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A comparison of two mechanisms of severe paediatric injury in Northern Israel

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ABSTRACT

Background: An increased incidence of severe injury due to falls from buildings (FFB) is reported in the rural area of northern Israel. This makes FFB, and motor vehicle collision (MVC) the two leading causes of severe paediatric trauma.
Methods: A single-centre, age–sex matched comparison analysis of the two mechanisms of injury was conducted. Children involved in MVC (study subjects) or FFB (controls), who were brought by the Emergency Medical System Mobile-Intensive-Care-Unit from the field to the trauma bay of the Emergency Department (ED) were enrolled on the basis of a convenience sample. Immediately following ED admission, heart rate (HR), systolic blood pressure (SBP), and base deficit (BD) were recorded. Types of injuries, Glasgow Coma Score (GCS) on scene, and Injury Severity Score (ISS) were also obtained.
Results: Eleven study subjects and 22 controls were enrolled during a 1-year period. The mean ISS for the study subjects group and for the controls was 23.4 and 19.5, respectively. No difference was found in comparing the ISS, BD, SBP and HR of the two groups ($p = 0.261$, $p = 0.421$, $p = 0.314$, and $p = 0.824$, respectively). Controls had a lower GCS ($p < 0.031$) and were more likely to have a skull fracture ($p < 0.0082$). Study subjects were more likely to have limb injuries ($p < 0.0001$) and thoracoabdominal injuries ($p < 0.0059$).
Conclusions: This study suggests that the Injury Severity Score of the two mechanisms of paediatric injury is high. The haemodynamic characteristics on ED admission were comparable between the two groups of patients but the likelihood of specific type of injury was different.

Introduction

Background

Trauma accounts for a significant number of emergency visits in children and is the leading cause of mortality and severe morbidity in children older than 1 year.[12,23] Various mechanisms of injury are the cause of these trauma cases: motor vehicle collisions (MVC), pedestrian and bicycle injuries, falls, non-accidental trauma (child abuse), penetrating injuries (gunshot and stab wounds), and burns. Injuries to motor-vehicle occupants and pedestrians account for the greatest number of deaths.[17] Initial haemodynamic parameters, such as vital signs and base deficit (BD), and calculated trauma scores, such as the Glasgow Coma Score (GCS) and the Injury Severity Score, are independent predictors of outcome in children with severe trauma.[10,4,8] Methods used for evaluating the relationship between the mechanism of injury and outcome have been derived from adult reports and attempts to apply them to children have been inaccurate.[14]

At the Rambam Health Care Campus (RHCC), the only level I trauma centre in the north of the country, the most common causes of severe paediatric trauma are fall from a building (FFB), and MVC.[21,7,2] An increased incidence of severe paediatric trauma due to a FFB is reported in the rural region of northern Israel because of falls from buildings and private houses (windows, roofs, balconies and staircases). Various strategies of injury prevention have been implemented in the recent past by both health and educational authorities but, unfortunately, these strategies have had minimal success to date.[21,7,2,24]

Study rationale

Prospective analysis of the injuries sustained and patient haemodynamic characteristics on admission to the Emergency Department (ED) may provide a better understanding of the

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mechanism of the severe injury, and may help the trauma care provider in Israel (paediatric emergency physicians, paediatric surgeons, and paediatric intensive care physicians) to develop a high index of suspicion for haemodynamic instability and for certain injuries that may be associated with these mechanisms of injury. This study examines the association between the mechanism of injury (MVC or FFB), injury characteristics, and patient haemodynamic characteristics on admission to the ED.

Materials and methods

Setting

The study was conducted between September 1, 2006, and August 31, 2007, in the ED of RHCC, a university-affiliated level I trauma facility in Haifa, Israel.

Design and patient selection

Patients who were brought by an Emergency Medical Services (EMS) mobile intensive care unit from the field to the trauma bay of the ED were enrolled on the basis of a convenience sample (presence of IS or AK). We enrolled children aged 2–8 years who were involved in a motor vehicle collision as passengers (MVC, study subjects) and patients who fell from windows, roofs, balconies or staircases (FFB, control subjects). Patients who were involved in a MVC as pedestrians or patients with other mechanisms of traumatic injuries were excluded, and patients who were transferred from other hospitals were not included in the study. Patients who had a fall from a height due to other causes were also excluded.

Control subjects were age–sex matched to the study subjects, first by closest date of birth, then by gender. Two controls were chosen to match each study subject (Fig. 1). The study was approved by the institutional human ethics board, and the parents of eligible patients provided informed consent.

Study protocol

The trauma response team was activated as soon as the ED desk received a call from the EMS declaring that a paediatric trauma patient was en route to the hospital. Criteria for trauma team activation included hypoxia, hypotension, tachycardia, and unresponsiveness. The study investigators (IS or AK) were notified by the triage nurse about children potentially eligible to be enrolled into the study. The trauma team nurse measured the heart rate (HR) and the systolic blood pressure (SBP) within 5 min of the patient's arrival. Measurements were made using a Welch Allyn *Propaq CS monitor*. The study investigators began to record data immediately. Several records were used to complete the data collection, including the ED nursing documentation sheet and the EMS record.

As soon as the patient's condition was stable, as determined by the trauma team leader, the patient's caregivers received an explanation about the condition of the patient from one of the trauma team physicians. Immediately following this reassurance, caregivers were approached by the study investigator who verified inclusion criteria, explained the purpose and design of the study, and obtained informed consent. If the caregivers of the child refused consent, the patient was dropped from the study and the patient's study records were eliminated.

Each patient was assessed and treated according to the usual trauma team protocol as judged by the trauma team leader. Study investigators maintained no contact with the trauma team leader and had no influence on trauma team decision-making.

Data collection

The study investigator collected the following patient data on a standardised data form at the time of ED presentation: demographics (age, gender, mechanism of injury); haemodynamic characteristics (HR, SBP, BD), and GCS on scene as reported by the paramedics of the mobile intensive care unit. Twenty-four hours post-admission, the study investigators recorded the injuries identified in each patient and calculated the ISS: skull fractures, intracranial injuries, limb injuries, and thoracoabdominal injuries.

Statistical analysis

Nonparametric tests were used to analyse the data. Categorical variables were compared using Fischer's exact test and continuous variables were compared using Wilcoxon matched-pairs signed-ranks test. All statistics were calculated using the SPSS-13 software and SAS 9.2.

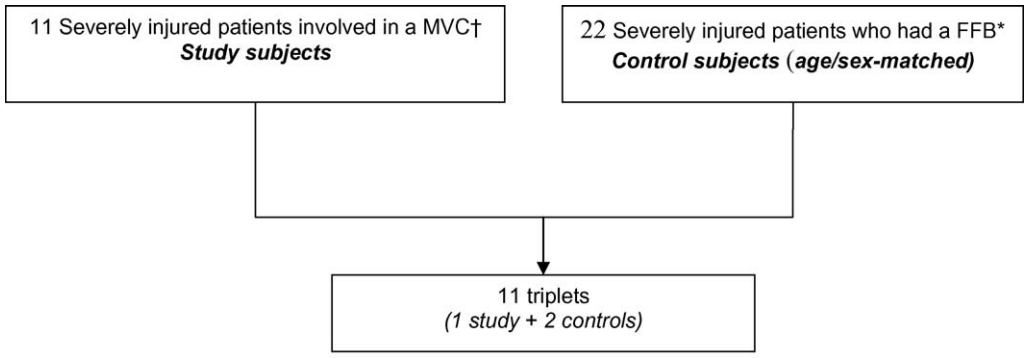

Fig. 1. Study design.