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DOI:
10.4103/2452-2473.276379

Trauma transfers to the pediatric emergency department – Is it necessary?

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Abstract:

OBJECTIVES: Pediatric trauma patients presenting to general emergency departments (EDs) may be transferred to pediatric EDs for further management. Unnecessary transfers increase health-care costs, add to workload, and decrease satisfaction. We, therefore, aimed to evaluate the proportion of unnecessary pediatric trauma transfers and describe patient characteristics of these transfers at the pediatric ED.

METHODS: A retrospective chart review of cases with trauma-related diagnoses was carried out from January to April 2017. Information regarding patient demographics, diagnosis, and clinical progress was collected. A transfer was defined as unnecessary if the patient was discharged from the pediatric ED without any therapeutic procedure performed.

RESULTS: There were 117 cases of trauma transfers. The mean age was 8.3 ± 4.9 years, and 77 (65.8%) patients were male. Ninety-five (81.2%) transfers were from restructured hospitals. Thirty-one (26.5%) cases were admitted to the hospital. Thirty-four (29.1%) cases were unnecessary transfers. The length of stay in the ED for these transferred cases was 118.4 ± 87.1 min. Referring ED was not significantly associated with discharge (odds ratio [OR]: 1.28, 95% confidence interval [CI]: 0.43–3.83, $P = 0.792$), discharge without any therapeutic procedure performed (OR: 1.47, 95% CI: 0.50–4.31, $P = 0.591$), or length of stay (mean difference: 22.3 min, 95% CI: 84.5–39.9, $P = 0.471$).

CONCLUSION: About a third of trauma transfers were unnecessary. Further collaborative efforts would be necessary to further define the situation in different health-care settings and exact reasons elucidated so that targeted interventions could be implemented to improve pediatric trauma care.

Keywords:

Pediatric, transfer, trauma

Received: 21-09-2019
Accepted: 23-09-2019
Published: 28-01-2020

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Introduction

Trauma is an important cause of morbidity and mortality in the pediatric population. Childhood injury has an incidence of 19.5% and accounts for a significant proportion of attendances at the emergency departments (EDs).^[1] These injured children are more likely to present to general EDs instead of pediatric EDs.^[2]

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However, there are concerns that general EDs may not be adequately prepared to handle pediatric emergencies due to issues surrounding the availability of trained personnel and equipment.^[3,4] General EDs may not be staffed by pediatricians, and emergency physicians may have varying levels of comfort and experience with pediatric patients. Furthermore, there may be a lack of access to specific pediatric subspecialties or inpatient pediatric units. Consequently, some pediatric trauma patients may require transfer to a pediatric ED for further evaluation and management.

How to cite this article: Lyria Hoa MH, Ong YKG, Pek JH. Trauma transfers to the pediatric emergency department – Is it necessary? Turk J Emerg Med 2020;20:12-7.

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Prior to transfer, general EDs should perform assessment and institute treatment appropriate for the patient's condition. These could range from resuscitation and stabilization of a child with severe trauma following a road traffic accident, to providing analgesia and applying a splint for a child presenting with a fracture following a fall. The emergency physician would then need to decide if the patient requires transfer to a pediatric ED. This decision is complex and multifaceted but important as it allows for optimal and efficient citing of pediatric trauma care which can improve outcomes, especially for patients with major trauma.^[5-7]

However, patients who are transferred may subsequently be discharged from the pediatric ED without further intervention.^[8,9] This phenomenon of unnecessary transfers to another ED is known as secondary overtriage and is more common in the pediatric population compared to adults.^[10] Secondary overtriage imposes a substantial resource and cost burden to hospitals, patients, and medical transportation infrastructure.^[11,12] Furthermore, it adds to the workload at the pediatric ED, causing diversion of limited resources which may potentially result in morbidity for other patients, longer wait times for consultation, and increased length of stay in the ED, as well as decreased satisfaction of patients, families, and providers.^[13-15]

Therein lies the importance of investigating trauma transfers to the pediatric ED. We aimed to evaluate the proportion of unnecessary pediatric trauma transfers to the pediatric ED and describe patient characteristics of these transfers at the pediatric ED. This work would provide an opportunity to understand the extent of secondary overtriage, thus fostering open communication among EDs to explore the limitations of pediatric trauma management at general EDs and identify the potential areas for enhancing delivery of care. Ultimately, it would ensure the provision of optimal pediatric trauma care.

Methods

Settings

This study was carried out in the ED of a tertiary pediatric hospital in Singapore with an annual attendance of about 170,000. Trauma cases account for 10%–15% of all attendances, of which minor trauma preponderates.

