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# What injuries should we expect in the emergency room?

M. Voth*, T. Lustenberger, B. Auner, J. Frank, I. Marzi

*Department of Trauma, Hand and Reconstructive Surgery, University Hospital, Goethe University Frankfurt, Frankfurt am Main, Germany*

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ABSTRACT

*Introduction:* Beside serious and potentially fatal injuries, the majority of pediatric trauma patients present with minor injuries to emergency departments. The aim of this study was to evaluate age-related injury pattern, trauma mechanism as well as the need for surgery in pediatric patients.
*Patients and methods:* Retrospective Study from 01/2008 to 12/2012 at a level I trauma center. All patients <18 years of age following trauma were included. Injury mechanism, injury pattern as well as need for surgery were analyzed according to different age groups (0–3 years, 4–7 years, 8–12 years and 13–17 years). Major injuries were defined as fractures, dislocations and visceral organ injuries. Minor injuries included contusions and superficial wounds.
*Results:* Overall, 15300 patients were included (59% male, median age 8 years). A total of 303 patients (2%) were admitted to the resuscitation room and of these, 69 (0.5% of all patients) were multiply injured (median Injury Severity Score (ISS) 20 pts). Major injuries were found in 3953 patients (26%). Minor injuries were documented in 11347 patients (74%). Of those patients with a major injury, 76% (2991 patients) suffered a fracture, 3% (132 patients) a dislocation and 3% (131 patients) an injury of nerves, tendons or ligaments. The majority of fractures were located in the upper extremity (73%) (elbow fractures 16%; radius fractures 16%; finger fractures 14%). Patients with minor injuries presented with head injuries (34%), finger injuries (10%) and injuries of the upper ankle (9%). The most common trauma mechanisms included impact (41%), followed by falls from standing height (24%), sport injuries (15%) and traffic accidents (9%). Overall, 1558 patients (10%) were operated. Of these, 61% had a major and 39% a minor injury.
*Conclusion:* Almost 75% of all children, who presented to the emergency department following trauma revealed minor injuries. However, 25% suffered a relevant, major injury and 0.5% suffered a multiple trauma with a median ISS of 20. Overall, 10% had to be operated. The most frequently found major injuries were extremity fractures, with elbow fractures as the most common fracture.


## Introduction

Starting from the age of one, injuries are the main cause of death in children and teenager in Germany [1]. In the year 2014, 3681 children under the age of 17 years died. Of these, 476 (equaling 13%) deaths were caused by trauma (accident, suicide, violence etc.) [2]. The five main causes of death in children (1–14 years of age) are drowning, fall from great height, burn, road traffic accidents and violence. These reasons are responsible for nearly 66% of all fatal injuries in children [3].

Multiple trauma in children is rare and accounts for only 5% of all severely injured patients [4]. However, beside these serious and potentially fatal injuries, many minor injuries are seen and treated in emergency departments. While most of the published literature in pediatric trauma focuses on those multiply injured children [4,5], only few studies have addressed minor injuries in children [6–9]. Data documenting injury mechanisms and patterns are scarce in this patient segment.

Therefore, the aim of the present study was to evaluate age-related injury patterns and trauma mechanisms as well as the need for surgery in pediatric patients presenting to a level I trauma center.

* Corresponding author at: Department of Trauma, Hand and Reconstructive Surgery, University Hospital, Goethe University, Theodor-Stern-Kai 7, D-60590 Frankfurt/Main, Germany.
*E-mail addresses:* maika.voth@kgu.de (M. Voth), Thomas.Lustenberger@kgu.de (T. Lustenberger), birgit.auner@kgu.de (B. Auner), Johannes.frank@kgu.de (J. Frank), marzi@trauma.uni-frankfurt.de (I. Marzi).

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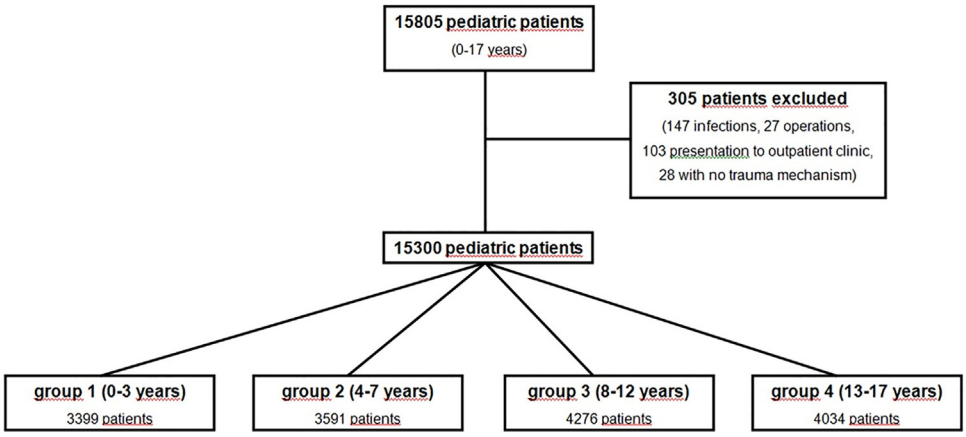


**Fig. 1.** Patient flow-chart of including process.

Values are reported as numbers.

