The Peculiarity of Presenting Signs and Symptoms among Paediatric Patients Aged Less than 16 Years in a Mixed University Emergency Department

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Abstract

Background: Most paediatric emergency departments (PED) in Switzerland are now interdisciplinary. Prior to that, a considerable number of children randomly presented to both the tertiary mixed adult and formerly separated medical and surgical paediatric EDs at Inselspital Bern.

Aim of the study: To review the specific presenting signs and symptoms, outcome and reason for presentation to the adult ED among paediatric patients prior to the opening of the interdisciplinary PED in January 2013.

Methods: A standardised activity-based hospital database system was used to identify all children aged less than 16 years presenting to the tertiary adult ED over a 10-year period (2001-2011). Patient demographics, reason for presentation, investigations performed, treatment administered and outcome were recorded and analysed retrospectively.

Results: Data of 554 eligible patients were analysed. Otorhinolaryngeal (ORL) symptoms (73.5%, n=407) predominated by far, followed by surgical issues (10.7%, n=59). Computed tomography (CT), conventional X-rays, low dose X-ray (LODOX®) scanner and magnetic resonance imaging (MRI) were required in 7.8%, 6.9%, 0.4% and 0.5% of all cases, respectively. Logistical reasons, the need for subspecialty referral and random parental choice were the main reasons to present to the adult ED.

Conclusion: Our findings highlight the high frequency of ORL illness and the requirement for imaging in at least 8% of the paediatric population presenting to the adult ED, strongly encouraging the addition of CT/MRI to larger PEDs. Paediatric Emergency Medicine (PEM) trained medical and nursing staff should be upsized, thus constituting an ideal environment to manage seriously ill and injured children.

Keywords: Paediatric patients; Mixed emergency department; Presenting complaints; Outcome; Switzerland

Abbreviations

CRP: C-reactive protein; CT: Computed Tomography; ED: Emergency Department, ENT: Ear, nose and throat; FMH- Foederatio Medicorum Helveticorum; HEMS: Helicopter Emergency Transport Services; LODOX: Low dose X-ray scanner; MRI: Magnetic Resonance Imaging; NZKJ: Notfallzentrum für Kinder und Jugendliche (emergency department for children and adolescents); ORL: Otorhinolaryngeal (ear, nose and throat); PED: Paediatric Emergency Department; PEM: Paediatric Emergency Medicine; UNZ: Universitäres Notfallzentrum (university emergency department)

Background

The numbers of paediatric presentations to the ED are steadily rising [1,2]. In comparison to other countries, there is paucity of Swiss data in the published literature on the distribution of presenting medical and surgical complaints in children who visit a paediatric, adult or mixed ED [1-5]. Authors from an English institution have found that breathing difficulty (20.1%), febrile illness (14.1%) and diarrhoea with or without vomiting (14.0%), rash (8.6%) and cough (6.7%) make up most of the medical problems among children aged 1 to 16 years presenting to the PED [1]. In contrast, the same institution reported that in adolescent patients, injury was the most frequently encountered presenting problem (71.8%). Of the remainder, the commonest presenting problems featured abdominal pain (16.3%), self-harm (10.6%), fits, faints and funny turns (10.4%), breathing difficulty (7.2%), and intoxication (6.0%) [2]. Other authors have reviewed subgroups of patients limited to medical [1] or surgical problems or issues related to one subspecialty only [6-10]. In
Switzerland, PEM has only been officially recognised as a subspeciality by the Foederatio Medicorum Helvetiorum (FMH, Swiss Medical Association) since January 2014. Conferral of the Swiss specialist title (FMH) has been conducted by the Swiss Medical Association since January 2014. Exclusion criteria were incomplete data collection and age ≥16 years. Age, gender, reason for referral, type of imaging study and laboratory diagnostic testing performed, treatment administered, if applicable as well as outcome were examined. Ethical approval of the study was obtained from the cantonal ethics committee Bern "Kantonale Ethikkommission für die Forschung - KEK Bern". Patient records were anonymized and de-identified prior to analysis.

**Methods**

In this retrospective case series with chart review, epidemiological data were collected on all paediatric patients aged less than 16 years of age, admitted to the tertiary mixed ED at Inselspital Bern (UNZ) from 2001-2011. Exclusion criteria were incomplete data collection and age ≥16 years. Age, gender, reason for referral, type of imaging study and laboratory diagnostic testing performed, treatment administered, if applicable as well as outcome were examined. Ethical approval of the study was obtained from the cantonal ethics committee Bern "Kantonale Ethikkommission für die Forschung - KEK Bern". Patient records were anonymized and de-identified prior to analysis.

