



Role of MDCT in Evaluating Urinary Tract Injuries

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ABSTRACT

Background:

MDCT (Multidetector computed tomography) is a cross sectional imaging technique with multiplanar and multiple reconstruction capabilities.

Objective:

The objective of this study was to find out role of MDCT in identifying varieties of urinary tract injuries; grading and quantifying severity of such injuries and thus helping referring consultants in planning treatment.

Materials and methods:

During the period of May 2016 to October 2016, a prospective study of 30 patients having history of abdominal/pelvic trauma was carried out. CECT of abdomen and pelvis was performed on Phillips 16 slice MDCT machine using standard protocol. In a few selected patients (5 patients) CT cystogram was also performed.

Conclusion:

In our study MDCT was found to be accurate in diagnosing urinary tract injuries.

KEYWORDS

MDCT, Urinary tract trauma, CT cystogram

INTRODUCTION

Classification of renal injuries is given by AAST – American association for surgery in trauma (based on the depth of injury and involvement of vessels or the collecting system) as follows:

Grade 1: Contusion /Subcapsular hematoma

Grade 2: Perinephric hematoma /Superficial (< 1cm deep) laceration

Grade 3: Lacerations (> 1 cm in depth) but do not involve the collecting system

Grade 4: Deep lacerations extending through the kidney into the collecting system/ Injury to main renal artery or vein with contained hemorrhage/Segmental infarction without associated laceration

Grade 5: Shattered kidney/Devascularized kidney/Ureteropelvic junction injuries.

Classification of ureteral injuries is given by AAST as follows:

Grade 1: hematoma only

Grade-2: laceration <50 percent of circumference

Grade 3: laceration >50 percent of circumference

Grade 4: complete tear <2 cm of devascularization

Grade 5: complete tear >2 cm of devascularization

Classification of urinary bladder injuries is given by AAST as follows:

Type 1 Bladder contusion

Type 2 Intraperitoneal injury

Type 3 Interstitial bladder injury

Type 4 Extraperitoneal injury

Type 5 Combined bladder injury

CT cystography may be performed expeditiously and is highly accurate as an adjunct to routine abdominopelvic CT in the trauma setting. This

technique obviates a separate study with conventional cystography, which entails additional cost and higher radiation exposure. Bladder injuries

have characteristic CT cystographic features that can be used for accurate classification and treatment planning.

MATERIALS & METHODS

During the period of May 2016 to October 2016, a prospective study of 30 patients having history of abdominal/pelvic trauma was carried out. The study group consisted of mainly patients from different parts of Gujarat.

All patients were imaged on emergency basis as a part of trauma work up. Clinical examination, X rays and FAST (Focused abdominal sonography in Trauma) were performed in all patients and indicated patients were imaged with MDCT.

Inclusion criteria:

1. Patients with abdominopelvic trauma having macroscopic hematuria and not in hypovolemic shock
2. Patients with abdominopelvic trauma having pelvic injuries and hematuria/anuria
3. Patients with abdominopelvic trauma having inconclusive FAST findings.
4. Patients diagnosed having urinary tract injury for grading injury.

CECT of abdomen and pelvis was performed on Phillips 16 slice MDCT machine using standard protocol. In a few selected patients (5 patients) CT cystogram was also performed.

RESULTS

Table 1: Age & sex distribution of patients in study

Age group (years)	Urinary tract injury					
	Renal injury		Ureter injury		Urinary bladder injury	
	Male	Female	Male	Female	Male	Female
10-19	2	3	0	1	0	1
20-29	4	2	1	0	1	0
30-39	2	3	0	0	2	1
40-49	5	2	1	0	0	0
50-59	0	1	0	0	1	0
60-69	1	0	0	0	0	0
Total	14	11	2	1	4	2
Total (of 30pt)	25(83%)		3(10%)		6(20%)	

In our study, the age distribution of patients was from 10 to 69 years.

It was observed that renal injuries were more prevalent in the age group of 40-49: 7 (28%), ureteric injuries in the age group of 10-29 and 50-59: 1 (33.3%) and bladder injuries in the age group of 30-39: 3 (50%).

The sex distribution for renal injuries was 14 males and 11 females with the ratio being 1.27:1, for ureteric injuries was 2 males and 1 female, the ratio being 2:1 and for bladder injuries was 4 males and 2 females, the ratio being 2:1.

Table 2: Injury grade wise distribution of patients in study (AAST classification- American Association for Surgery in Trauma)

Injury Grade	Urinary tract injury		
	Renal injury	Ureter injury	Urinary bladder injury
1	7(28%)	0	0
2	8(32%)	1(33%)	3(50%)
3	6(24%)	1(33%)	0
4	2(8%)	0	2(33%)
5	2(8%)	1(33%)	1(17%)
Total	25	3	6

The renal injuries succumbed by the patients were predominantly grade 2 injuries with 8 patients (32%). Least common was the grade 4 and 5 injuries which included 2 patients each (8%).