Our institution is one of the two pediatric hospitals in Singapore which are restructured hospitals (public hospitals owned by the government). Both hospitals are tertiary institutions with a pediatric ED staffed by pediatric emergency physicians, as well as inpatient and outpatient pediatric specialties relevant to trauma care such as pediatric intensive care, pediatric surgery,

pediatric neurosurgery, and pediatric orthopedics. General EDs are located in 15 tertiary institutions (7 restructured hospitals and 8 private hospitals) and are staffed by emergency physicians with variable training in pediatric emergency care. There are no pediatric emergency physicians at all general EDs, and there are no inpatient and outpatient pediatric specialties in the restructured tertiary institutions.

Design

A retrospective review of pediatric trauma transfers from general EDs to the tertiary pediatric institution between January and April 2017 was made. Medical records of the patients were accessed for data collection and tabulated in a standardized form. Information including demographics, referring ED, therapeutic procedure performed, disposition, and length of stay (defined as the duration in the ED between the time of arrival to disposition) was collected for analysis.

Therapeutic procedures for trauma cases included the following: procedural sedation; wound care management such as laceration or nail bed repair; fractures and/or joint dislocation management (i.e., reduction, casting, and splinting); and examination of sexual assault victims.^[16] Therapeutic procedures such as intubation, mechanical ventilation, invasive line or chest tube insertion, as well as procedures performed in the operating theater were excluded as these patients would be transferred to the inpatient unit, bypassing the pediatric ED. We also excluded point-of-care, laboratory or imaging tests as these were standard investigations available at general EDs.

This study was approved by the Institutional Review Board at SingHealth, Singapore (CIRB reference 2018/2268). The study data would not be available for sharing in the public domain in accordance to the requirements of the IRB.

Statistical analysis

Statistical analysis was performed using SPSS software version 22 (SPSS, Chicago, IL, USA). Categorical and continuous data were presented as frequencies with percentages and means with standard deviations, respectively. Associations between categorical variables were assessed using the Chi-square test, whereas associations between continuous variables were assessed using the Wilcoxon rank-sum test. The level of significance was taken as 0.05.

Results

There were 62,353 attendances at the pediatric ED during the study period. Of these, 9467 (15.2%) cases were trauma related and 117 (1.2%) cases were transferred from general EDs.

Patient characteristics

The mean age was 8.3 ± 4.9 years, and 77 (65.8%) patients were male. Ninety-five (81.2%) transfers were from restructured hospitals [Table 1].

Diagnoses of cases

Orthopedic fractures were the most common case type (n = 43, 36.8%). Upper limb fractures, head contusions, and facial lacerations were the top three diagnoses made at the pediatric ED among the trauma cases transferred [Table 2].

Table 1: Patient characteristics

Variable	Total n=117
Age (mean±SD)	8.3±4.9
Gender, n (%)	
Male	77 (65.8)
Female	40 (34.2)
Source, n (%)	
Restructured hospital	95 (81.2)
Private hospital	22 (18.2)

SD=Standard deviation

Table 2: Discharge diagnoses of all transfer cases

Diagnosis	Cases transferred, n (%)	Unnecessary transfer, n (%)
Upper limb injury	45 (38.5)	10 (22.2)
Fracture	37 (31.6)	7 (18.9)
Contusion	3 (2.6)	1 (33.3)
Laceration	2 (1.7)	-
Sprain	2 (1.7)	2 (100)
Crush injury	1 (0.9)	-
Head injury	19 (16.2)	5 (26.3)
Contusion	15 (12.7)	4 (26.7)
Laceration	3 (2.6)	-
Fracture	1 (0.9)	1 (100)
Facial injury	17 (14.4)	7 (41.2)
Laceration	11 (9.3)	1 (9.1)
Contusion	6 (5.1)	6 (100)
Lower limb injury	12 (10.3)	4 (33.3)
Fracture	6 (5.1)	1 (16.7)
Laceration	3 (2.6)	-
Sprain	2 (1.7)	2 (100)
Contusion	1 (0.9)	1 (100)
Foreign body	8 (6.7)	3 (37.5)
Animal bite	2 (1.7)	1 (50)
Dental injury	2 (1.7)	1 (50)
Eye injury	2 (1.7)	2 (100)
Drowning	2 (1.7)	-
Multiple injuries	2 (1.7)	-
Burn	1 (0.9)	1 (100)
Chest contusion	1 (0.9)	-
Child abuse	1 (0.9)	-
Nail injury	1 (0.9)	-
Perineum contusion	1 (0.9)	-
Sexual assault	1 (0.9)	-

Outcome of cases

Figure 1 shows the outcome of the trauma transfers. Among the 31 (26.5%) cases admitted to the hospital, 2 (1.7%) required care in the high-dependency unit [Table 3]. Among the 86 (73.5%) cases discharged, 34 (29.1%) did not require any therapeutic procedure. Casting or splinting (23.9%) was the most commonly performed procedure [Table 4]. Upper limb fractures, facial contusions, and head contusions were the top three diagnoses from the cases discharged without therapeutic procedure [Table 5].