**Statistical analysis**

Data were collected from Qualicare (Qualidoc AG, Trimbach, Switzerland) and E.care database (E.care bvba, Turnhout, Belgium) and analysed using SPSS version 17. Results for categorical variables are presented as absolute and relative frequencies (n = number and %). Summary statistics for quantitative variables (e.g. age) are presented as median values and their interquartile range. The Kolmogorov-Smirnov test (K-S) for normality was employed for age and the non-parametric Mann-Whitney (M-W) test was used to identify any statistical differences between age and gender. A 5% significance threshold was applied.

**Results**

Between 2001 and 2011, a total of 554 eligible paediatric presentations to the mixed ED at Inselspital Bern, Switzerland, were numbered. Among all presentations, 52.5% (n=291) were single presentations, 37.4% (n=207) 2-fold presentations, 7.4% (n=41) 3-fold presentations, 2% (n=11) 4-fold presentations and 0.7% (n=4) 5-fold presentations. Patients presented for scheduled follow-up visits in 25 cases (4.5%).

**Age and gender**

Age was distributed unequally with a predominance of patients of adolescent age (K-S, p < 0.001). The cohort consisted of 336 males (60.6%), with a median age of 12 years (interquartile range, 1-15) and 218 females (39.4%), with a median age of 12 years (interquartile range, 2-15) without a statistically significant difference between average age and gender. Median age for both males and females combined was 12 years (interquartile range, 1-15). The male/female ratio was 1.54.

**Presenting signs and symptoms**

The frequency of all presenting signs and symptoms among the paediatric cohort are detailed in Figure 1. The vast majority of children presented with ORL complaints (73.3%, n=407). In specific detail, ear, nose and throat (ENT) infection (18.2%, n=101), foreign body aspiration or ingestion (11.6%, n=64) and traumatic injury (6.7%, n=37) predominated. The entirety of the ORL diagnoses is listed in Table 1. Next most common were surgical issues (10.7%, n=59), followed by orthopaedic (4.3%, n=24), neurosurgical (4.7%, n=26) complaints and polytrauma (2.5%, n=14) (Figure 1). The individual diagnoses in this area are depicted in Figures 2A-2D. Internal medical (1.3%, n=7), psychosocial (1.1%, n=6), neurologic (0.7%, n=4), ophthalmological (0.5%, n=3), dental (0.4%, n=2) and urological

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**Aim of the Study**

We sought to describe the most common presenting signs and symptoms among all paediatric patients presenting to the mixed adult and paediatric ED in a tertiary hospital in Switzerland. We aimed to utilise the results as a prerequisite for a better understanding and formulation of required resources in a tertiary paediatric or trauma and resuscitation centre, in order to ensure optimal care and outcome of ill and injured children.

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(0.4%, n=2) problems were much rarer in the children (Figure 1.) The individual diagnoses in the other areas are listed in Table 2.

![Figure 1: Frequency of presenting signs and symptoms.](image1)

**Figure 1:** Frequency of presenting signs and symptoms.

![Figure 2A: Surgical diagnostic subgroups in % of all ED presentations.](image2a)

**Figure 2A:** Surgical diagnostic subgroups in % of all ED presentations.

**Clinical examination**

Overall, the majority of examinations were performed for investigation of ORL symptoms and confirmation of diagnosis, or even intended for treatment. In detail, 231 patients (41.7%) benefited from otoscopy, whereas nasal, throat and oral cavity examinations were performed in 73 (13.2%), 23 (4.2%) and 6 (1.1%) patients, respectively.

**Work-up**

**Imaging studies**

The most frequently used modalities for imaging in the paediatric patient group were computed tomography (CT) in 43 (7.8%) and conventional X-rays in 38 patients (6.9%), two of whom (0.4%) benefited from the low dose dose X-ray (LODOX®) scanner, a time-saving, full-body, digital X-ray imaging device (case 1: thoracic spine fracture T6-9, secondary to a mountainbike accident, case 2: left frontoparietal subarachnoidal haemorrhage, cerebellar, supratentorial and frontal contusions, right sinus frontalis fracture following a fall of 10 metres). Less commonly, MRI (n=3, 0.5%) and ultrasonography (n=4, 0.8%) were indicated. Angiography (n=2, 0.4%) was used as the imaging device to search for arteriovenous malformations in 2 epistaxis cases. Fifteen (15) patients (2.7%) underwent more than 2, whereas 466 (84%) patients (15.5%) did not undergo any imaging study.

