Timing and Predictors for Urinary Drainage in Children with Expectantly Managed Grade IV Renal Trauma

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Abbreviations and Acronyms

CT = computerized tomography

LOS = length of stay

UPJ = ureteropelvic junction

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Purpose: We determined which children sustaining blunt grade IV renal trauma are at greatest risk for failing nonoperative management and in what time frame they will likely present.

Materials and Methods: We retrospectively reviewed children presenting with nonvascular grade IV blunt renal trauma between 2003 and 2012. We compared characteristics on computerized tomography, reasons for intervention, type and timing of surgery, length of hospital stay and need for readmission between children undergoing early intervention (less than 72 hours after admission) and those managed conservatively (with any subsequent intervention undertaken more than 72 hours after admission).

Results: A total of 26 children were identified with nonvascular grade IV blunt renal trauma. Conservative management was attempted in 16 cases (62%). Seven of these patients (44%) required intervention (ureteral stent and/or percutaneous drain placement), with a mean time to intervention of 11 days. Collecting system clot and larger urinoma (1.45 cm in cases with successful and 4.29 cm in those with failed conservative management) significantly predicted failure of conservative management ($p < 0.05$). Presence of dissociated renal fragments (57% vs 11%) and interpolar contrast extravasation (57% vs 0%) were increased in the early intervention group compared to the conservatively managed group ($p > 0.05$), as was rehospitalization (43% vs 0%), mean length of stay (7.9 vs 5.4 days) and transfusion (14% vs 0%, $p > 0.05$).

Conclusions: Collecting system hematoma and urinoma size significantly predicted failure of conservative management, with a mean time to intervention of 11 days. Children with failed conservative management had a greater incidence of dissociated renal fragments and interpolar extravasation. Early identification of these patients may decrease hospital readmissions, length of stay and prolonged morbidity.

Key Words: kidney; pediatrics; wounds and injuries; wounds, nonpenetrating

Conservative management of grade IV renal lacerations in the pediatric population has been shown to be effective in preserving renal function and reducing the morbidity associated with operative care.[1–13] A recent meta-analysis demonstrated that nonoperative management of nonvascular grade IV blunt renal trauma was successful in more than 80% of children who incurred these injuries.[3] Other reports have revealed that

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renal salvage rates as high as 95% to 99% can be achieved when managing grade IV injuries conservatively.[8,10] However, loss of renal units can occur when open or minimally invasive techniques fail to control bleeding, drain enlarging urinomas or evacuate infected hematomas.[3,5,8,10] Indeed, when open operations were used to primarily manage grades IV and V renal injuries, nephrectomies were subsequently performed in 60% to 65% of cases.[5,11,14] Concerns regarding complications in conservative management, such as delayed hypertension and lengthened hospital stays, have been refuted by several large institutional reviews.[6–8,10]

Absolute indications for intervention in high grade renal trauma include unstable hemorrhage and/or ureteropelvic disruption, marked by absence of contrast material in the ipsilateral ureter on delayed CT.[1,6,8] It has been suggested that relative indications for operative intervention may include wide separation of renal fragments, multiple areas of urine extravasation and need for transfusion. In these instances an intervention may be highly anticipated during a period of conservative or expectant management.[5,8,15,16]

We retrospectively examined the charts and radiographic findings for 26 children who sustained grade IV renal trauma during a 10-year period. We were interested in studying those who sustained collecting system injuries that were initially managed conservatively yet ultimately required an intervention to control the injury. We hypothesized that there might be a predictable time frame to such intervention(s) and that additional risk factors leading to intervention could be identified.

METHODS

Research data were derived from an institutional review board approved protocol from the University of Pittsburgh Medical Center. We retrospectively reviewed data on children entered in the pediatric trauma database at Children's Hospital of Pittsburgh (a level I trauma center) from 2003 to 2012. A total of 104 patients 4 to 16 years old (mean 11.2) with renal lacerations were identified. Contrast enhanced CT with delayed images was reviewed by the pediatric radiology and pediatric urology staff to identify patients with evidence of urinary extravasation. In 1 patient only renal ultrasound was performed before recognizing the need for intervention.

A total of 26 patients were identified for our review of nonvascular grade IV blunt renal trauma.[17] Exclusion criteria consisted of penetrating renal trauma in 1 patient, isolated renal vascular injuries in 5 and all other grades of renal injury in the remaining 98. We collected variables of age, gender, mechanism of injury, associated injuries, presence of gross hematuria, length of hospital stay, readmissions, transfusion requirements, timing and type of intervention, length of intervention and followup imaging. Radiological characteristics of largest linear dimension of urinoma, location of extravasation, presence of clot in the collecting system, number of renal fragments and number of perfused renal fragments on initial CT urogram were also recorded. Cases were then categorized into an early intervention group (open surgical repair or endoscopic drainage within 72 hours of presentation) and conservative management group (those without intervention or undergoing intervention more than 72 hours after presentation). Characteristics of cases that succeeded and failed conservative management were compared using chi-square and 2-tailed t-tests (GraphPad Prism® 6).

RESULTS

A total of 26 children with a median age of 11.5 years meeting our inclusion criteria were identified. Of the patients 18 (69%) were male. The most frequent causes of injury were falls (10 patients, 38%), followed by motor vehicle accidents (7, 27%), sledding accidents (4, 15%), all-terrain vehicle accidents (2, 8%), sports related injuries (2, 8%) and abuse (1, 4%). Gross hematuria was present in 17 children (65%) at initial presentation. Three patients (12%) had evidence of preexisting UPJ obstruction with otherwise intact renal parenchymal units, 15 had an incomplete laceration of the renal parenchyma and 8 had complete dissociation of the affected renal unit with all fragments showing evidence of at least partial perfusion. Evidence of hematoma within the collecting system was present in 17 renal units (65%). The largest single dimension of the urinoma was recorded for each patient and the mean was 3.9 cm. No patient had bilateral radiographic injury to the kidneys (table 1).

Ten patients (38%) who underwent intervention within the first 72 hours of presentation to the hospital were categorized as the early intervention group and analyzed separately. Of the remaining 16 children in whom conservative management was attempted 7 (44%) ultimately required intervention. Of the early intervention group 3 patients (30%) had a ruptured renal pelvis from a preexisting UPJ obstruction with resultant large and symptomatic urinomas. Of the 7 remaining patients 3 underwent procedures based on the size of the urinoma on initial CT, 2 had no evidence of ureteral contrast on delayed films, 1 had an enlarging urinoma on early repeat imaging and 1 manifested a high fever with worsening flank pain. In addition, 1 patient required early selective angioembolization to control hemorrhage before stent placement for enlarging urinoma.

Average LOS for the early intervention group was 7.4 days with no rehospitalizations. In those cases with initial and durable nonoperative management the mean LOS was 5.4 days with no readmissions. However, when conservative management failed and delayed intervention was undertaken, the mean