Injury (1993) 24, (9), 619–621 *Printed in Great Britain*

Missed urological injuries in children with polytrauma

V. C. Onuora[1], M. G. Patil[1] and A. N. Al-Jasser[2]

Departments of Urology, [1]Central Hospital, and [2]Security Forces Hospital, Riyadh, Kingdom of Saudi Arabia

Fifteen children (11 boys and 4 girls) with severe injuries of the urinary tract were admitted to the Riyadh Central Hospital between 1990 and 1992. Their ages ranged from 2.5 to 12 years (mean 7.3 years), and their injuries were parts of multiple-organ trauma. Following resuscitation, every child was evaluated and staged by either intravenous urography, CT scan or ultrasonography or a combination of these. Commonly associated injuries were to the skeleton, spleen and liver. Two patients with ureteropelvic junction injuries and two girls with traumatic urethrovaginal fistulas were not diagnosed. The delay in diagnosis contributed to an increase in morbidity. Despite modern radiological imaging, some severe injuries of the urinary tract can still be missed. Heightened awareness and thorough clinical examination are mandatory for early diagnosis of such injuries in children with multiple injuries.

Introduction

Death and disability from injuries are rising worldwide. In some countries, injuries are responsible for over 50 per cent of deaths occurring in children aged 1–12 years (Rouse and Eichelberger, 1992). To anticipate the needs of the injured child, it is important to know the spectrum of injuries that children suffer. Most children with blunt trauma have multisystem injuries. The urinary tract is involved in 8–10 per cent of such patients. The initial management in these patients aims at saving life. It is generally assumed that most injuries of the urinary tract are not life-threatening. Nevertheless, every effort must be made to prevent complications and preserve functioning renal parenchyma. If the injury is missed or diagnosed late, there is often an increase in morbidity from urinary extravasation, abscess formation and septic complications.

This paper is the result of a retrospective study carried out in Riyadh to determine the pattern of urinary injuries in children with multiple injuries. Emphasis is laid on those subtle but severe injuries which were missed in the early post-trauma period.

Patients and methods

Riyadh city and its environs constitute a sprawling metropolis of over 1 000 000 people with excellent roads and a high density of automobiles. Riyadh Central Hospital is the main receiving centre for trauma in this area. In the 3-year period 1990 to 1992, 15 children were admitted to the urology department of this hospital for blunt injuries to the urinary tract; they form the subjects of this study. The hospital possesses facilities for intravenous urography (IVU), ultrasonography (US), CT scan and angiography. The injured child was resuscitated in the emergency unit and the urology service usually consulted because of haematuria, loin swelling or a retroperitoneal haematoma discovered at laparotomy for other abdominal injuries. The relevant information regarding the further management of these children was culled from the case files. All the radiographs were reviewed and, where necessary, the opinion of the radiologists was sought afresh.

Results

There were 11 boys and 4 girls. Their ages ranged from 2.5 to 12 years (mean 7.3 years), but only two children were over 10 years of age. Road traffic accidents accounted for 11 of the admissions; three children sustained their injuries from falls, while one child presented after a kick from a horse.

The most common presentations were abdominal pain (ten cases), haematuria (eight), shock (five), convulsions (two). Two girls with pelvic fractures also presented with bleeding per vaginam.

The diagnosis and staging of the injuries were done using IVU (ten cases), CT scan of the abdomen (four), ultrasonography (two), and urethrocystography (three). Three children who presented in shock could not be stabilized enough to undergo any radiological investigation and underwent urgent exploratory laparotomy: one had nephrectomy for pedicle injury and the other two had repair of ruptured kidneys.

Associated injuries occurred to the skeleton (six cases), spleen (three), liver, mesentery, chest and head (two each). Pre-existing urological abnormality was found in two children; one had a malrotated kidney and he developed severe haematuria after a kick from a horse, the other child had bilateral hydronephrosis and sustained injuries to both pelvic-ureteric junctions (PUJ).