## Patients and methods

### *Study design*

This study was retrospectively performed at the Hospital of the J. W. Goethe University, Department of Trauma, Hand and Reconstructive Surgery, with institutional ethics committee approval (130/15, in accordance with the Declaration of Helsinki and reported following the Strengthening the Reporting of OBservational studies in Epidemiology, STROBE guidelines) [10].

### *Patients*

Fig. 1 shows the patient flow-chart for including process.

All patients in the age of 0–17 years presenting to our emergency department (ED) following trauma from 01/2008 to 12/2014 were enrolled.

Exclusion parameters consisted of an age ≥18 years, no acute trauma mechanism, presentation to our outpatient clinic and conditions other than operations and infections.

Trauma mechanisms were defined as following: “fall” (from standing height), fall from great height (≥1,5 m) (“fall great height”), traffic crashes (“traffic”), injuries caused by sport activities (“sports”), injuries caused on playground (“playground”), injuries following assaults (“violence”), injuries caused by contusions, distorsions or impacts by striking against or being struck unintentionally by objects or persons (“impact”) and injuries caused by pathologic causes (“pathologic”).

An amputation, a fracture, a dislocation, a visceral organ injury as well as significant head injuries (skull fractures, intracerebral, epidural or subdural hematomas) were considered as a major injury. Minor injuries were defined as a contusion, distorsion, burns or simple wounds.

Concussions and head contusions as well as skin/scalp lacerations and little wounds were considered as minor head injuries.

Multiply injured patients were defined as an Injury Severity Score (ISS) ≥ 16 pts [11].

For the purpose of the analysis, the patients were divided into four age groups: group 1 (0–3 years, “toddler”), group 2 (4–7 years, “pre-school”), group 3 (8–12 years, “school-age”) and group 4 (13–17 years, “teenager”).

### *Data collection and analysis*

The patient’s characteristics and injury mechanism, injury pattern, admission to the resuscitation room (RR, “shock room”), for the hemodynamic stabilization and diagnosing of the patient, as well as the need for surgery were obtained from the patient’s electronic files. A computerized spreadsheet (Microsoft Excel 2010; Microsoft Corporation, Redmond, WA) was created to abstract the variables. The median and interquartile range were performed using GraphPad Prism 3.02 (GraphPad Software Inc. San Diego, CA).

## Results

### *Demographic results and injury patterns*

The demographic results, injury characteristics and need for surgery overall and stratified by the different age groups are presented in Table 1. Overall, 15.300 patients were included. There was a gender distribution of 59% male to 41% female with a similar distribution in all four patient groups. The median age was 8 years (IQR: 3.9–12.7 years).

**Table 1**
Demographics, injury characteristics and need for surgery in pediatric trauma patients stratified by age groups.

| | all patients (n = 15300) | group 1 (n = 3399) | group 2 (n = 3591) | group 3 (n = 4276) | group 4 (n = 4034) |
|---|---|---|---|---|---|
| Age, years (Median, IQR) | 8.3 (3.9–12.7) | 2 (1–3) | 5 (4–6) | 10 (9–11) | 15 (14–16) |
| Sex (male, n, %) | 8970 (59%) | 1921 (57%) | 2124 (59%) | 2493 (58%) | 2421 (60%) |
| Admission to RR (n, %) | 303 (2%) | 59 (2%) | 64 (2%) | 87 (2%) | 93 (2%) |
| ISS ≥ 16 (n, %) | 69 (0.5%) | 2 (0.1%) | 10 (0.3%) | 22 (0.5%) | 35 (0.9%) |
| Major injuries (n, %) | 3953 (26%) | 893 (26%) | 923 (36%) | 1130 (26%) | 1007 (25%) |
| Minor injuries (n, %) | 11347 (74%) | 2506 (74%) | 2668 (74%) | 3146 (74%) | 3027 (75%) |
| Surgery in the OR (n, %) | 1028 (7%) | 115 (3%) | 254 (7%) | 297 (7%) | 362 (9%) |
| Surgical intervention in the ED (n, %) | 530 (3%) | 44 (1%) | 90 (3%) | 98 (2%) | 298 (7%) |

Age is reported as median (interquartile range, IQR). All other values are reported as numbers and percentages.
Abbreviations: ED, Emergency Department; IQR, Interquartile Range; OR, Operating Room; RR, Resuscitation Room.