Equal number of patients succumbed to ureteric injuries of the grades 2, 3 and 5 which was 1 patient (33%). None of the patients suffered grade 1 and 4 ureteric injuries.

Most common bladder injury was found to be grade 2 in which there were 3 patients (50%) while none of the patients suffered grade 1 and 3 bladder injuries.

Table 3: Association with symptoms and other imaging findings in patients of study

Associated Imaging finding/symptom	Urinary tract injury		
	Renal injury(25 patients)	Ureter injury (3 patients)	Urinary bladder injury (6 patients)
Other visceral injury(liver,spleen,bowel)	15(60%)	1	2
Pelvic fracture	2(8%)	0	5(84%)
Rib fracture	14(56%)	0	1
Free fluid/Hemoperitoneum in absence of other visceral injury	2(8%)	0	1
Abdominal/pelvic pain	17(68%)	0	3
Hematuria	16(64%)	2	4(75%)

- The most common associated imaging finding with renal injuries and ureteric injuries was found to be other visceral injuries which included 15 patients (60%) and 1 patient (33.3%) respectively.
- The most common associated imaging finding with bladder injuries was found to be pelvic fractures which included 5 patients(84 %).
- Free fluid/ hemoperitoneum in absence of other visceral organ injuries was least found associated with all renal, ureteric and bladder injuries which included 2 (8%), 0 (0%) and 1(16%) respectively,
- The most common associated symptom was abdominal/pelvic pain in case of renal injuries which included 17 patients (68%) while in case of ureteric and bladder injuries was hematuria which included 2 patients (66.6%) and 4 patients (75%) respectively.

Table 4: Comparison of MDCT with other imaging modalities(USG/X RAY)

Injury	Sensitivity(%)		Specificity(%)		PPV(%)		NPV(%)	
	MDCT	USG/XRAY	MDCT	USG/XRAY	MDCT	USG/XRAY	MDCT	USG/XRAY
Renal injury	100	80	100	100	100	100	100	50
Ureteric injury	75	0	100	-	100	-	96	87
Bladder injury	75	25	100	100	100	100	92	78
Pelvic fracture	100	71	100	92	100	100	100	92
Rib fracture	100	80	100	88	100	100	100	83

- MDCT is more sensitive and specific in the detection of renal, ureteric , bladder injuries and pelvic fractures as compared to USG/XRAY.
- MDCT and USG/XRAY show an equal positive predictive value (100%) for renal, bladder injuries, pelvic and rib fractures.
- MDCT shows a higher negative predictive value for these injuries and fractures as compared to USG/XRAY.

DISCUSSION

- In our study, It was observed that renal injuries were more prevalent in the age group of 40-49: 7 (28%), ureteric injuries in the age group of 10-29 and 50-59: 1 (33.3%) and bladder injuries in the age group of 30-39: 3 (50%).
- In nutshell, urinary tract injuries were more common in middle aged group.
- The sex distribution for renal injuries was 14 males and 11 females with the ratio being 1.27:1, for ureteric injuries was 2 males and 1 female, the ratio being 2:1 and for bladder injuries was 4 males and 2 females, the ratio being 2:1.
- The renal injuries succumbed by the patients were predominantly grade 2 injuries with 8 patients (32%). Least common was the grade 4 and 5 injuries which included 2 patients each (8%).
- Equal number of patients succumbed to ureteric injuries of the grades 2, 3 and 5 which was 1 patient (33%). None of the patients suffered grade 1 and 4 ureteric injuries.
- Most common bladder injury was found to be grade 2 in which there were 3 patients (50%) while none of the patients suffered grade 1 and 3 bladder injuries.
- The most common associated imaging finding with renal injuries and ureteric injuries was found to be other visceral injuries which included 15 patients (60%) and 1 patient (33.3%) respectively.
- The most common associated imaging finding with bladder injuries was found to be pelvic fractures which included 5 patients(84 %).
- Free fluid/ hemoperitoneum in absence of other visceral organ injuries was least found associated with all renal, ureteric and bladder injuries which included 2 (8%), 0

