; 93(7):937-954.	12	N/A	Expert panel consensus statement on issues in diagnosis and management of renal injuries. Literature search was performed to make evidence-based recommendations, which was based on a 5 point scale.	There were many level 3 and 4 citations, few level 2, and one level 1 which supported clinical practice patterns. Findings of nearly 200 reviewed citations are summarized. Authors recommend prospective trials to improve the quality of evidence.	3
3. Shariat SF, Jenkins A, Roehrborn CG, Karam JA, Stage KH, Karakiewicz PI. Features and outcomes of patients with grade IV renal injury. *BJU Int* 2008; 102(6):728-733; discussion 733.	3b	77	Analysis of a prospective trauma database to determine patterns of injury, operative outcomes and complications of patients with grade IV renal injury.	36% of patients required surgical exploration to treat associated non-urological injuries. Of the 32 patients who underwent renal exploration, 63% (20/32) underwent renorrhaphy and 37% (12/32) underwent nephrectomy. Patients with no renal injuries and/or haemodynamic instability are more likely to require exploration. Rate of complications was not statistically different according to management type (conservative vs renal exploration).	2
4. Cass AS, Luxenberg M, Gleich P, Smith CS. Clinical indications for radiographic evaluation of blunt renal trauma. *J Urol* 1986; 136(2):370-371.	13	831	Review records of patients with hematuria following blunt renal trauma to determine whether renal contusion can be diagnosed clinically without radiographic evaluation. The association of microhematuria without shock and renal trauma was evaluated.	Microscopic hematuria without shock was found in 160/241 patients without and 33/590 with associated injuries. 159/160 had renal contusion and 1 had a renal laceration. 329/334 had renal contusion, three had renal laceration, one had renal rupture and one had a pedicle injury. Avoiding a radiographic evaluation in patients with blunt renal trauma plus microhematuria and no shock would miss a few cases of severe renal injury.	2
5. Moore EE, Shackford SR, Pachter HL, et al. Organ injury scaling: spleen, liver, and kidney. *J Trauma* 1989; 29(12):1664-1666.	15	N/A	Review organ injury scaling (O.I.S) for spleen, liver, and kidney.	Abdominal Trauma Index and other similar indices using organ injury scoring can be easily modified by replacing older scores with the O.I.S.'s.	N/A

Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
6. Nicolaisen GS, McAninch JW, Marshall GA, Bluth RF, Jr., Carroll PR. Renal trauma: re-evaluation of the indications for radiographic assessment. *J Urol* 1985; 133(2):183-187.	13	359 patients Group 1: 85 patients with gross or microscopic hematuria/ shock Group 2: 221 patients with microscopic hematuria/no shock Group 3: 53 patients with penetrating trauma	Prospective study to refine the indications for radiographic assessment in patients with blunt (306) or penetrating (53) renal trauma.	Radiographic evaluation is necessary in those with penetrating trauma or blunt trauma with gross or micro hematuria and shock.	2
7. Herschorn S, Radomski SB, Shoskes DA, Mahoney J, Hirshberg E, Klotz L. Evaluation and treatment of blunt renal trauma. *J Urol* 1991; 146(2):274-276; discussion 276-277.	13	126	Retrospective study to determine the criteria for radiological investigations and the imaging study of choice in patients with blunt renal trauma.	Radiological investigations are not necessary in those with blunt trauma, micro hematuria and no shock. CT is recommended when radiological investigations are indicated.	2
8. McAndrew JD, Corriere JN, Jr. Radiographic evaluation of renal trauma: evaluation of 1103 consecutive patients. *Br J Urol* 1994; 73(4):352-354.	13	1,103	Retrospective study to determine whether radiographic evaluation is necessary in all trauma patients with hematuria.	Radiographic evaluation is necessary for all patients with penetrating trauma and any degree of haematuria, but only for patients with blunt trauma if associated with gross haematuria, microscopic haematuria and hypotension, or microscopic haematuria and significant associated injuries.	2
9. Mee SL, McAninch JW, Robinson AL, Auerbach PS, Carroll PR. Radiographic assessment of renal trauma: a 10-year prospective study of patient selection. *J Urol* 1989; 141(5):1095-1098.	13	1,146	10-year prospective study to determine if radiographic staging is necessary in patients with renal trauma.	No significant renal injuries in 812 patients with blunt trauma and microhematuria without shock. Radiographic staging is compulsory in patients with penetrating trauma to the flank or abdomen and in patients with blunt trauma associated with either gross or microscopic hematuria and shock.	1
10. Brandes SB, McAninch JW. Urban free falls and patterns of renal injury: a 20-year experience with 396 cases. *J Trauma* 1999; 47(4):643-649; discussion 649-650.	13	396	To determine the distribution and stage of renal injuries from free falls and appropriate method for evaluation and management.	Height of fall cannot reliably predict degree of renal injury. Renal imaging is recommended in vertical deceleration injuries, especially those associated with multiple-system injuries and/or physical signs of potential renal injury.	2

Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
11. Knudson MM, Harrison PB, Hoyt DB, et al. Outcome after major renovascular injuries: a Western trauma association multicenter report. *J Trauma* 2000; 49(6):1116-1122.	15	89	Retrospective, multicenter study to describe the factors leading to outcome after major renovascular trauma. Study determined whether the highest percentage of renal salvage would be achieved by reducing the time from injury to repair.	Factors are blunt trauma, the presence of a grade V injury, and an attempted arterial repair. Patients with blunt major vascular injuries (grade V) are likely to have associated major parenchymal disruption. Immediate nephrectomy is recommended in these patients. Neither the time to definitive surgery nor the operating surgeon's specialty significantly affected outcome.	2
12. Fang JF, Wong YC, Lin BC, Hsu YP, Chen MF. Usefulness of multidetector computed tomography for the initial assessment of blunt abdominal trauma patients. *World J Surg* 2006; 30(2):176-182.	10	252	Prospective enrollment of patients with blunt abdominal trauma to evaluate the usefulness of MDCT as an initial assessment tool.	Sensitivity, specificity, and accuracy of MDCT in identifying patients with active bleeding were all 100%. MDCT is recommended as a second line initial assessment tool.	2
13. Jansen JO, Yule SR, Loudon MA. Investigation of blunt abdominal trauma. *BMJ* 2008; 336(7650):938-942.	12	N/A	To investigate blunt abdominal trauma in adults using evidence based approach.	US is recommended in haemodynamically unstable patients. CT is recommended in haemodynamically stable patients.	3
14. Meyer DM, Thal ER, Coln D, Weigelt JA. Computed tomography in the evaluation of children with blunt abdominal trauma. *Ann Surg* 1993; 217(3):272-276.	9	60	To determine the sensitivity and specificity of diagnostic peritoneal lavage (DPL) vs CT in pediatric patients with blunt abdominal trauma.	CT had sensitivity of 67%, DPL sensitivity of 94%. Both had specificity of 100%. DPL was more accurate (98%) than CT (89%). Authors recommend DPL as initial study.	2
15. Himmelman RG, Martin M, Gilkey S, Barrett JA. Triple-contrast CT scans in penetrating back and flank trauma. *J Trauma* 1991; 31(6):852-855.	10	88	Prospective study to determine whether CT with oral, rectal and IV contrast could predict injury in penetrating back or flank trauma.	Scans were classified according to risk of injury requiring repair. CT had NPV of 100% ± 11%.	2
16. Ekeh AP, Saxe J, Walusimbi M, et al. Diagnosis of blunt intestinal and mesenteric injury in the era of multidetector CT technology--are results better? *J Trauma* 2008; 65(2):354-359.	10	57 patients had CT	To determine if multislice CT has resulted in a change in the diagnosis of blunt intestinal and mesenteric injury (BBMI).	46 patients (80.7%) had findings indicating possible BBMI. Missed injuries remain common in BBMI even with multislice CT. Free fluid without solid organ injury continues to be an important finding.	3
17. Drost TF, Rosemurgy AS, Kearney RE, Roberts P. Diagnostic peritoneal lavage. Limited indications due to evolving concepts in trauma care. *Am Surg* 1991; 57(2):126-128.	13	100	To determine the appropriateness of celiotomy in patients with a positive DPL.	61% had therapeutic celiotomy; 39% had nontherapeutic celiotomy. Positive DPL determined by either gross inspection or laboratory testing has a poor accuracy rate. Role of DPL should be limited in the evaluation of patients with abdominal trauma.	2

Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
18. Willmann JK, Roos JE, Platz A, et al. Multidetector CT: detection of active hemorrhage in patients with blunt abdominal trauma. *AJR* 2002; 179(2):437-444.	9	165	Retrospective study to determine the CT imaging findings in patients with active hemorrhage after trauma. Findings were compared with surgical and angiographic results or clinical follow-up.	22 (13%) showed active bleeding in one or more sites (14 intraperitoneal, 10 extraperitoneal). Active hemorrhage in patients after blunt abdominal trauma is mostly seen as a jet of extravasated contrast agent on MDCT.	2
19. Goletti O, Ghiselli G, Lippolis PV, et al. The role of ultrasonography in blunt abdominal trauma: results in 250 consecutive cases. *J Trauma* 1994; 36(2):178-181.	10	250	Prospective study to determine the accuracy of US in detecting free fluid in patients following blunt abdominal trauma.	• Sensitivity of US for detecting free fluid collection was 98%, specificity 99% and PPV 100%. • Spleen injures had sensitivity of 93%, specificity of 99%, PPV of 93%. • Liver injuries had sensitivity of 80%, specificity 100%, PPV 100%. Kidney lesions had sensitivity of 100%, specificity of 100%, PPV of 100%. • US is recommended as fist diagnostic approach.	2
20. Sirlin CB, Brown MA, Andrade-Barreto OA, et al. Blunt abdominal trauma: clinical value of negative screening US scans. *Radiology* 2004; 230(3):661-668.	10	3,679	Retrospective review to assess accuracy of negative screening US scans in blunt abdominal trauma.	99.9% with negative US were true negative. 93.65% of the patients with true-negative findings (3,641) required no additional tests and 6.4% (n=234) had CT or other tests. 38 patients had false-negative US findings for abdominal injury. Combination of negative US findings and negative clinical observation eliminate abdominal injury in patients who are admitted and observed for at least 12-24 hours.	2
21. Sirlin CB, Brown MA, Deutsch R, et al. Screening US for blunt abdominal trauma: objective predictors of false-negative findings and missed injuries. *Radiology* 2003; 229(3):766-774.	13	3,679	Retrospective study to classify patients with negative US into high-risk and low-risk categories.	High-risk patients 24 times more likely to have missed abdominal injury. Hematuria in fractures of lumbar spine and pelvis most common by high risk findings.	2

Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
22. Lee BC, Ormsby EL, McGahan JP, Melendres GM, Richards JR. The utility of sonography for the triage of blunt abdominal trauma patients to exploratory laparotomy. *AJR* 2007; 188(2):415-421.	10	4,029	Retrospective study to assess the value of focused abdominal sonography for trauma (FAST) in the triage of hypotensive and normotensive blunt abdominal trauma patients to exploratory laparotomy.	In predicting the need for therapeutic laparotomy in hypotensive patients, sensitivity of FAST was 85%, specificity was 60%, and accuracy was 77%. Of 3,907 normotensive patients, 3,584 had negative FAST findings, 323 had positive FAST findings. In normotensive patients, the sensitivity of FAST was 85%, specificity 96%, and accuracy 96%. In both hypotensive and normotensive patients, 4,029 patients with blunt abdominal trauma underwent US: 3,619 had negative and 410 had positive FAST findings. In all patients regardless of blood pressure, the sensitivity of FAST was 85%, specificity was 96%, and accuracy was 95%.	2
23. Hoffman L, Pierce D, Puumala S. Clinical Predictors of Injuries Not Identified by Focused Abdominal Sonogram for Trauma (FAST) Examinations. *J Emerg Med* 2008.	13	458 had FAST and CT	Retrospective chart review to identify clinical characteristics of blunt traumatic injury that increased the risk of peritoneal or pericardial fluid collections and abdominal organ injuries not identified by a bedside FAST examination.	Significant predictors were the presence of a radiographically proven pelvic fracture (odds ratio 3.459; 95% CI: 1.308-9.157) and a radiographically or operatively proven renal injury (odds ratio 3.667; 95% CI: 1.013-13.275). The presence of a pelvic fracture or renal injury in adult victims of blunt abdominal trauma increases the likelihood of a US-/Conf+ exam. Patients with negative FAST and pelvic fracture may benefit from additional radiographic or operative evaluations for occult injuries.	3
24. McGahan JP, Richards JR, Jones CD, Gerscovich EO. Use of ultrasonography in the patient with acute renal trauma. *J Ultrasound Med* 1999; 18(3):207-213; quiz 215-206.	10	32 patients 37 renal injuries	Retrospective study to identify number of patients in which US detected free fluid or a renal parenchymal abnormality.	7/20 patients with isolated renal injuries had free fluid in the abdomen (35%), while 13/20 patients (65%) had no evidence of free fluid. Renal parenchymal abnormalities were identified on US in 8/37 (22%) of injured kidneys. The abnormalities were prevalent in cases of severe injury (60%).	3
25. Valentino M, Serra C, Zironi G, De Luca C, Pavlica P, Barozzi L. Blunt abdominal trauma: emergency contrast-enhanced sonography for detection of solid organ injuries. *AJR* 2006; 186(5):1361-1367.	9	69	Prospective study to compare the diagnostic value of US and contrast-enhanced US with CT for the detection of solid organ injuries in blunt abdominal trauma patients.	US had sensitivity 45.7%, specificity 91.8%, PPV 84.2%, NPV 64.1%. Contrast-enhanced US had a sensitivity 91.4%, specificity 100%, PPV 100% and NPV 92.5%. Contrast-enhanced US is recommended in the assessment of blunt abdominal trauma.	2

Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
26. Stevenson J, Battistella FD. The 'one-shot' intravenous pyelogram: is it indicated in unstable trauma patients before celiotomy? *J Trauma* 1994; 36(6):828-833; discussion 833-824.	10	926 IVP	Retrospective review to assess the value of "one-shot" IVP in unstable patients.	239 preoperative "one-shot" IVP were identified: 53 had abnormal findings and 183 had normal findings. 8% of patients with normal IVP had had renal injuries not detected by "one-shot" IVP; 26% with abnormal studies had no intraoperative evidence of abnormality.	2
27. Demetriades D, Hadjizacharia P, Constantinou C, et al. Selective nonoperative management of penetrating abdominal solid organ injuries. *Ann Surg* 2006; 244(4):620-628.	13	152 patients 185 injuries	Prospective study to assess the role of selective nonoperative management in penetrating abdominal solid organ injuries.	41 patients (27.0%), including 18 cases with grade III to V injuries, were successfully managed without a laparotomy and without any abdominal complication. 28.4% of all liver, 14.9% of kidney, and 3.5% of splenic injuries were successfully managed nonoperatively. Selective nonoperative management is successful in the right environment.	2
28. Alsikafi NF, McAninch JW, Elliott SP, Garcia M. Nonoperative management outcomes of isolated urinary extravasation following renal lacerations due to external trauma. *J Urol* 2006; 176(6 Pt 1):2494-2497.	13	61	Retrospective review of data on nonoperative management outcomes of isolated urinary extravasation following renal lacerations due to external trauma.	27 (44%) of 61 were treated operatively. Open surgical exploration resulted in nephrectomy in 5/27 (19%) patients Of 34 (56%) patients treated nonoperatively 3 (9%) had persistent, nonprogressing urinary extravasation by CT. All 3 (100%) had uncomplicated endoscopic ureteral stent placement followed by complete resolution of urinary extravasation. Nonoperative management is safe and results in resolution in more than 90%.	2
29. Santucci RA, Fisher MB. The literature increasingly supports expectant (conservative) management of renal trauma--a systematic review. *J Trauma* 2005; 59(2):493-503.	11	110 citations	Systematic review of literature to determine the level of support for expectant management of renal injury.	Most papers support the wider use of nonoperative therapy of renal injuries, although this approach is not widely accepted.	2
30. Cheng DL, Lazan D, Stone N. Conservative treatment of type III renal trauma. *J Trauma* 1994; 36(4):491-494.	13	71	Retrospective review to determine if CT diagnosed of deep cortical lacerations could be managed without surgery.	81% successfully managed. CT allows confident conservative therapy for even severe renal injuries.	2
31. Matthews LA, Smith EM, Spirnak JP. Nonoperative treatment of major blunt renal lacerations with urinary extravasation. *J Urol* 1997; 157(6):2056-2058.	13	46	Retrospective review to determine whether non-operative treatment of major renal lacerations with urinary extravasation has a negative impact on patient outcome.	Extravasation resolved spontaneously in 87.1%. 12.9% required stent placement. Nonoperative treatment is safe and effective.	3
32. Erturk E, Sheinfeld J, DiMarco PL, Cockett AT. Renal trauma: evaluation by computerized tomography. *J Urol* 1985; 133(6):946-949.	13	22	To describe the use of CT to guide conservative therapy of renal injuries.	17/22 was successfully managed with conservative therapy and 5 underwent surgical exploration. CT is recommended in patients suspected of sustaining major renal injury and/or other organ injuries.	3

