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Quality Indicators of pediatric polytrauma care

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Abstract

Background: Polytrauma is still the major cause of death in children all over the world. Initial evaluation and management should be approached by teamwork that includes pediatric physicians, pediatric intensive care physicians, and trauma surgeons. Trauma care provides injured children with life- and limb-saving treatment, but it is unclear if the proper tools have been developed to measure the quality of care delivered.

Objective: To review quality indicators for evaluating care delivered to pediatric polytrauma patients aged ≤ 12 years and illustrate various complaints, shortages, suggestions, and possible solutions in the management of children at Aljalla Trauma Hospital–Benghazi/Libya.

Methods: This study was conducted during a period of the Benghazi War (From July 2015 to July 2016). A retrospective records review of 228 children admitted as PPPs was done. All types of injury were included with a focus on the hospital stage of PPPs management. A questionnaire form for evaluation of the quality indicators of emergency management of pediatric polytrauma patients was prepared and filled out by the staff in charge.

Results: The questionnaire has been answered by 93 of the staff who work in an adult emergency room, adult intensive care unit, and trauma surgeons. Our results enhance the findings of epidemiological studies for musculoskeletal injuries in PPPs and positively confirm the need to establish educational courses and continuous evaluation of performance for personage included in pediatric polytrauma patients management.

Conclusion: Trauma centers may not have the resources to care for all the injured children within their referral region at any given time, and pediatric trauma centers should serve as referral points in major urban areas.

Keywords: Pediatric, polytrauma, injury, medical problems, patient transportation

Introduction

Multiple trauma is the major cause of mortality in children even in developed countries and can lead to poor short-term and long-term outcomes [1]. A fatal outcome is a usual consequence of this trauma. In addition to road traffic accidents and falls from height as the major causes of pediatric polytrauma, expulsions, and gunshot injuries are contributory factors due to war at the time of the study. The appropriate timing and adequacy of therapeutic and diagnostic measures for managing children with severe multiple injuries are a prerequisite for improving treatment outcomes. The injured patient should be transferred immediately from the scene to a specialized trauma center in the “golden hour”. Distance and duration of patient transportation are contributory factors for good outcomes. However, multiply-injured children affected in rural areas, are usually admitted in the closest general hospital, where the provision of multidisciplinary care to pediatric patients is limited. That reflects the presence of many logistic and medical problems.

The optimization of the surgical treatment of injuries facilitated a reduction in the duration of the intensive care unit (ICU) stay of patients and the overall hospital stay. Pediatric polytrauma should be considered a public health problem, to improve the outcome. Initial evaluation and management should be approached by a multidisciplinary team including pediatric physicians, pediatric intensive care physicians, and trauma surgeons. Most trauma staff lack experience with pediatric polytrauma management. Some studies have shown a high rate of mortality in pediatric polytrauma patients (PPPs) in developing countries; this may be attributed to a lack of pediatric trauma centers or trauma centers located very far from the scene of trauma [2].

As the first hours following trauma are the golden hours for critical treatment of PPPs, the staff must be aware of the unique anatomical and physiological characteristics of the injured child. Accumulative evidence suggests that many PPPs do not receive optimal treatments and strategies [3, 4]. The concept of immediate surgical treatment of all injuries in place is currently debatable. Reducing the duration of the victim's stay in the general hospital and the earliest possible transfer to a specialized center significantly improves the outcome of the patient's treatment. Poor functional outcomes of the treatment of concomitant injuries in children also indicate the need to improve anesthesiology, resuscitation, and surgical treatment at all stages of care. Centers that lack a regimented protocol are at risk of providing suboptimal care to PPPs.

Clinical practice improvements are associated with short-, medium- and long-term health and developmental consequences.

Aim of the study

To expose the unfamiliarity with emergency care of PPPs and substandard emergency room equipment and its effect on the mortality rate; to improve the pediatric trauma care service include the hospital stage of the injured children to a general trauma center (GTC) regarding clinical experience and service of the trauma team who deals with PPPs. Also for reveal priorities to improve pediatric surgical care for (PPPs).

Materials and Methods

This retrospective study was conducted during the period from July 2015 to July 2016 at Al Jalla Trauma Hospital; a referral trauma center in the east and south of Libya, affiliated with Benghazi University, and included 228 children admitted as polytrauma patients with two or more body regions were injured. Age, sex, address, cause of trauma, pre-hospital situation, medical staff in charge, type of injuries, and mortality all were retrieved from file records. Inclusion criteria were age 0-12 years, and two or more systems affected. We did not include pre and post-hospital stages of evaluation in the quality of PPP care. Also, details of surgical treatment that have been done according to different surgical subspecialties were excluded. The Injury Severity Score (ISS) has been used to assess children following admission to the hospital because it is defined and is in common use in trauma research [5]. Patients with an ISS \geq 16 were considered to be severely injured.