![Figure 2B: Orthopaedic diagnostic subgroups in % of all ED presentations.](image2b)

**Figure 2B:** Orthopaedic diagnostic subgroups in % of all ED presentations.

**Laboratory testing**

Haemoglobin only was tested in 4 patients (0.7%), a routine baseline laboratory (lab) sampling was performed in 12 (2.2%), routine laboratory, viral serology and autoantibodies in 3 (0.5%), routine laboratory and C-reactive protein (CRP) in 20 (3.6%), routine lab, CRP and other infectious parameters in 1 (0.2%) and CRP only in 1 (0.2%) subjects, respectively. For 513 patients (92.6%), no laboratory testing at all was performed.

![Figure 2C: Neurosurgical diagnostic subgroups in % of all ED presentations.](image2c)

**Figure 2C:** Neurosurgical diagnostic subgroups in % of all ED presentations.
Diagnostic procedures

Fiberoptic nasal/oral endoscopy was performed in 30 children (5.4%) and 25 children (4.5%) benefited from audiometry. One hundred and sixty four (164) patients (29.6%) were investigated by no or other not further specified diagnostic resources.

Table 1: Frequency of all ORL presentations (n= Number of patients).

| Subspecialty                | Presenting complaint          | No of patients (%) |
|-----------------------------|-------------------------------|--------------------|
| Internal medical            | infection                     | n=3 (0.5%)         |
|                             | gastroenteritis               | n=1 (0.2%)         |
|                             | asthma                        | n=1 (0.2%)         |
|                             | abdominal pain                | n=1 (0.2%)         |
|                             | not otherwise specified       | n=1 (0.2%)         |
| Psychosocial                | drug use/aggressive behavior  | n=2 (0.4%)         |
|                             | suicidal tendencies           | n=2 (0.4%)         |
|                             | suicide attempt               | n=1 (0.2%)         |
|                             | child abuse                   | n=1 (0.2%)         |
| Neurologic                  | headache                      | n=2 (0.4%)         |
|                             | facial palsy                  | n=1 (0.2%)         |
|                             | stroke                        | n=1 (0.2%)         |
| Ophthalmologic              | trauma                        | n=1 (0.2%)         |
|                             | infection                     | n=2 (0.4%)         |
| Dental                      | abscess/infection             | n=1 (0.2%)         |
|                             | not otherwise specified       | n=1 (0.2%)         |
| Urologic                    | pyelonephritis                | n=1 (0.2%)         |
|                             | not otherwise specified       | n=1 (0.2%)         |

Table 2: Frequency of less common paediatric presenting signs and symptoms. n= Number of patients.

| Treatment and procedures |
|--------------------------|
| Antibiotics were administered to 71 children (12.8%), symptomatic treatment, defined by the authors as simple analgesia or antipyretic therapy was given to 117 (21.1%) and no treatment whatsoever to 188 patients (33.9%), respectively. Airway management by endotracheal intubation was required in 19 subjects (3.4%). |

Surgical treatment

Twenty-two (22) children (4%) benefited from surgery. Seven (7) subjects (1.3%) underwent wound management (suturing) whereas
chest drain insertion and abscess incision and drainage were performed in one patient (0.2%), respectively.

Orthopaedic procedures

Fracture reduction was indicated in 13 (2.3%) and fracture splinting was needed in 12 patients (2.2%).

ENT interventions

Foreign body removal was conducted in 57 children (10.3%), electrocoagulation for epistaxis in 8 (1.4%), haemostasis by other means in 10 (1.8%) and drainage of peritonisillar abscess in 3 (0.5%) children, respectively.

Outcome

Presentation to the ED led to the hospital admission of 43 patients (7.8%). Whereas 176 children (31.8%) had a good outcome, 2 (0.4%) had been administered antibiotics, one (0.2%) was intubated, 3 (0.5%) were performed in one patient (0.2%), respectively.

Reasons for presentation to the adult ED

Logistic reasons, such as availability of imaging devices or a helicopter platform located on the roof of the adult ED, need for subspecialty referral not available in the paediatric ED and lastly, reasons for presentation to the adult ED were independently directed interdisciplinary PED at Inselspital Bern in 2013, still a relatively new concept in Switzerland. Data collection was performed prior to the opening of the airborne severely ill or injured child to the adult ED is self-explanatory, whereas primary arrival of a less emergent case by helicopter, a frequent occurrence at our institution, following will simply an approximately 5-minute transfer to the PED. Interestingly, one study found that helicopter emergency transport services (HEMS) do not independently improve outcome for traumatically injured children, and 22.3% of children transported by HEMS are not significantly injured [13]. These facts should be considered when requesting HEMS for transport of injured children.

