

Spinal Injuries and Associated Trauma in Children

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Abstract: Paediatric spinal injuries, although rare, are associated with the highest mortality rate of all orthopaedic injuries in children. A 5 years retrospective study was undertaken of all patients treated for a spinal injury at our institute. A total of 40 patients had a documented diagnosis of spinal injury. The area most commonly injured was the cervical spine (37.5%). The most common mechanism of injury was motor vehicle accident. Over 65% of the children sustained one or more associated injuries. The average Glasgow Coma Score (GCS) was 14 and the mean injury severity score was 18.95. Spinal injuries in children differ from adults due primarily to the biomechanical and anatomical features of the developing musculoskeletal system. When a spinal injury is identified on initial radiographic or clinical evaluation of an injured child, one should have a high index of suspicion that concurrent potentially life threatening injuries may be present.

Key words: Spinal injury, children, Trauma, features, diagnosis

INTRODUCTION

Trauma is the leading cause of death and disability in children (Galano *et al.*, 2005). Spinal column and cord injuries are rare due not only to the plasticity of the paediatric spine, but also due to the difficulty of diagnosis and the usually severe if not fatal, associated injuries. The spine is vulnerable in children due to the unique biomechanical and anatomical features of the developing musculoskeletal system, leading to a different pattern of injury than is seen in adults (Peclet *et al.*, 1990; Vialle and Vialle, 2005; Spivak *et al.*, 1995). Complete examination is essential when evaluating a multiply injured child as spinal injuries are often associated with injury to other body regions and indeed maybe overlooked in the face of more obvious pathology (Hadley *et al.*, 1992; Hamilton and Myles, 1992; Pang, 2001). In this report, we present our experience with paediatric spinal injury over a 5-years period at our institute. The objective of this study was to present a concise review of paediatric spinal injuries and to examine the incidence and pattern of associated injuries.

MATERIALS AND METHODS

All children treated at our institute with a spinal injury during the 5-years period from January 2000 to December 2005 were identified from the Hospital inpatient enquiry (HIPE) system. This search identified 40 consecutive children with a spinal cord or column injury.

The complete medical records of all 40 patients were then obtained and retrospectively reviewed.

RESULTS

Over the study period 40 patients with spinal injury were treated at our institute. The patients ranged in age from 2-15 years (mean age 10 years). Twenty-five of the patients were male (62.5%). The average Glasgow Coma Score (GCS) was 14 (range 3-15). The average Injury Severity Score was 18.95 (range 1-75). The mean hospital stay was 10.9 days (range 3-45). The area most commonly injured was the cervical spine (37.5%, 15/40). The presenting features in this group being neck pain in 9, neurological deficit in 4, fixed abnormal head position in 1 and a GCS under 8 in one. There were 14 thoracic spine injuries, which presented with back pain in 8, ecchymoses and localized tenderness in 3, GCS under 8 in 2 and a neurological deficit in 1. One patient sustained contiguous compression fractures of the lower 2 thoracic vertebrae and the upper 2 lumbar vertebrae and presented with a neurological deficit. A lumbar spine injury was recorded in ten children, 6 presented with back pain, 2 with ecchymoses and localized tenderness, 1 with abdominal pain and 1 with a GCS under 8. Two children died (5%, 2/40), these deaths were both attributed to major head injury following motor vehicle accident (MVA).

The most common mechanism of injury was MVA (40%, 16/40). Nine were vehicle occupants, 5 were pedestrians and 2 were cyclists. The rest of the patients were injured as a result of falls (35%, 14/40) sporting injuries (17.5%, 7/40) and assaults (7.5%, 3/40). MVA's were responsible for the 2 mortalities and all persisting neurological disability, with the exclusion of one patient injured in a fall, within this series.

In a total of 27 (67.5%) cases, the patients suffered one or more concomitant injuries. There were 17 injuries to the face/head, 6 thoracic injuries, 6 abdominal/visceral injuries and 18 additional non vertebral fractures. Two patients were treated with closed reduction for unilateral facet dislocation at C5-C6. Surgery was required in 2 cases, both children having been involved in an MVA. A 10 year old girl with a C4-C5 unilateral facet fracture-dislocation with incomplete neurology underwent open reduction and posterior arthrodesis with wire fixation and a 13 years girl with a burst fracture of L1 was treated with open reduction, decompression and short segment stabilization.

DISCUSSION

Although, paediatric spinal injury is rare, it can result in devastating neurological, psychosocial and economic consequences (Ruge *et al.*, 1998; Anderson and Schutt, 1980; Andrews and Jung, 1979). Understanding the patterns in which traumatic spinal injuries and their associated injuries occur in children is vital to the establishment of effective preventative, diagnostic and therapeutic interventions in order to optimize the outcomes of those injured.

The area most commonly injured was the cervical spine with 15 cases (37.5%). Previous studies have emphasized the predominance of high cervical spine injury in younger children (Osenbach and Menezes, 1985; Fesmire and Luten, 1989). In our study however, of the patients aged 0-9 years at the time of injury only 5 of 14 (35%) sustained a cervical spine injury in spite of the fact that 13 out of the 14 (92%) were injured in high velocity trauma.

Fractures at 2 or more contiguous levels were seen in 11 of the children (27.5%). Contiguous compression fractures are a common feature of paediatric spinal injury. The increased flexibility of a child's spine allows the force of energy to be dissipated more easily over a greater number of segments thus minimizing the incidence of neurological injury. Contiguous fractures however should be looked for in all flexion injuries to the paediatric spine, the degree of Kyphosis and the skeletally maturity of the child being related to the risk of progressive deformity.

Burst fractures comprise only 10% of all thoracolumbar injuries in children, due to the increased spinal flexibility preventing the concentration of compressive forces required. There were three cases in this series, all occurred as a result of motor vehicle accidents (MVA's) and all had at least one major associated injury.

There was one Chance fracture in this series, the injury occurred in a child who was restrained by a lap belt in the rear of a vehicle. The association between these flexion-distraction injuries and the wearing of lap belts has been well documented, the theory being that a child due to smaller physical size will tend to "submarine" beneath the belt so that when an accident occurs the belt acts as a fulcrum about which hyper flexion of the spine takes place. There is a high incidence of associated trauma with this injury type, the child in this series sustained a small bowel perforation and a head injury.

Spinal cord injury without radiological abnormality (SCIWORA) occurs as a consequence of a stretch or distraction injury to the relatively flexible spinal column that exceeds the tensile limits of the spinal cord (Pang and Wilberger, 1982; Glasauer and Cares, 1973). This injury usually occurs following high energy trauma and there is often one or more associated injuries. In the three cases of SCIWORA reported here, all were injured in MVA's and all sustained serious concomitant injuries. Magnetic resonance imaging (MRI) demonstrated complete cord transection at the T1 level in 2 and focal swelling plus cord edema at the C6 level in 1 associated injuries in children may be difficult to diagnose secondary to an inability to communicate due to various factors such as age, non-compliance, or unconsciousness. The increased flexibility of a child's spine requires a higher-energy insult to cause injury compared with the adult trauma patient (Leventhal, 1960). When a child sustains a significant spinal injury, a high energy trauma has occurred. In this series, 67.5% of the children had sustained one or more associated injuries to various body regions. Therefore, when a spinal fracture or neurological deficit in the case of SCIWORA is identified on initial examination/investigation of a child that has been involved in a trauma, one should have a high index of suspicion that associated serious bony or soft tissue injuries may also be present.

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