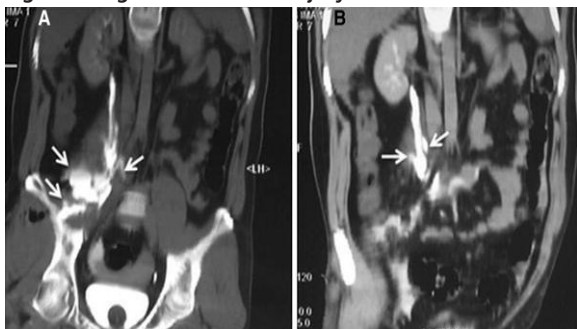
- (0%) and 1(16%) respectively,
- The most common associated symptom was abdominal/pelvic pain in case of renal injuries which included 17 patients (68%) while in case of ureteric and bladder injuries was hematuria which included 2 patients (66.6%) and 4 patients (75%) respectively.
- MDCT is more sensitive and specific in the detection of renal, ureteric , bladder injuries and pelvic fractures as compared to USG/XRAY.
- MDCT and USG/XRAY show an equal positive predictive value (100%) for renal, bladder injuries, pelvic and rib fractures.
- MDCT shows a higher negative predictive value for these injuries and fractures as compared to USG/XRAY.

To conclude,

In our study MDCT was found to be accurate in diagnosing urinary tract injuries.

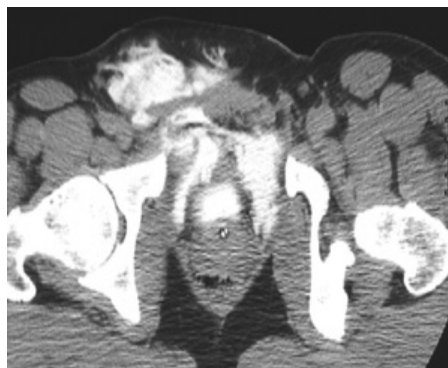
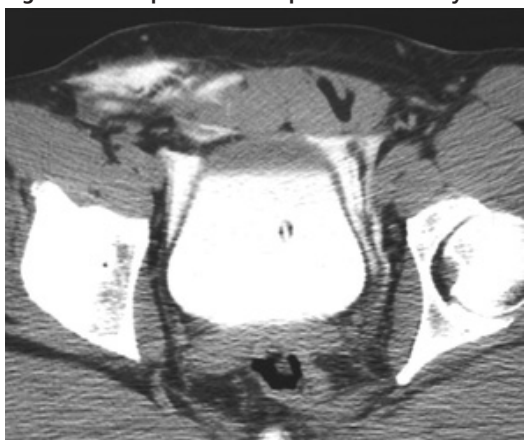
FIGURE LEGENDS

Figure 1: Right mid ureteric injury:-



> (A)Coronal MPR image of Delayed phase of CECT scan of abdomen shows extravasation of contrast from right mid ureter/ into right periureteric space. (B):Extravasation of contrast in periureteric region in delayed phase. However, urinoma formation has not occurred yet.

Figure 2:Extraperitoneal rupture of urinary bladder:->



(A)Delayed axial CT image shows extravasation of contrast from urinary bladder extraperitoneally into perivesical space through a rent on antero-inferior aspect of urinary bladder. (B) Similar patient. Axial image of CT shows similar findings with contrast extending extraperitoneally into muscles and further into subcutaneous tissue.

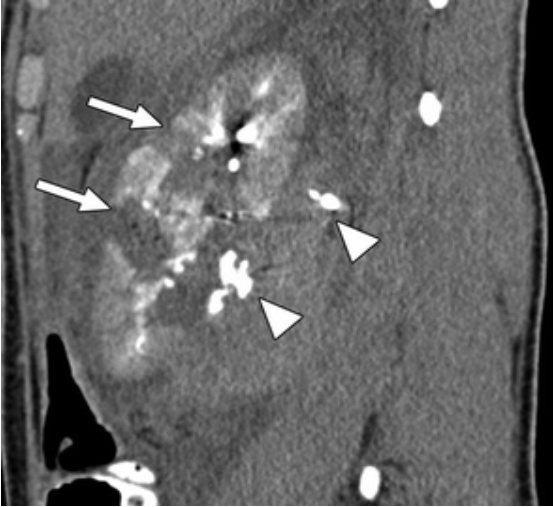
Figure 3: Intra-peritoneal rupture of urinary bladder:->



(A) Coronal MPR image of CT cystogram shows extravasation of bladder contrast into peritoneal cavity outlining bowel loops through rent in dome of urinary bladder following cystoscopic examination. (B) Axial CT images of same patient shows contrast extravasation in interbowel region.

Figure 4: Right renal and pelviureteric junction /upper ureteric complete transection:->





(A) Axial delayed CT image shows deep right renal parenchymal laceration with extravasation of contrast into right perinephric space with large hematoma in perinephric space. (B) Sagittal MPR image in delayed scan shows contrast extravasation into right perinephric space and non opacification of right upper ureter, suggests possibility of complete transection of pelviureteric junction/ upper ureter.

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