Age and gender

Median age was 12 years for both girls and boys in our cohort. In contrast, Australasian authors found that children of 0-4 years of age represented the greatest absolute number of ED presentations in a mixed ED, consistently over time and across all triage categories [9]. In an Indian hospital, subjects 0-5 years of age constituted 78.8% of the study population [3]. Among all children who presented to the ED with face lacerations, not surprisingly, preschool-aged children predominated by far among the study population (34.9% of all study subjects including adults) [10]. Children in this age group often lack attention or still have unstable gait [14] and these facts need to be taken into account from an injury prevention perspective. In contrast, Lee et al found that among adolescents, the proportion of males with face lacerations was significantly higher than in the other age groups [10], which was possibly attributable to a more risk-seeking behaviour in this subgroup. Among all children presenting to the ED with eye injuries in an Indian study, boys aged 0-16 years accounted for 70% of all cases and the majority of eye injuries had happened in the 5-10 years age group [7]. Regarding imaging devices, only two children benefited from LODOX® scanner imaging. LODOX® provides an excellent X-ray quality image up to 6 feet in length in just 13 seconds [15]. It is not only fast but also safer than conventional X-rays, emitting up to 10 times less harmful dose than regular X-ray systems, a fact which could be of particular interest in the paediatric population where health care professionals seek to adapt radiation protection to the particularly vulnerable organs. However, in paediatric radiology, the minimal necessary radiation dose is generally used to achieve maximum results and protection compared to X-ray imaging in the adult population [15]. A CT scan was used for imaging in approximately 8% of all children investigated in this study. Despite this single-digit percentage, it is evident that CT imaging must be promptly available for severely injured children. CT is the quickest and most exact imaging modality in emergent situations requiring quick and
precise diagnosis. Interestingly, the majority of children in this review presented to the adult ED with ENT problems. Likewise, Curtis et al. have previously found that a significant portion of children present to the ED after adenotonsillectomy for poorly controlled pain, dehydration, or fever which is associated with significant costs [8]. The predominant ENT presentations among the paediatric population in this study were more or less complex in nature, and this highlights the demand for prompt disposition of ENT subspecialist support. From a practical point of view, ENT review and likewise all other subspeciality review for ill and injured children could take place in the adult or mixed ED requiring transport of the child from the PED to the ED for the subspeciality examination. Alternatively, the subspeciality consultation could take place in the PED. If the PED is distant, it may take time for the subspecialty physician to attend to the child needing review. We acknowledge minor limitations to our review: Firstly, the size of the cohort is rather small and hence may not truly represent the typical pediatric population. Secondly, due to incomplete data, a considerable number of subjects had to be excluded from our study and thus was not available for interpretation. Thirdly, faster availability of subspecialists such as ear-nose-throat or ophthalmology physicians in the adult ED may have predisposed to choosing the adult ED for initial presentation. Lastly, location of the helicopter landing platform closer to the adult ED also may have played a part in choosing the initial destination for the pediatric patient brought to ED by helicopter.

Conclusion

This is the first Swiss 10-year report illustrating the variety of presenting complaints, required investigations and intervention, as well as outcome of paediatric patients presenting to a tertiary adult ED in Switzerland. Gender and age distribution partly differ from previous reports. This might be due to the fact that only a random selection of paediatric patients were seen in the adult (mixed) ED at Inselspital, Bern, whereas the majority of children did present to the medical or surgical PED, and did not require management in the adult ED. Our results highlight the need for prompt availability of subspecialty review, e.g. ORL, on the one hand, and for provision of CT, MRI and optionally, LODOX® apparatus, in addition to ultrasound and classical X-ray, which are available in most PEDs, if we are to provide the best possible care to severely ill or injured children. However, very few institutions in Switzerland currently have such a fully equipped PED. A wise way to counteract this deficiency could be to train the interdisciplinary adult ED staff in the unique aspects of paediatric emergency care, for the time being. This could be both clinical and during regular simulated interdisciplinary team training, an effective state-of-the-art method to improve efficient interprofessional team work [16,17]. Ultimately, it seems evident that risk of death for injured children might be significantly lower when care is provided in paediatric trauma centres rather than in non-paediatric trauma centres. This ideal setting would incorporate both medical and nursing staff with paediatric training as well as adequate technical resources including e.g. CT and MRI equipment.

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