Injury, Int. J. Care Injured xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Paediatric pelvic fractures: A review of 2 cohorts over 22 years

Neil Chotai, Sulaiman Alazzawi, Syeda Saman Zehra, Matthew Barry*

Department of Orthopaedics, The Royal London Hospital, Whitechapel, London E1 1BB, United Kingdom

ARTICLE INFO

Article history:
Received 31 October 2017
Received in revised form 23 January 2018
Accepted 5 February 2018

Keywords:
Fracture
Pelvis
Paediatric fracture
Trauma
Trauma guidelines

ABSTRACT

Aims: The aim of this retrospective review was to identify all children that presented to our institution with a pelvic or acetabular fracture and to compare these children to a previous cohort of paediatric pelvic fractures that we have reported.
Patients: 53 children under the age of 16 were identified over a ten year period.
Methods: We reviewed our trauma database, hospital records and radiological imaging to determine the age, gender, fracture pattern, associated injuries and management of the pelvic fracture.
Results: There were 32 boys and 21 girls. Mean age of the boys was 8.8 years and the girls 10.7 years. In seven children the pelvic fracture was an isolated injury and in the remaining 46 children, there were 113 additional injuries. 56% of the additional injuries was either a fracture/dislocation (37%) or a head injury (19%). Compared to our first cohort, we had a larger number of children in the second cohort. Age, sex distribution, mechanism of injury was similar in the two groups. In this current cohort, use of CT scan imaging was more frequent, there were more unstable pelvic fracture patterns identified, ISS scores were higher and mortality was lower.
Conclusion: We have seen more children with more severe injuries, higher ISS scores but a lower mortality rate.

Introduction

Paediatric pelvic fractures are uncommon with a reported incidence of between 0.2% and 2% of all paediatric fractures [1,2]. Pelvic fractures in children are usually sustained as the result of high energy trauma and are commonly associated with other injuries [3]. The reported mortality rates following paediatric pelvic fracture vary from 2% to 25% [4,5] with a mean of 6.4% [6]. Death is almost always as the result of associated injuries, particularly head injury.

We have previously reported [4] on our experience of paediatric pelvic fractures admitted to our institution between 1994 and 2003. With the subsequent introduction of trauma networks in England and the development of protocols for the management of pelvic fractures [7] we have investigated a second cohort to determine if these changes have altered the pattern of injuries, epidemiology, imaging and management of paediatric pelvic fractures.

Patients and methods

From our trauma database, we retrospectively identified all children under 16 years of age who presented to our hospital with a pelvic or acetabular fracture between January 2007 and December 2016. We reviewed the database as well as the medical records and radiological imaging to determine the patient demographics, mechanism of injury, the presence of any associated injuries, Injury Severity Score (ISS), management and mortality. Radiological images were reviewed and classified by the modified Torode & Zeig classification [8]. We considered types I, II and III to be stable fractures and type IV to be an unstable pelvic fracture. The modified Torode & Zeig classification does not include isolated acetabular fractures and so we have also used the classification proposed by Silber [9] which is a further modification of Torode & Zeig's classification that includes acetabular fractures.

Results

53 children with pelvic fractures were identified and the demographic details are given in Table 1. In seven children (13%) the pelvic fracture was an isolated injury and in the remaining 46 children, there were 113 additional injuries and the number of additional injuries per child ranged from 1 to 6 (Table 2). Minor abrasions, lacerations and contusions were not

* Corresponding author.
E-mail address: matthew.barry@uhs.nhs.uk (M. Barry).

https://doi.org/10.1016/j.injury.2018.02.005
0020-1383/

Table 1
Demographics of 53 paediatric pelvic fractures.

	Boys	Girls
Sex	32 (60%)	21 (40%)
Age*	8.8 (2–15)	10.7 (1–15)
Mechanism of injury:		
Motor vehicle accident (MVA)	27 (84%)	18 (86%)
Fall	3 (9%)	3 (14%)
Gunshot	1 (3%)	0
Assault	1 (3%)	0
ISS on admission *	25.3 (4–57)	25.7 (4–75)
Deaths	1	2

*mean (range).

Table 2
Number of additional injuries.