Length of stay

For the cases which were unnecessarily transferred, the length of stay in the ED was 118.4 ± 87.1 min.

Referring emergency department

Referring ED was not statistically significantly associated with discharge (odds ratio [OR]: 1.28, 95% confidence interval [CI]: 0.43–3.83, P = 0.792), or discharge without any therapeutic procedure performed (OR: 1.47, 95% CI: 0.50–4.31, P = 0.591). There was also no significant difference between the mean length of stay for patients referred from restructured or private EDs (mean difference: 22.3 min, 95% CI: 84.5–39.9 min, P = 0.471).

Discussion

About a third of trauma transfers to the pediatric ED were unnecessary and potentially avoidable as these patients were discharged without any therapeutic procedure performed. This finding calls to attention the potential for change and a need to implement step-wise interventions empowering general EDs to provide enhanced, comprehensive trauma care for children.

A unique skillset is necessary in managing pediatric patients in the emergency setting. Understandably, emergency physicians from general EDs differ in their

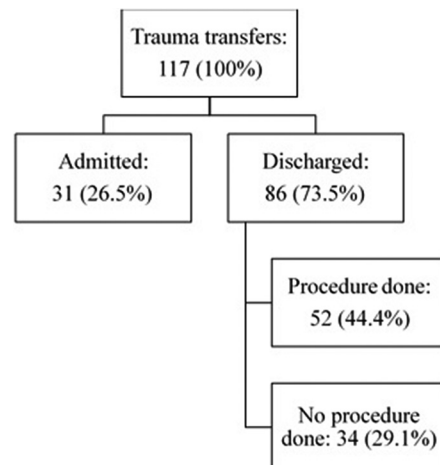


Figure 1: Outcome of cases

Table 3: Disposition of cases

Disposition	n (%)
Admission	31 (26.5)
Level of disposition	
General ward	29 (24.8)
HDU	2 (1.7)
Admitting discipline	
Pediatric surgery	10 (8.6)
Neurosurgery	8 (6.8)
Pediatric medicine	7 (5.9)
Orthopedics	5 (4.3)
Otolaryngology	1 (0.9)
Discharge	86 (73.5)
Referred to specialist outpatient clinic	73 (62.3)
No follow-up required	11 (9.4)
Referred to polyclinic/general practitioner	1 (0.9)
Against medical advice	1 (0.9)

HDU=High-dependency unit

Table 4: Therapeutic procedures

Therapeutic procedure*	n (%)
Casting or splinting	28 (23.9)
Toilet and suture	18 (15.4)
Manipulation and reduction	18 (15.4)
Procedural sedation	16 (13.7)
Removal of foreign body	3 (2.6)
Nail bed repair	2 (1.7)
Sexual assault examination	1 (0.9)

*Therapeutic procedures are not mutually exclusive as some patients may require more than one procedure. For instance, a patient may require casting after manipulation and reduction of a fracture under procedural sedation

Table 5: Discharge diagnoses of cases discharged without therapeutic procedures

Diagnosis	n (%)
Upper limb injury	10 (29.5)
Fracture	6 (17.7)
Contusion	2 (5.9)
Sprain	2 (5.9)
Head injury	5 (14.7)
Contusion	4 (11.8)
Fracture	1 (2.9)
Facial injury	5 (14.7)
Contusion	5 (14.7)
Lower limb injury	4 (11.8)
Sprain	2 (5.9)
Fracture	1 (2.9)
Contusion	1 (2.9)
Foreign body	3 (8.8)
Dental injury	2 (5.9)
Eye injury	2 (5.9)
Animal bite	1 (2.9)
Burn	1 (2.9)
Perineum contusion	1 (2.9)

levels of comfort and experience when dealing with pediatric cases,^[4] and some patients may be transferred to a pediatric ED for a second opinion on evaluation

and management. A resultant subset of these transfers would have been unnecessary – with involved patients being discharged after the second consultation, without additional interventions provided by the pediatric ED. The proportion of unnecessary transfers seen in our study is consistent with the existing literature on pediatric trauma transfers in other countries, with percentages ranging from 10% to 37.5%, and orthopedic fractures being the most common case type.^[8,17-19] The variability of proportions observed suggests a mirroring of the differences between general EDs in their capacity for provision of pediatric emergency care.

