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Renal Trauma in an Adolescent of a Tertiary Care Hospital; Is Ultrasound Adequate?

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Abstract

Children are at high risk of renal injury from blunt trauma than adults. Renal trauma can be from direct, blunt, penetrating and iotrogenic injury. Renal injuries are accounting for 10% of abdominal trauma. In our cases, renal injury caused to patient after falling from bicycle in September 2023.

Depending upon the pre-existing congenital or acquired renal pathology, its incidence increases. Blunt trauma comprises more than 95% of traumatic renal injury. Patient with renal trauma present with flank &/or abdominal pain and with hematuria.

Computed tomography (CT) is the investigation of choice in evaluation of blunt renal injury. Ultrasound is helpful in detecting hemoperitonum in patients with suspected intraperitoneal injury. FAST (Fast Abdominal Sonography for Trauma), thus is important. Sonography was conducted to precisely diagnose and detect renal injuries caused by blunt abdominal trauma. Ultrasonography is also useful in detecting injuries and it is less value in evaluating those with suspected extraperitoneal injury. In some cases, MRI, Renal angiogram and scintigraphy may be useful.

In our case, an adolescent boy with fall from bicycle sustaining blunt abdominal trauma in September 2023 with Gr-IV injury to right kidney is under observation as hemodynamically stable.

No Pediatric renal trauma guidelines have been established though children are at higher risk of renal injury from blunt trauma than adults.

Keywords: Pediatric Renal Injury, Blunt Trauma, Hematuria, USG, CT

Introduction

The isolated renal trauma in vast majority is minor (95-98%) and major renal injuries are less common as kidneys are located in retroperitoneum. Blunt trauma from falls, motor vehicle crashes etc are the important cause of renal injury in 85% of cases, the mechanism being deceleration injuries from collision of kidney with vertebral column or thoracic cage. The spectrum of renal injuries include-contusion/ hematoma, laceration, avulsion of renal pedicle, AV-fistula, Pseudo-aneurysm, renal artery thrombosis etc.

Kidney is the most commonly involved organ associated with urologic trauma and involved in 1-20% of trauma cases, kidney injuries take place between 1-5% on average.

Excretory phase CT is important for detection of collecting system injury.

Computed tomography (CT) is the investigation of choice in the evaluation of blunt renal injury. Ultrasonography is helpful in detecting hemoperitoneum in patients with suspected intaperitoneal injury. IVP (Introvenous pyelography) is used basically for gross assessment of renal function in hemodynamically unstable patients. Selective renal arteriography and venography is useful for providing information regarding vascular injury.

The American association for the surgery of trauma(AAST), organ injury scale (OIS), the most commonly used grading system updated in 2018 and incorporates imaging findings from contrast enhanced CT.

The primary goal of acute renal trauma is to optimize patients' survival and preserve renal function.

Comparing to adult kidney, the child's kidney is larger in relation to the rest of the body, less well protected than the adult kidney. The Child kidney is having foetallobulations, therefore, a blunt trauma can easier end in local parenehymal disruption. In children there is less developed perirenalfat, much weaker abdominal muscles, more elastic and compressible thoracic cage. Thus, children are more likely to sustain renal injuries after blunt trauma than adults. Sports accidents, falls and contact with blunt objects are the cause of sudden deceleration of child's body.

Case report:

Ours is an adolescent patient of 14 years of age who fell down from bicycle and sustained injury and presented to emergency in the same day with pain abdomen and hematuria. There is no LOC, Seizure or any ENT bleed.

The CBC was normal with mild increase in WBC count. The Kidney function test was normal, PT, APTT&INR also within normal limits.

CT-CT done two days after injury showed a wedge shaped infarct in upper pole. Large hypodense area is noted involving the lower part of interpolar region and lower pole with involvement of PCS and Spillage of excreted contrast on delayed images. Large hematoma of 110.0cc in perinephric space with associated mild to moderate ascitis. Main renal artery and vein grossly appear normal.

Ultrasonography done after six days after the injury.

FAST (focused abdominal sonography for trauma) is the first step to detect hemoperitoneum and kidney status.Right kidney is enlarged and deeply lacerated dividing right kidney into two halves with perinephric collection in mid and lower pole (Fig 1 & 2).