Renal Trauma
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
33. Bozeman C, Carver B, Zabari G, Caldito G, Venable D. Selective operative management of major blunt renal trauma. *J Trauma* 2004; 57(2):305-309.	13	26	Retrospective study to determine if surgery is necessary in stable patients with grade IV or V injuries.	46% required surgery; 54% managed conservatively. Conservative management is recommended in hemodynamically stable patients.	3
34. Sangthong B, Demetriades D, Martin M, et al. Management and hospital outcomes of blunt renal artery injuries: analysis of 517 patients from the National Trauma Data Bank. *J Am Coll Surg* 2006; 203(5):612-617.	15	517	To assess the incidence of renal artery injuries, evaluate current therapeutic approaches and effect of various therapeutic modalities on hospital outcomes.	Patients who had surgical revascularization had a considerably longer ICU and hospital stay than observed patients. Patients who had nephrectomy had a considerably longer hospital stay than observed patients. Blunt renal artery injury is rare. Nonoperative management is recommended.	2
35. Broghammer JA, Fisher MB, Santucci RA. Conservative management of renal trauma: a review. *Urology* 2007; 70(4):623-629.	12	N/A	Review patient selection, complication management, and operative criteria to assess costs and benefits of conservative management renal trauma.	Authors believe published data support increasing conservative attempts in the hemodynamically stable patient.	4
36. Sofocleous CT, Hinrichs C, Hubbi B, et al. Angiographic findings and embolotherapy in renal arterial trauma. *Cardiovasc Intervent Radiol* 2005; 28(1):39-47.	13	22	Retrospective review to evaluate angiographic findings and embolotherapy in renal arterial trauma.	Selective and super-selective embolization is recommended in hemodynamically stable and controlled patients.	3
37. Lynch TH, Martinez-Pineiro L, Plas E, et al. EAU guidelines on urological trauma. *Eur Urol* 2005; 47(1):1-15.	15	N/A	A summary of literature review by a consensus committee to determine the diagnosis and treatment of genitourinary trauma.	350 citations were reviewed. Literature is based on expert opinion and single-institution retrospective series. Prospective trials are needed.	3

Evidence Table Key

Study Type Key

Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
    a. Cohort
    b. Cross-sectional
    c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews
8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.