Renal injury mechanisms of motor vehicle collisions: analysis of the crash injury research and engineering network data set

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Purpose: Injury prevention requires efficient diagnosis and management, and knowledge of collision kinematics may allow first responders to triage victims earlier based on crash scene assessment. We identified possible collision patterns and vehicle interior components that may have a role in kidney injury following motor vehicle collision.
Materials and Methods: A total of 115 cases (131 renal injuries) were identified in the multicenter Crash Injury Research and Engineering Network database. For each case a crash investigation was performed, identifying vehicle kinematic characteristics, vehicle damage profile and an assessment of the interior compartment to determine points of occupant contact and restraint system use. A multidisciplinary team reviewed each case to establish a probable mechanism for all injuries sustained. Review of the medical record was performed to identify subject demographics and injury characteristics. Cases were analyzed based on frontal vs side impact.

Results: Of the subjects 52% were male. Mean age was 36.1 years and median injury severity score was 33. Overall injuries were low grade in 72.5% of patients, 30% were unrestrained and 47.6% of collisions were side impact. No difference was observed between frontal and lateral collisions with respect to renal injury severity. For frontal impact the seat belt was the source in 26 of 29 renal injuries (90%) and 12 of 15 unrestrained cases (80%) were due to direct impact with the steering column. Of 131 side impact injuries 62 were attributable to impact with lateral compartment elements. Side impact injuries were associated with lateral door panel impact (41 of 61) with the armrest accounting for 22. The mean lateral compartment intrusion was 29.6 cm. No grade V injuries occurred when vehicle intrusion was less than 30 cm. The mean change in velocity for frontal and lateral collisions was 24.0 and 31.5 mph, respectively ($p < 0.05$). In frontal collisions the change in velocity for kidney injuries sourced to the steering wheel vs seat belt injuries was statistically greater (41.5 vs 28.4 mph, $p = 0.05$).
Conclusions: Renal injury in frontal and side impact collisions appears to occur after direct impact from objects in the vehicle compartment. For frontal crashes occupant acceleration into the seat belt or steering wheel seems to result in renal injuries. Side impact injuries occur when the vehicle side panel intrudes into the compartment, striking the occupant. Further collision evaluation in larger data sets is required to substantiate our findings.

Editorial Comment

When evaluating a trauma patient in the emergency department one of the important aspects to elicit is the mechanism of injury. If the mechanism is blunt, the typical questions to be answered are the speed of the vehicle, location of the victim (passenger or diver, front or back seat), restrained / unrestrained, and if the victim was ejected from the vehicle. The above study by Kuan et al., is the first study on blunt kidney injuries to analyze the injury pattern by the direction of the collision, lateral or frontal, and if the victim was restrained or unrestrained. With frontal collisions, kidney injuries are due to deceleration and sheering either from collision with the steering column or instrument panel or the seat belt. For lateral collisions, renal injury appears to be from compartment intrusion striking the flank. The overall injury severity increases in relation to the degree of intrusion, with the majority occurring with intrusions > 30 cm. Perhaps mandatory side air bags would minimize the injuries from such lateral intrusions.

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Role of magnetic resonance imaging in assessment of posterior urethral distraction defects

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Objectives: To determine the clinical usefulness of magnetic resonance imaging (MRI) in the assessment of posterior urethral distraction defects.
Methods: A total of 21 male patients, 6 to 35 years old, with posterior urethral distraction defects underwent MRI of the pelvis and combined antegrade retrograde urethrography before surgical repair. Repair was performed with a bulboprostatic urethral anastomosis through the perineum in 13 patients and transpubically in 8. The MRI and urethrographic findings were compared and correlated with the operative findings. The MRI findings were also correlated with the incidence of posttraumatic impotence.

Results: On MRI, the length of urethral defect and type of prostatic displacement could be correctly determined in 86% and 89% of the patients, respectively. Also, MRI precisely delineated the extent of scar tissue, which varied according to the type and magnitude of the original trauma. Furthermore, MRI revealed the presence of paraurethral false tracks in 3 patients. In addition, MRI demonstrated avulsion of the corpus cavernosum, as well as lateral prostatic displacement in all 6 patients with posttraumatic impotence.
Conclusions: Preoperative MRI can provide useful information that might help determine the appropriate surgical repair. It correctly estimates the length of the urethral defect, clearly demonstrates the type and degree of prostatic displacement, precisely delineates the site and density of scar tissue, and reveals the presence of paraurethral false tracks. Also, MRI can identify the cause of posttraumatic impotence such as avulsion of the corpus cavernosum and thus might predict the potency outcome in these cases.

Editorial Comment

Posterior urethral distraction defects were classically described as prostato-membranous disruption injuries by Turner-Warwick. In other words, posterior urethral injuries from pelvic fracture are not urethral strictures but scar tissues that fill the gap from the displacement of the prostate or the bulbar urethra. While many of the urethral injuries from pelvic fracture are at the prostato-membranous junction, roughly as many are at the bulbo-membranous junction. When preparing for a posterior urethroplasty, a well performed and simultaneous VCUG and RUG are needed. The keys here a properly performed study is to first perform a static cystogram to test the competence of the bladder neck, and then have the patient void, in order to fill the prostatic urethra. In this day and age with an aggressive initial management of primary realignment with flexible cystoscopes, the final distraction defect distance is typically < 2 cm and only occasionally > 2 to 3 cm. For such short distances, there is rarely the need for an abdominal perineal approach. The progressive perineal approach, as detailed by Webster, will typically bridge all gaps. In my personal experience with posterior urethroplasty, I have only needed to perform a pubectomy 2 times in over the last 10 years. In conclusion, while having a MR imaging of the urethra preop is nice, it is more of a luxury then a true necessity. The area that I have found the pelvic MR to be a value is when the prostate is displaced laterally and it is those circumstances that the prostatic urethra can be difficult to find. The other interesting finding from pelvic MR study, is that impotence after pelvic fracture may be due to avulsion of the corpus cavernosum from the ischium, and not necessarily a vascular injury at Alcock's canal.

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