Child Abuse & Neglect 37 (2013) 430–445

Contents lists available at SciVerse ScienceDirect

Child Abuse & Neglect

A systematic review of abusive visceral injuries in childhood—Their range and recognition☆

S.A. Maguire[a,*], M. Upadhyaya[b], A. Evans[c], M.K. Mann[d], M.M. Haroon[e], V. Tempest[a], R.C. Lumb[a], A.M. Kemp[a]

[a] Child Health Department, School of Medicine, Cardiff University, University Hospital of Wales, Heath Park, Cardiff CF14 4XN, UK
[b] Department of Paediatric Surgery, Bristol Children's Hospital, Bristol BS2 8BJ, UK
[c] Radiology Department, University Hospital of Wales, Heath Park, Cardiff CF14 4XN, UK
[d] Support Unit for Research Evidence, Cardiff University, University Hospital of Wales, Heath Park, Cardiff CF14 4XN, UK
[e] Leicestershire Partnership, Families, Young People and Children's Services, Bridgepark Plaza, Bridgepark Road, Thurmaston, Leicester LE4 8PQ, UK

ARTICLE INFO

Article history:
Received 5 February 2012
Received in revised form 28 October 2012
Accepted 31 October 2012
Available online 7 January 2013

Keywords:
Visceral injury
Systematic review
Abdominal injury
Duodenal trauma
Screening tests

ABSTRACT

Objectives: To define what abusive visceral injuries occur, including their clinical features and the value of screening tests for abdominal injury among abused children.
Methods: We searched 12 databases, with snowballing techniques, for the period 1950–2011, with all identified studies undergoing two independent reviews by trained reviewers, drawn from pediatrics, radiology, pediatric surgery and pathology. Of 5802 studies identified, 188 were reviewed. We included studies of children aged 0–18, with confirmed abusive etiology, whose injury was defined by computed tomography, contrast studies or at surgery/post mortem. We excluded injuries due to sexual abuse, or those exclusively addressing management or outcome.
Results: Of 88 included studies (64 addressing abdominal injuries), only five were comparative. Every organ in the body has been injured, intra-thoracic injuries were commoner in those aged less than five years. Children with abusive abdominal injuries were younger (2.5–3.7 years vs. 7.6–10.3 years) than accidentally injured children. Duodenal injuries were commonly recorded in abused children, particularly involving the third or fourth part, and were not reported in accidentally injured children less than four years old. Liver and pancreatic injuries were frequently recorded, with potential pancreatic pseudocyst formation. Abdominal bruising was absent in up to 80% of those with abdominal injuries, and co-existent injuries included fractures, burns and head injury. Post mortem studies revealed that a number of the children had sustained previous, unrecognized, abdominal injuries. The mortality from abusive abdominal injuries was significantly higher than accidental injuries (53% vs. 21%). Only three studies addressed screening for abdominal injury among abused children, and were unsuitable for meta-analysis due to lack of standardized investigations, in particular those with 'negative' screening tests were not consistently investigated.
Conclusions: Visceral injuries may affect any organ of the body, predominantly abdominal viscera. A non-motor vehicle related duodenal trauma in a child aged < five years warrants consideration of abuse as an etiology. In the absence of clear evidence for a screening

☆ This work was funded by the National Society for the Prevention of Cruelty to Children (NSPCC) UK, and we are grateful to all of our reviewers for their contribution to this work: Sara Harrison, Richard Jones, Katina Kontos, Narad Mathura, Sue Morris, Alison Mott, Aideen Naughton, Ingrid Prosser, Sankarasubramanian Rajaram, Alicia Rawlinson, Marion Schmidt, Jonathan Sibert and to Laura Wain for editorial assistance.

* Corresponding author.

http://dx.doi.org/10.1016/j.chiabu.2012.10.009

strategy, clinical vigilance is warranted in any young child with suspected abuse for the presence of abdominal injury, where the absence of abdominal bruising or specific symptoms does not preclude significant injury.