The two girls who presented with vaginal bleeding later developed labial swelling followed by severe toxaemia from perineal cellulitis. Vaginoscopy revealed traumatic urethrovaginal fistulas. One boy deteriorated rapidly, developing anuria and azotaemia. He later had retrograde ureteropyelography and was found to have sustained bilateral PUJ obstruction from blunt trauma. Another girl developed a huge swelling in the flank which was discovered after

0020–1383/93/090619–03

retrograde ureterogram to be a urinoma arising from avulsion of the PUJ on that side. In all these four children the correct diagnosis had been missed, even after earlier radiological imaging.

Emergency exploration was carried out in eight patients; two had repair of calyces (including one with liver tear), one had nephrectomy for pedicle injury (he also had shock and head injury), no urological intervention was deemed necessary in five cases and these included the four children in whom the diagnoses were missed. In all cases the indication for laparotomy was positive peritoneal lavage.

There was a total of nine pure renal injuries, graded according to Karp et al. (1986) into Type I (two cases), Type II (three cases), Type III (three cases) and Type IV (one case). Pelvi-ureteric junction injuries occurred in two children; two girls had traumatic urethrovaginal fistulas; two other children had ruptured bladder, including one boy who had a ruptured urethra in addition. Hence, 13 of the 15 children had major injuries to the urinary tract.

Discussion

As with most retrospective studies, this series had some faults. For instance, we were unable to get the accurate total of all children with trauma. The records were complete for only those whose injuries were severe enough to necessitate hospital admission. There were no records to determine if urine microscopy was done to ascertain microscopic haematuria. Nevertheless, the study revealed 13 children with severe injuries to the urinary tract within a period of 3 years. This total compares with 26 cases of major renal trauma reported by Baumann et al. (1992) over a 10-year period. High-speed vehicular accidents are not uncommon in the Riyadh metropolis.

Improvements in acute care medicine and better ambulance services mean that many severely traumatized children survive and reach the hospital. Often the injuries involve multiple-organ systems. In this study, 13 of the 15 cases had associated intra-abdominal injuries commonly to the liver and the spleen. In addition, eight of these children had skeletal injuries and two had chest or head injuries. The aim of initial management of such patients is to save life. But every effort must be made to obtain early diagnoses of all injuries. The diagnoses and staging of urotrauma are usually accomplished with the aid of IVUs, CT scans and angiography (McAninch and Carrol, 1982) as was done in this study. Peritoneal lavage was performed whenever intra-abdominal bleeding was suspected, although this procedure is rarely used nowadays in many paediatric trauma centres (Rouse and Eichelberger, 1992). Eight children were subjected to exploratory laparotomy for suspected intra-abdominal visceral injuries. Associated urological injuries requiring intervention were found in only three of them; one type IV renal injury had nephrectomy and two cases of Type II/III renal injuries needed repair of torn calyces. In spite of the radio-imaging and surgery, four cases of severe injuries to the urinary tract were missed. The delay in diagnosis led to an increase in morbidity in every case. There were two children with pelvi-ureteric junction injuries and two girls with traumatic urethrovaginal fistulas.

The ureter and renal pelvis, located in the retroperitoneum and surrounded by fat and muscles, are rarely injured from external trauma. The patients with pelvi-ureteric junction injuries are usually children and have suffered multiple injuries (Reznichek et al., 1973). The two children in this study with this type of injury had associated injuries to the spleen, chest and the skeleton. Emergency IVUs and CT scans performed in such cases often yield limited results. Urinary extravasation of contrast may be delayed owing to hypotension or concomitant renal injury and the injured ureter may not be opacified. In addition, the site of injury may be obscured by large amounts of haematoma or urinary extravasation. A high index of suspicion is necessary to avoid delays in diagnosis which are often followed by increased rates of nephrectomy (Reznichek et al., 1973). Diagnosis is aided by retrograde ureteropyelography, as was the case in this study, or by intraoperative injection of dyes (Presti et al., 1989). Retrograde studies must be done as soon as possible in children with multiple trauma in whom collecting system injury is suspected.