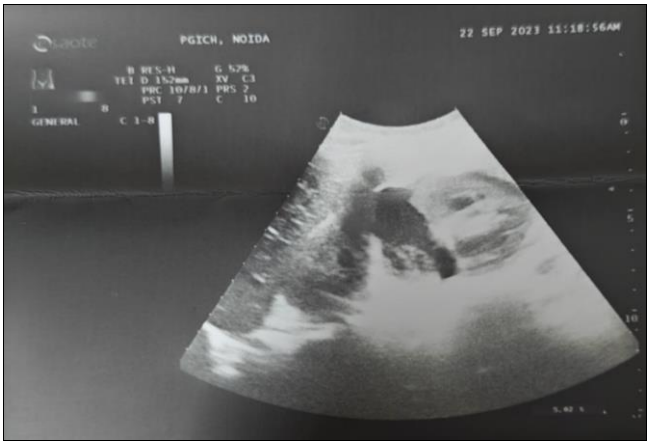

Fig 1:

Fig 2:

Fig 1 & 2 Deeply lacerated right kidney longitudinal and transverse sections.

The gap between the two halves is 1.8 cm. Vascularity of upper pole area is normal (Fig 3).

Fig 3: Doppler of the right kidney shows normal blood flow in upper pole region. No flow in mid and lower pole region.

Vascularity in fractured lower half is not visualized. It is classified as AAST Gr-IV (American Association for surgeons of trauma).

Discussion

Hematuria is very unreliable sign in determining the need to screen the renal injuries. In some studies, there is no evidence of gross or microscopic hematuria in upto 70% children sustaining grade 2 or higher renal injury [2].

In this case we assume that ultrasound imaging would be able to diagnose & rule out clinically significant renal injuries when compared to the gold standard CT scan in the setting of pediatric blunt abdominal trauma [1]. When compared to a CT scan as the gold standard, kidney ultrasound images had a sensitivity of 79-100% to detect Grade III-V injuries [1].

Blunt renal injuries accounting for 71-95 % of renal trauma cases are more common than penetrating injuries [7, 8]. Motor vehicle accidents are main cause of blunt trauma, followed by fall, sports and pedestrian accidents [9, 10]. Physical exam: attention paid to symptoms suggestive of kidney injury such as gross hematuria, flank hematoma, flank ecchymoses and tenderness, rib#, pelvic pain etc [7, 8, 11, 13]. Lab test- Besides urine analysis, CBC and kidney function tests to detect renal function [8, 13]. Focused abdominal sonography for trauma (FAST) exam is the first step to detect hemoperitoneum, CT with intravenous contrast is the gold standard in blunt trauma to find out intra abdominal and retroperitoneal injuries in stable patients. A renal arteriogram must be done in suspected arterial injury [14, 15].

Presently non-operative management for gr-III injury is followed [3]. Conservative management of gr-IV renal injuries in the majority of cases preserves renal function as measured by dimercaptosuccinic acid, renal scintigraphy. This is a recent prospective, multicenter observational study [4].

According to AAST, conservative treatment approach is referred in gr-I-II and hemodynamically stable grade-III and IV renal injuries. Non operative approach with active monitoring done in the presence of hemodynamically stable in grade-IV and V cases. It is found that non operative management provides approximately 84-100% kidney preservation [8, 13, 16, 17] and upto 95 % of blunt renal injuries are minor, conservatively managed.

Our experience suggests that after initial CT for accurate staging with application of ALARA concept, of pediatric blunt renal trauma, Serial monitoring can be performed with ultrasound in most patients (excluding those with hemodynamic instability) [18]. In a study by Reza Jalli, Nazafarin K *et al* [19] over all accuracy of Ultrasonography seems to be 79%.

A FAST Scan (Ultrasounds Scan) that is negative for intra abdominal injuries combined with normal serial physical examinations over 24 hours of period of observation will virtually rule out the presence of significant intra abdominal injuries [20].

The WSES-AAST (World society of emergency surgeons & American Association for surgery of trauma) guidelines recommend ultrasound in pediatric patients as an alternative to CT in the presence of hemodynamic stability during the immediate assessment and follow up examinations [21]. Sonographic monitoring is safe is most pediatric patients after initial staging by CT for accurate staging of pediatric blunt renal trauma [24].

CEUS (Contrast enhanced ultrasound) has emerged as a promising tool to assess renal injuries [22]. It seems to be advisable to routinely perform repeated sonographic scanning in higher grade injuries to facilitate timely diagnosis of complications [23].

Conclusion

The Kidneys are the most frequently injured organ of the pediatric urinary system with the majority of these lesion caused by blunt trauma. Provided hemodynamic stability of the patients, the injuries can be managed conservatively resulting good outcome. A small percentage of patients with life threatening injuries need urgent operative intervention. Injuries to ureter, U. bladder & urethra are rarely seen encountered in poly-traumatized children.

FAST is the first step to detect hemoperotonum. Ultrasonography can detect other intra abdominal organ injuries also. Serial monitoring by Ultrasonography is advisable in hemodynamically stable injuries as it is safe. Further, it is advisable to routinely perform repeated sonographic scannings in higher grade injuries to diagnose the complications timely.

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