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

Ruth M Löllgen[1*], Pagona Chouchou[2], Christian T Braun[3], Daniel Garcia[1], Aristomenis K Exadaktylos[3] and Steffen Berger[4]

[1]*Paediatric Emergency Department, Inselspital, University of Bern, Switzerland*

[2]*2nd Neonatology Intensive Care Unit, Aristotle University of Thessaloniki, Greece*

[3]*Emergency Department, Inselspital, University of Bern, Switzerland*

[4]*Department of Paediatric Surgery, Inselspital, University of Bern, Switzerland*

[*]**Corresponding author**: Ruth M. Löllgen, Paediatric Emergency Department, Inselspital Bern, CH-3010 Bern, Switzerland, Tel: +41 31 632 9290; E-mail: ruth.loellgen@insel.ch

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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 Helveticorum (FMH, Swiss Medical Association) since January 2014. Conferral of the Swiss specialist title in PEM requires 24 months of PEM training in a recognised interdisciplinary PED at a university or teaching hospital, e.g. University Hospital Inselspital Bern. PEM training can likewise be completed in Switzerland or in any other country with a recognized PEM training program, e.g. Australia, Canada, New Zealand, the United Kingdom or the United States of America; this is after completion of at least 3 years of general training in either specialty. Starting in 2016, Swiss PEM trainees will have to complete a viva voce examination at the end of their training if they are to be awarded the PEM specialist title by the FMH. Most Swiss PEDs are currently operated as interdisciplinary medico-surgical departments, however, directed conjointly by both the heads of the general paediatric and paediatric surgery departments. The "Notfallzentrum für Kinder und Jugendliche" (NZKJ) (Emergency Department for Children and Adolescents) at Inselspital Bern is the first independently directed interdisciplinary PED and has had a dedicated head of department since January 2013. The PED Bern does not currently have its own CT or MRI apparatus, but does have a state-of-the-art ultrasound and radioscopy apparatus. Consequently, for structural and logistical reasons, seriously injured or sick paediatric patients requiring urgent imaging secondary to traumatic injuries or critical medical conditions are still initially managed in the adult ED ("Universitäres Notfallzentrum" (UNZ) (University Emergency Department) at Inselspital Bern. The latter institution is located on the same campus at a 5 minute walking distance from the PED. The decision as to which ED initially receives the seriously injured or sick child, including those brought to the ED by rotary wing platform or road ambulance, is made by the PED consultant on call. The decision is based on the emergency of vital signs, mechanism of injury and anticipated requirement for immediate imaging. A telephone-based checklist [11] has been designed by the first author to support a brief triage discussion between the referring pre-hospital medical staff (paramedic or physician) and the accepting PED in order to adequately determine the optimal initial resuscitation resources and structures. For the time being, the PED consultant takes the lead in resuscitation, if the child is admitted to the PED for medical or surgical patients, respectively. If the child is accepted by the adult ED, the resuscitation is led by the paediatric surgeon, ED consultant or anaesthesiologist, in a multidisciplinary approach. In high stakes situations, the PED and adult ED staff are supported by paediatric intensive care and anaesthesiology specialists, respectively. In view of ongoing needs for the development of appropriate structural and personal resources, we aimed to examine the specific presenting signs and symptoms, outcomes as well as reasons for referral of the sickest medical and surgical paediatric patients admitted to the adult ED prior to the recent opening of the interdisciplinary PED in Bern, Switzerland in 2013.

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.

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 (73.5%, 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

(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.

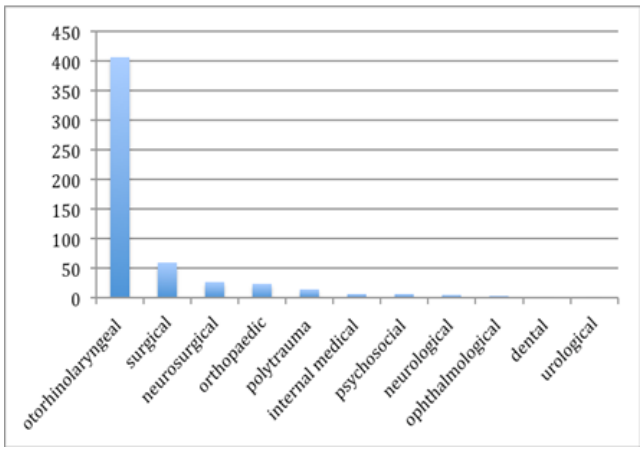

Figure 1: Frequency of presenting signs and symptoms.