We prepared the questionnaire shown below for an evaluation of the quality indicators of emergency management of PPPs. A questionnaire was answered (Filled out without was?) by 93 of the staff working in the adult emergency rooms, adult ICU, and trauma surgeons in our hospital.

Questionnaire for Quality Indicators of PPP Emergency Management (Benghazi /Libya)

1. Where do you work?

Pediatric ICU General ICU Pediatric emergency General emergency.

2. What is your job?

Anesthesiologist Trauma Surgeon Pediatric physician General Practitioner Emergency Nurse ICU nurse

3. Your experience in the emergency department?

< 2yr 2-7yr > 7yr

4. Are you included in the emergency management of PPP?

Always Sometimes Rarely No

5. Do you participate in trauma courses like ATLS (Advanced Trauma Life Support) or PTLIS (Pediatric Trauma Life Support) course?

Yes No One course

6. How many persons on your team receive the PPPs?

< 2 Persons 2-4 Persons > 4 Persons

7. How does the child arrive at the hospital?

Personal care Ambulance with accompanying professional medical staff Ambulance without professional medical staff

8. The presence of the parent of the injured child during resuscitation

Agree Not agree

9. Do you have a stocked resuscitation trolley?

Yes No

10. Do you ask about any fluid therapy received before the child arrive at the hospital?

Yes No

11. Do you use special standard formulas like tape based on weight and height to prevent errors in drug dosing?

Yes Sometimes No

12. Do you have any idea about the differences in anatomy and physiology in a child versus an adult?

Yes No

13. In your hospital do you have minimum infrastructure like a well-equipped emergency department, blood bank, ICU with ventilator facilities, and radiology services e.g. x-ray, CT, and operating room?

Very good quality Good quality Poor quality

14. How much vascular access do you use in a polytrauma child?

Venous cannula Intraosseous venous cut down I do not know

15. Do you insist to keep the resuscitation room sufficiently warm?

Yes No

16. Do you know any quality indicators for pediatric trauma evaluation?

Yes No

17. Do you agree about file documentation in PPP?

Yes No

18. When the opinion of a pediatric physician for PPPs is needed

He is always attending in ICU and Resuscitation department
You will call him from inside the hospital You will call him from outside the Hospital

19. What is the distance between your hospital and the nearest pediatric hospital?

- Close to each other
- Less than one km
- Less than 10 Km
- Less than 50 Km
- More than 100 Km

20. How many PPPs do you see every duty?

- < 2 pt.
- 2-4 pt.
- > 4 pt.

Results

The total number was 228 children (171 boys, and 57 girls), aged ≤ 12 years with an average of 4.3 years. Aetiology of trauma was a road traffic accident (R.T.A.) in 199 patients (87.3%), explosive injury in 17 patients (7.5%) (Fig. 1 A, and B), fall in 7 patients (3.07%), and a gunshot wound in 5 patients (2.2%) (Fig.2 A, B, and C).



Fig 1: A): Abdominal injury, B), Explosive injury with open fracture distal radius



Fig 2 A): X-ray shows fracture of neck and proximal left femur, B), Colostomy bag for perforating abdominal injury, and C), Outlet wound of gunshot injury right gluteal region

Table 1: Distribution of injuries according to body systems.

System	No. of cases	Percentage (%)
Musculoskeletal	132	%57.9
Head	50	%21.9
Abdomen	21	% 9.2
Face	5	%2.2
Chest	5	%2.2
Genitourinary	5	%2.2
Spine	4	%1.8
Neck	2	%0.9
Vascular	4	%1.8

Fractures were associated with the following injuries

1. **Foot fractures:** other injuries (25%).
2. **Femoral fractures:** head injury (14%), chest injury (2%), abdominal injury (7%), and genitourinary system (1%); (fig. 3A, B, and C).
3. **Pelvic fractures:** genitourinary injuries (1.3%).

4. Twenty-five patients had open fractures (11.5%).



Fig 3 A): Closed fracture shaft of the Rt. femur, (B and C): CT scan views show temporal bone fracture and Lt. Eye penetrating injury

The musculoskeletal injuries were associated with other system injuries (Table 2).