Number of injuries	Number (%)
Isolated pelvic fracture	7 (13)
1	16 (30)
2	12 (23)
3	7 (13)
4	5 (9)
5	4 (8)
6	2 (4)

included as these were not consistently documented in the hospital record. The nature of the additional injuries and number identified are listed in Table 3. 21 children did not sustain any limb fractures and 32 children sustained 42 limb fractures/dislocations. 22 children sustained one fracture/dislocation and 10 children sustained two fracture/dislocations. The associated fractures/dislocations are listed in Table 4. One child was admitted with an almost complete traumatic hemi-pelvectomy with significant bowel, bladder and neurovascular disruption within the hemi-pelvis and extensive injuries to the ipsilateral leg. The leg was judged to be non-viable and he underwent an immediate hind-quarter amputation through the sacro-iliac joint and symphysis on the affected side.

Pelvic fractures

50 (94%) children had a Computed Tomography (CT) scan of the pelvis. Three (6%) children only had a pelvic radiograph, 42 (79%) children had both a pelvic radiograph and CT scan and eight (15%) children had a pelvic CT scan alone. After review of the radiological images, 37 (70%) pelvic fractures were considered to be stable and 16 (30%) fractures were unstable. The modified Torode and Zeig types identified in our patients is given in Table 6 and the Silber classification is given in Table 7. We classified the fractures based on the CT scan findings except in the three children who did not have a CT scan.

Table 3
Additional injuries identified (n = 113).

Injury	Number (%)
Limb fracture(s) or dislocation	42 (37.2)
Head	22 (19.5)
Chest	15 (13.3)
Abdomen	12 (10.6)
Maxillofacial	9 (8.0)
Spine	6 (5.3)
Urethra	3 (2.7)
Degloving	3 (2.7)
Rectal laceration	1 (0.9)

Table 4
Associated limb fractures or dislocations.

Fracture/Dislocation	Number (%)
Femur	11 (26.2)
Tibia	7 (16.7)
Ankle	6 (14.3)
Clavicle	5 (11.9)
Forearm	4 (9.5)
Humerus	3 (7.1)
Calcaneum	2 (4.8)
Hip dislocation	2 (4.8)
Elbow dislocation	1 (2.4)
Finger	1 (2.4)

Of the 42 children that had both a pelvic radiograph and CT scan, after review of both imaging modalities, in 28 (67%) cases there was agreement in the radiological classification of the injury. In six (14%) cases additional fractures were identified on CT scan that upgraded the classification and in eight (19%) cases, plain radiographs did not identify any fractures.

Of the 50 children who had a CT scan, in 39 cases (78%) contrast was injected to confirm that there was no significant arterial bleed that might require embolization.

Deaths

Three children died from their injuries giving an overall mortality rate of 5.7%. There was one boy and two girls. The mean ISS score of the three children that died was 56.6 (range 38–75) as compared to the mean ISS score in the 50 survivors of 23.6 (range 4–57). All three deaths were as a result of their associated head injuries. Two deaths occurred within the emergency department and the other death was less than 24 h after admission. The pelvic fracture pattern was unstable in two of the deaths and stable in the third death.

Management of injuries

Pelvic fracture (n = 53)

50 fractures were managed non-operatively. Stable pelvic fractures were allowed to weight bear as comfort allowed and as dictated by any associated injuries. Unstable fractures were mobilised touch weight bearing for 6 weeks on the unstable side. In two children, the fracture was stabilised with percutaneous sacro-iliac screws and in one child, the unstable pelvic fracture was managed with the hip spica cast applied for an ipsilateral femoral fracture. The one case of traumatic hemipelvectomy, the contra-lateral hemipelvis was intact. Use of an external fixator to stabilise the pelvic fracture was not required in any cases. No pelvic fracture required intra-pelvic packing apart from the 1 case of traumatic hemipelvectomy that did require an initial packing to contain the bladder and bowel within the pelvis.

Limb fractures/dislocations (n = 42)

Joint dislocations were managed by closed reduction, displaced limb fractures were managed with a closed reduction and cast application or elastic stable intramedullary nails (ESIN). The femoral fractures were managed with either hip spica cast for younger children or internal fixation, usually with ESIN.

Head injuries (n = 22)

Three children died of their head injuries and of the remining 19, one child underwent craniectomy and evacuation of an extradural haematoma and two children had intra-cranial pressure monitoring bolts inserted. In the remaining 16 children, the head injuries were managed non-operatively.

Please cite this article in press as: N. Chotai, et al., Paediatric pelvic fractures: A review of 2 cohorts over 22 years, Injury (2018), https://doi.org/10.1016/j.injury.2018.02.005