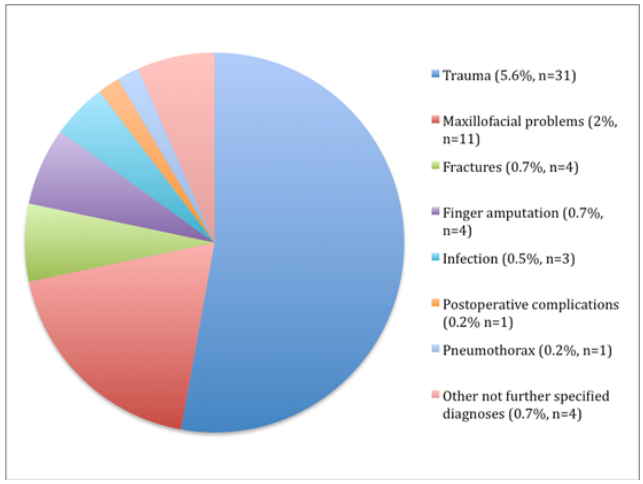

Figure 2A: Surgical diagnostic subgroups in % of all ED presentations.

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.

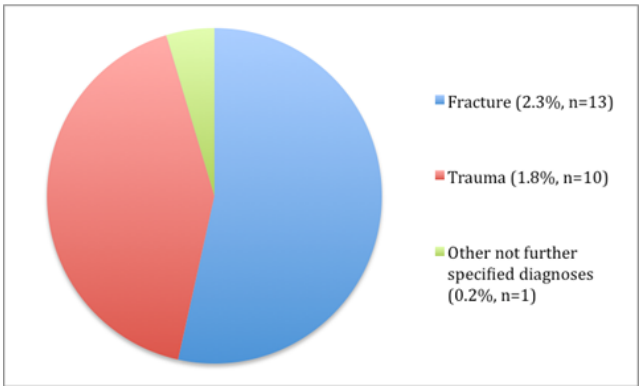

Figure 2B: Orthopaedic diagnostic subgroups in % of all ED presentations.

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.

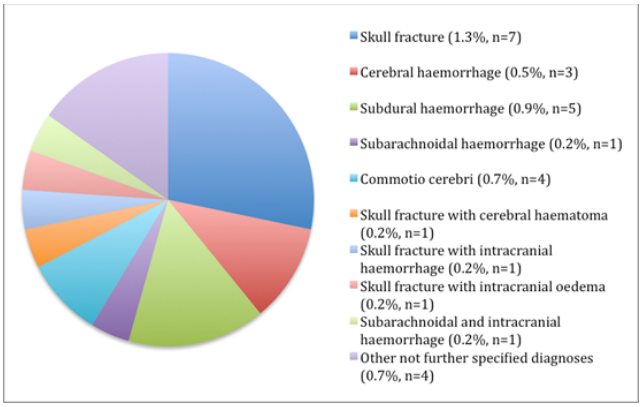

Figure 2C: Neurosurgical diagnostic subgroups in % of all ED presentations.

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.

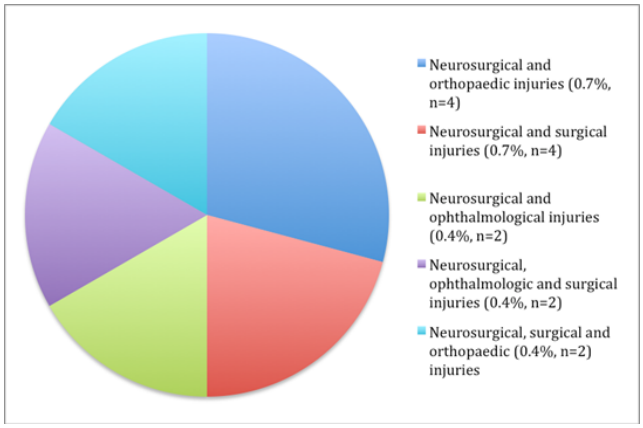

Figure 2D: Polytrauma diagnostic subgroups in % of all ED presentations.