Reasons for transfers to a pediatric ED include a lack of resources for the management of pediatric trauma, unfamiliarity with pediatric trauma, challenges in evaluation and management, need for admission or specialist consult, and family request.^[8] It is likely that the majority of trauma transfers in our study were for reasons other than the need for admission as the proportion requiring inpatient stay was only 26.5%, much lower than the percentages of 52.8%–62% in other countries.^[8,9] This is further supported by the apparent benignity of cases discharged without therapeutic procedure as suggested by their diagnoses, although this observation could be influenced by the disparity in clinical assessments between general and pediatric emergency physicians. Further constructive efforts directed at evaluating admission criteria, as well as promoting consistency of diagnoses and indications for admission between the referring general ED and receiving pediatric ED, are necessary.

The expense incurred in each pediatric interhospital transfer is estimated to be US\$4843, which includes the costs of personnel involved in the transfer, ambulance transport, and emergency services provided at both referring and receiving ED.^[9] Unnecessary transfers clearly contribute to financial inefficiency within our health-care system, resulting in increasing health-care costs. Physician cognizance of the financial implications of secondary triage is required to motivate active efforts in preventing unnecessary transfers. Unfortunately, most physicians are unaware of the economics of care and are unlikely to have given due consideration to cost concerns when deciding on interhospital transfers.^[20]

Possible interventions which may reduce unnecessary transfers include developing protocols for pediatric trauma care and guidelines for transfer, providing education for all staff, identifying areas for capacity building, and increasing access to pediatric subspecialty consults.^[8] Protocols for pediatric trauma care based on evidence and best practices will provide emergency physicians with a quick and reliable reference to pediatric trauma conditions which they may not

encounter commonly. These protocols will also define the expected standard of care and reduce variability in patient management. Guidelines for transfer will be a useful tool in assisting discernment of necessary versus unnecessary transfers, thus minimizing secondary overtriage. Continuing medical and nursing education, as well as simulation sessions, will equip ED staff with the knowledge and skills to deal with pediatric trauma. Repeated and deliberate practice will increase staff familiarity with the management of pediatric trauma, boosting competence and confidence. General EDs should also look into deficiencies and lapses in the provision of pediatric trauma care so that targeted interventions, such as resource development to ensure availability of pediatric equipment, can be made for capacity building.

As general EDs do not have access to pediatric specialty consults, patients may be transferred for a second opinion. Telemedicine using a real-time videoconference consultation, or phone consultation, is a feasible and promising adjunct to improve access, facilitate triage and transport, as well as reduce cost and disparities in care.^[21-24] Furthermore, it has been shown to be associated with high parental and provider satisfaction. Prospective studies are necessary to determine the impact of these interventions and their benefits to pediatric trauma care at the general EDs.

Limitations

This was a single-center study carried out at the pediatric ED receiving trauma transfers. Therefore, diagnoses made and management at the referring general EDs, details of the transferring emergency physicians, and their reasons for transfer could not be reliably obtained. Furthermore, interhospital transfers may have been influenced by other variables such as the capabilities of the ED, as well as patients' access to transportation and medical care at the EDs. Consequently, although our study enabled identification of the issue of secondary overtriage, we were ultimately unable to explicate from this retrospective review the exact reasons for, or propose specific solutions to, the problem at large. A multi-institutional collaborative effort would be vital in further endeavors at reviewing this issue on the necessity of pediatric trauma transfers.

We were also unable to estimate the health-care costs associated with unnecessary transfers as we did not have access to data concerning the costs of various services provided at the general EDs and those related to transport. The retrospective nature of this study also precluded the assessment of patient, parental, and provider satisfaction. Instead, we have used the length of stay at the pediatric ED as a surrogate measure of the inconvenience caused by these unnecessary transfers.

Despite the limitations, our work would contribute to the existing literature by providing further insight about the proportion of unnecessary transfers specific to pediatric population with trauma based on the definition of unnecessary trauma transfers by Medford-Davis *et al.*^[16]

Conclusion

Our study showed that about a third of pediatric trauma transfers were unnecessary and did not require therapeutic interventions. Such transfers are a strain to the receiving pediatric ED and impose a substantial resource and cost burden to patients, their families, and our health-care system. Collaborative efforts with general EDs would be necessary to further define the situation in different health-care settings and exact reasons elucidated so that targeted interventions could be implemented to improve pediatric trauma care.

Author contribution statement

All authors have made substantial contributions to the conception and design of the study, acquisition of data, or analysis and interpretation of the data. All authors have also revised the material critically for important intellectual content and approved the final version to be submitted. The authors have full access to all aspects of the research and writing process, and take final responsibility for the paper.

Funding

None.

Conflicts of interest

The authors declare that they have no conflict of interest.

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