There are very few reports in the literature of urethral injuries in association with pelvic fractures in females (Fallon et al., 1984; Pokorny et al., 1979; Musemeche et al., 1987). Most of the cases reported were in children and also involved the bladder neck and the vagina (Parkhurst et al., 1981; Merchant et al., 1984). Because of the abdominal position of the bladder in childhood, the vesical neck is more exposed and vulnerable to injury than in adults. Pelvic fractures with displacement of the pubic bones directly into the bladder or by traction on the supporting tissues of the bladder neck could result in the disruption of the vesical neck (Montie, 1977). It has been suggested that the vesicovaginal septum in girls may be a point of minimal resistance (Merchant et al., 1984). A sudden increase in intravesical pressure or a severe shearing force may result in traumatic blowout of the septum, with resultant vesicovaginal or urethrovaginal fistulas as described in two girls in this study. In reporting urethral injuries in 4.6 per cent of 130 adult females with pelvic fractures, Perry and Husmann (1992) stressed the importance of thorough clinical examination in all females with pelvic fractures, especially if there is bleeding per vaginam. Two girls in this study presented with pelvic fractures, haematuria and blood at the vaginal introitus. Vaginal examination was perfunctory and the diagnosis of traumatic urethrovaginal fistulas was delayed with resultant septic complications. A careful vaginal examination would have aroused suspicion and careful cystovaginoscopic and/or radiographic evaluation led to early and correct diagnosis.

In summary, improvements in acute care medicine have resulted in increased survival of the severely injured child. A lot of reliance is increasingly laid on modern radiological imaging for evaluation and staging of these injuries. There remain subtle but severe injuries of the urinary tract which are not easily diagnosed by 'staging' radio-imaging in the immediate post-trauma phase. Delays in diagnosis lead to increased morbidity and even mortality. Meticulous and repeated clinical examination of the injured child coupled with a high index of suspicion would enable early diagnosis of these injuries.

References

Baumann L., Greenfield S. P., Aker J. et al. (1992) Nonoperative management of major blunt renal trauma in children: in-hospital morbidity and long-term follow-up. *J. Urol.* **148,** 691.

Fallon B., Wendt J. C. and Hawtrey C. E. (1984) Urological injury and assessment in patients with fractured pelvis. *J. Urol.* **131,** 712.

Karp M. P., Jewett T. C. Jr, Kuhn J. P. et al. (1986) The impact of computed tomography scanning on the child with renal trauma. *J. Pediatr. Surg.* **21**, 617.

McAninch J. W. and Carroll P. R. (1982) Renal trauma: kidney preservation through improved vascular control – a refined approach. *J. Trauma* **22**, 285.

Merchant W. C. III, Gibbons D. and Gonzales E. T. Jr (1984) Trauma to the bladder neck, trigone and vagina in children. *J. Urol.* **131**, 747.

Montie J. (1977) Bladder injuries. *Urol. Clin. North Am.* **4**, 59.

Musemeche C. A., Fischer R. P., Cotler H. B. et al. (1987) Selective management of paediatric pelvic fractures: a conservative approach. *J. Pediatr. Surg.* **22**, 538.

Parkhurst J. D., Coker J. E. and Halverstadt D. B. (1981) Traumatic avulsion of the lower urinary tract in the female child. *J. Urol.* **126**, 265.

Perry M. O. and Husmann D. A. (1991) Urethral injuries in female subjects following pelvic fractures. *J. Urol.* **147**, 139.

Pokorny M., Pontes J. E. and Pierce J. M. Jr (1979) Urological injuries associated with pelvic trauma. *J. Urol.* **121**, 455.

Presti J. C., Carroll P. R. and McAninch J. W. (1989) Ureteral and renal pelvic injuries from external trauma: diagnosis and management. *J. Trauma* **29**, 370.

Reznichek R. C., Brosman S. A. and Rhodes D. B. (1973) Ureteral avulsion from blunt trauma. *J. Urol.* **105**, 812.

Rouse T. M. and Eichelberger M. R. (1992) Trends in paediatric trauma management. *Urol. Clin. North Am.* **72**, 1347.

Paper accepted 21 June 1993.

Requests for reprints should be addressed to: Dr V. C. Onuora, Department of Urology, Central Hospital, PO Box 2897, Riyadh 11196, Kingdom of Saudi Arabia.