Ear, nose and throat (ENT) Diagnosis	Number of patients (%)
ENT infection	n=101 (18.2%)
Foreign body	n=64 (11.6%)
Trauma	n=37 (6.7%)
Nasal fracture	n=28 (5.1%)
Perforation	n=25 (4.5%)
Postoperative complications	n=25 (4.5%)
Epistaxis	n=22 (4%)
Hearing loss	n=15 (2.7%)
Tonsillitis	n=12 (2.2%)
Otalgia	n=12 (2.2%)
Otorrhea	n=12 (2.2%)
Pararhinocolpitis	n=12 (2.2%)
Abscess	n=11 (2%)
Bleeding tonsils	n=7 (1.3%)
Swelling of structures	n=6 (1.1%)
Nasal obstruction, hyperplastic tonsils/adenoids	n=3 (0.5%)
Lymphadenitis	n=2 (0.4%)
Sore throat	n=2 (0.4%)
Perichondritis	n=2 (0.4%)
Postoperative follow-up	n=2 (0.4%)
Jaw pain	n=1 (0.2%)
Forehead swelling	n=1 (0.2%)
Allergic rhinitis	n=1 (0.2%)
Tracheitis	n=1 (0.2%)
Tumor	n=1 (0.2%)
Stomatitis	n=1 (0.2%)
Not otherwise specified	n=1 (0.2%)

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	abcess/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

Tweny-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 peritonsillar 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%) died in the ED despite resuscitative efforts. Outcome was not documented in 333 patients (60.1%). A sub-analysis of the treatment received in the ED in relation to the outcome showed that 48 patients in the good outcome group (8.7%) had been treated conservatively and 42 (36.2%) had received treatment not otherwise specified. Thirteen (13) children (2.3%) had not required any treatment, 2 (0.4%) had been administered antibiotics, one (0.2%) was intubated, 3 (0.5%) were scheduled for follow-up or not referred for subspecialty review, respectively. Among all admitted patients, 13 (2.3%) required endotracheal intubation and 7 (1.3%) went into surgery. Two children (0.4%) were treated conservatively, 6 (1.1%) received treatment not otherwise specified and one (0.2%) was not referred for subspecialty review. Among the two deceased patients, one (0.2%) had required endotrachel intubation and the other (0.2%) had been given treatment not otherwise specified. In the group with undocumented outcome, 137 patients (24.7%) were not referred for subspecialty review, 85 (15.3%) were treated conservatively, 70 (12.6%) were started on antimicrobial therapy, 66 (11.9%) were given treatment not otherwise specified, 19 (3.4%) were not given any treatment, 14 (2.5%) underwent surgery, 12 (2.2%) were scheduled for follow-up and 3 (0.5%) required endotracheal intubation.

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, random parental choice were the main reasons to present with their children to the adult ED.

Discussion

To our knowledge, this is the first Swiss retrospective 10-year review reporting the specific signs and symptoms of ill and injured paediatric patients presenting to a tertiary mixed ED and trauma centre in Switzerland. Data collection was performed prior to the opening of Switzerland's first independently directed interdisciplinary PED at Inselspital Bern in 2013, still a relatively new concept in Switzerland and Europe in general. We believe our results allow us to assess the frequency of severe trauma, the need for imaging studies and the required number of subspecialty reviews among children. Due to the prevailing limited structural and personal resources in most PEDs in Switzerland, e.g. lack of availability of CT and MRI apparatus, certain sectors of medical care can at present only be supplied to the sickest ill or injured patients in larger EDs equipped with these facilities. This holds true for our institution too, especially for trauma patients. For the time being, severely injured children are directly transported to the adult ED by road or air, following a conjoint decision on the optimal destination of care by the PED consultant on call and referring medical staff. This decision is supported by a telephone-based checklist and algorithm [12]. Management of the child in the adult ED may include all aspects of resuscitation and imaging as well as subspecialty reviews, e.g. ORL, ophthalmology, maxillo-facial, dental et and subsequently, possible indication for operative or interventional specialist care. However, occasionally subspecialty consultations take place in the paediatric ED if subspecialty staffare available to make their way to the PED. In contrast, paediatric patients are often referred to the adult ED for logistical reasons other than availability of subspecialty staff or imaging facilities, such as the location of the helicopter landing platform on top of the roof of the adult ED building. Primary arrival 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 subspecialty 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 subspecialty examination. Alternatively, the subspecialty 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 opthalmology physicians in the adult ED may have predisposed to chosing the adult ED for initial presentation. Lastly, location of the helicopter landing platform closer to the adult ED also may have a played a part in chosing 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 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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