Table 2: Distribution of the musculoskeletal injuries and associated injuries.

Injury	No. of cases	% of associated injuries
Femur fracture	31	24
Leg bones fracture	18	12
Foot fractures	21	25
Shoulder girdle fractures	13	9
Humerus fractures	17	8
Forearm fractures	23	10
Hand fractures	9	7
Pelvic fracture	4	20
Physical injuries	28	11
Soft tissue injuries	34	15
Fractures with N/V injuries	4	23
Penetrating joint injury	11	9

Morbidity and mortality

1. A total of 37 children died (16.2%), of them 23 on arrival at the emergency room (10%), and 14 within a period of 2 to 7 days after arriving at the hospital due to multisystem failure (6.2%).
2. Two patients were treated with amputation (one due to the severity of leg injury and the other due to failed vascular surgery of the injured brachial artery).
3. One patient with brachial plexus injury due to missed surgical emphysema after penetrating injury of the neck.
4. One child had acute compartment syndrome of the hand due to improper insertion of the I.V. cannula (fig. 4) and was treated with fasciotomy.



Fig 4: Photo of a child with compartment syndrome of hand after insertion of an intravenous cannula.

A questionnaire was answered by 93 trauma staff members and revealed the following:

1. 95% of staff that deal with PPPs are working in general emergency hospitals.
2. 70% of staff receive from 2-4 cases in their duties per month.
3. 95% of staff did not attend emergency courses like ATLS (Advanced Trauma Life Support) or PTLIS (Pediatric Trauma Life Support) and their hospitals had medium to good infrastructure for emergency departments.
4. 70% of the PPPs arrived at the hospital by personal ambulance.
5. Pediatric physician attended after a written call from the pediatric hospital that is at least 5 km distance from the general emergency hospital in a traffic city.
6. All staff are not satisfied with the file documentation

system.

7. 90% of staff had no idea about fluid therapy received in the pre-hospital stage.
8. 92% of staff have no idea about physiological and anatomical differences between adults and children.
9. CT scan was done at the request once a time and not repeated at regular intervals.

Discussion

Regarding the causes of trauma, we agree with Puri P, *et al.* [1]; road traffic accidents are the major cause of pediatric polytrauma. In our study, an increased incidence of gunshot and explosive injuries was noted and this was not mentioned in previous works of literature, which is attributed to the war in our country during the time at which this research was conducted. The extremity fractures were 132 cases (57.9%) which is compatible with Kay RM' findings? [6].

There were 37 children received dead (17%), this is attributed to the pre-hospital emergency care providers are not familiar with the basics of the transportation of critical cases. The lack of experience was continuous also in the hospital stage where 14 children (6.48%) died within 2 to 7 days after arrival to the hospital due to multisystem failure, these facts are consistent with Dieckmann *et al.* who demonstrated the risk of lack of professional experience in the management of PPPs in pre-hospital stage [7].

As all children in our study were treated at Adult Trauma Center (ATC) due to the lack of a Pediatric Trauma Center (PTC) in Benghazi, this may explain the high mortality in the hospital stage of caring PPPs, this data is consistent with Rashid Amini *et al* which concluded that injured children treated at PTC have better survival than those treated at all other levels of ATC [8].

The ability to provide good pediatric services including the presence of physicians and different surgical subspecialties is important. Yet, the ability of our country to provide a pediatric trauma team is a problem due to workforce shortage, this matches the finding of Rodriguez JL *et al.* [9].

Concerning negative answers of our staff regarding quality indicators for emergency management of pediatric polytrauma patients, the American College of Surgeons verified that the trauma centers may not have the resources to care for all of the injured children within their referral region at any given time [10]. We agree with Henry T *et al.*, that there is limited experimental research regarding quality indicators in pediatric trauma care [11]. Our study has some limitations like the lack of a proper documentation system due to the loss of file information seen in wartime during the collection of the data, and also the majority of quality indicators were designed for adults and applied for children.

Conclusion

The international quality indicators and deficiencies demonstrated in our results can positively confirm the need for educational establishment courses and continuous performance evaluation for a personage included in PPPs management. Pediatric trauma centers should be referral points in major urban areas with a familiarity of pediatric surgical specialists and pediatric medical subspecialists, who should be well prepared for trauma and emergency. The most critical step in the care of PPPs is the readiness of the staff and an emergency bay provided with age-oriented drugs and equipment combined with a disciplined approach.

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