Introduction

Trauma is the leading cause of death in children aged over one in most developed nations, and causes significant morbidity, in addition to the financial burden on the health services (Gaines & Ford, 2002). Blunt trauma is more common than penetrating injuries in childhood, accounting for 90% of admissions in trauma series (Gaines & Ford, 2002; Touloukian, 1968). There are several unique anatomical reasons that make the intra abdominal organs in children more susceptible to blunt trauma. Children have a less muscular and a thinner abdominal wall; the diaphragm is more horizontal thus the liver and spleen are more anterior and less protected by ribs, which are themselves elastic and very compressible, potentially crushing solid organs below (Gaines & Ford, 2002).

Motor vehicle collisions (MVC) are the commonest cause of abdominal trauma followed by those sustained at play or at home (Holmes, Sokolove, Land, & Kuppermann, 1999). While abusive head trauma (AHT) is the commonest cause of death among abused children (Roaten et al., 2006; Sibert et al., 2002), it is estimated that abdominal trauma contributes to up to 50% of abusive fatalities (Ledbetter, Hatch, Feldman, Fligner, & Tapper, 1988). The true prevalence of abusive abdominal injuries is difficult to determine. While it is reported as occurring in 0.5–4% (Cooper et al., 1988; Holmes et al., 1999, 2002) of child abuse admissions, unless clinicians specifically consider abuse as a possible cause of trauma in children presenting to the ED, it is unlikely to be recognized (Louwers et al., 2011), with potentially devastating consequences (Byard & Heath, 2010). Likewise, significant visceral injury may present with little or no specific signs, where as few as 12% may have abdominal bruising (Ledbetter et al., 1988). As some children may present with non-specific symptoms, e.g. vomiting, irritability, it would be of value to define which clinical and hematological features could help to identify those children that require further radiological imaging such as contrast Computerized Tomography (CT) (Hilmes et al., 2011; Lindberg et al., 2009). The systematic review aims to define the spectrum of abusive visceral injuries, and define the value of screening tests.

Methods

An all-language literature search across 12 bibliographic databases (Appendix 1) was conducted to identify original articles published from 1950 to May 2011. The initial search strategy (Appendix 2) was developed across OVID Medline databases using keywords and Medical Subject Headings (MeSH headings) and was modified appropriately to search the remaining bibliographic databases.

Supplementary material related to this article found, in the online version, at http://dx.doi.org/10.1016/j.chiabu.2012.10.009.

The search sensitivity was augmented by the use of a range of supplementary 'snowballing' techniques including consultation with subject experts and relevant organizations, and hand searching selected websites, non-indexed journals and the references of all full-text articles (Appendix 1). Identified articles, once scanned for duplicates and relevancy, were transferred to a purpose-built Microsoft Access database to coordinate the review and collate critical appraisal data. Where applicable, authors were contacted for primary data and additional information. Relevant studies with an English language version available were scanned for eligibility by the lead researcher; those that met our inclusion criteria (Table 1) were reviewed (Fig. 1).

A panel of pediatricians, radiologists, an information specialist, a forensic pathologist and a pediatric surgeon conducted two independent reviews of all relevant articles, using standardized critical appraisal forms (Appendix 3) based on criteria defined by the National Health Service's Centre for Reviews and Dissemination (Centre for Reviews and Dissemination, 2009). We also used a selection of systematic review advisory articles to develop our critical appraisal forms (Critical Appraisal Skills Programme (CASP); Polgar & Thomas, 1995; Rychetnik & Frommer, 2002; Weaver et al., 2002; Weightman, Mann, Sander, & Turley, 2004). All reviewers underwent critical appraisal training purposefully designed for this review. A third review was undertaken to resolve disagreement between the initial reviewers when determining either the evidence type of the article or whether the study met the inclusion criteria (Table 1).

Supplementary material related to this article found, in the online version, at http://dx.doi.org/10.1016/j.chiabu.2012.10.009.

Quality standards

Regarding evidence type, the optimal study design to address our primary question (what visceral injuries occur as a consequence of physical abuse, and what are their distinguishing characteristics) would be high quality comparative studies (case control/cross sectional) of abusive injury vs. accidental injury (AI). Given the difficulties of researching in this field, we accepted high quality case series/studies, where abuse had been confirmed. We wished to minimize 'circularity' in relation to confirmation of abuse, i.e. to ensure that those cases classified as 'abused' in our review did not have that diagnosis based