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Evaluation the accessibility of emergency care for traumatic children in emergency departments

Amir Hossein Jafari-Rouhi[1], Samad Shams Vahdati[2], Asghar Jafari-Rouhi[3], Afshin Firuzi[4], Maryam Khameneh[5], *Leila Vahedi[6]

[1] MD, Tuberculosis and Lung Diseases Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.

[2] MD, Emergency Medicine Research Team, Tabriz University of Medical Sciences, Tabriz, Iran.

[3] MD, Emergency Medicine Department, Zanjan University of Medical Sciences, Zanjan, Iran.

[4] MD, Emergency Medicine Research Team, Tabriz University of Medical Sciences, Tabriz, Iran.

[5] Student, Islamic Azad University of Tabriz, Tabriz, Iran.

[6] Assistant professor, MD-PhD of Medical Genetics, Liver and Gastrointestinal Diseases Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.

Abstract

Background: Emergency care of traumatic children is an important health subject. The aim of this study was to evaluate the accessibility of emergency care for traumatic children in terms of management equipment, cause defects, and familiarity of medical staff with training programs.

Methods: This descriptive-analytical study evaluated the emergency departments of all general hospitals in East Azerbaijan province during 2018, based on a checklist with 4 sections and 20 items, rated according to Likert scale from very high (scored 3) to very low (scored 0). For a score less than 3, defect causes were explained in 7 categories. The staff training certificates were considered for early and advanced pediatric life support in an emergency situation. The staff's training certificates in terms of early and advanced resuscitation of children were also surveyed. Data was analyzed by SPSS 21.

Results: From among 20 emergency hospitals, more than 50% were equipped with adequate airway instruments. All of the emergency departments were provided with oxygen therapy equipment, but more than 70% had no chest tube and ventilator fit for children. More than 70% of them had cardiac monitoring and a sphygmomanometer for pediatric patients; however, less than 50% had a blood transfusion set and a urinary catheter. Only two hospitals had held early and advanced pediatric resuscitation workshops for their staff.

Conclusions: This study showed that 19 (95%) of emergency departments had the potential for early diagnosis and treatment of traumatic children. However, only 2 (10%) of the emergency staff had enough work experience in this issue. It is necessary to implement training programs for the familiarity of medical staff with pediatric early and advanced life support in emergency departments.

Key Words: Emergency, Equipment, Trauma, Children.

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**** Corresponding Author:***

Leila Vahedi, Assistant professor, MD-PhD of Medical Genetics, Liver and Gastrointestinal Diseases Research Center, Imam Reza Hospital, Gholghasht street, Tabriz University of Medical Sciences, Tabriz, Iran. Email: vahedi.l49@gmail.com

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1- INTRODUCTION

Trauma is the main cause of mortality and disability in children aged 1-14 years. It causes more death and disability than other pediatric diseases (1). Pediatric trauma remains a major public health problem in the United States (2). It leads to the annual death of more than 10,000 children in the world (3). About 15% of all pediatric ICU admissions and approximately 25% of pediatric emergency visits are related to pediatric trauma (4). Despite improving educational and safety issues, trauma is still a major cause of death in children aged 1-14 years (5). Pediatric trauma and mortality resulting from it are also rising in the United States despite presentation, observation and control regulations. Most of the deaths were related to vehicle accidents (6, 7).

A comparison between the equipment for pediatrics and adults in emergency centers indicated that in most cases the equipment for children was less than that of adults (8). Most of the defects in the equipment used in the emergency centers were related to the lack of simultaneous equipment and trained personnel. In most cases, the lack of these two subjects had reduced service quality (9). Although children are less likely to be injured compared to adults, they could have missed easier as a result of lack of timely treatment (6).

An organized pediatric trauma system can save the lives of many children and dramatically increase the survival rate for children despite severe skeletal, brain, or internal injuries. Therefore, it seems that collecting data regarding the present situation along with the national indicators for providing the best care in pediatric trauma is necessary (10).

The aim of this study was to evaluate the accessibility of emergency care for traumatic children in terms of management equipment, cause defects and familiarity of medical staff with pediatric early and advanced life support in emergency departments in East Azerbaijan province.

2- MATERIALS AND METHODS

2-1. Study design and population

The present research was a descriptive-analytical study that evaluated the accessibility of pediatric emergency care in terms of management equipment, cause defects, and familiarity of medical staff with pediatric early and advanced life support in emergency departments in East Azerbaijan province, during 2018.

2-2. Methods

In the present study, all active emergency departments in East Azerbaijan province were evaluated by one of the researchers (F.A) in-person according to the checklist provided in Persian based on the international standards of WHO (11). This checklist included 4 sections and 20 items (**Table 1**). Items were based on a four point Likert scale ranging from very high (scored 3) to very low (scored 0). The reliability and validity were evaluated by analyses of Cronbach's alpha which was 0.8 and by consensus of experts.

Table-1: Equipment status and cause defects in the management of traumatic children in the emergency departments of East Azarbaijan province

Systems	Variables	Score	F (%)	Cause defects	F (%)
Respiratory system and oxygen therapy	Endotracheal tube	0	1 (5)	Equipment with insufficient numbers	2 (50)
		1	2 (10)		
		2	1 (5)	Other cases	2 (50)
		3	16 (80)		
	Mask with ambu	0	0 (0)	Other cases	1 (100)

Systems	Variables	Score	F (%)	Cause defects	F (%)
	bag	1	1 (5)		
		2	0 (0)		
		3	19 (95)		
	Nasogastric tube	0	1 (5)	Lack of equipment	5 (100)
		1	4 (20)		
		2	0 (0)		
		3	15 (75)		
	Cervical collar	0	1 (5)	Lack of equipment	7 (70)
		1	3 (15)		
		2	6 (30)	Equipment with insufficient numbers	3 (30)
		3	10 (50)	Other cases	1 (10)
	Oxygen therapy facilities	0	0 (0)	-	-
		1	0 (0)		
		2	0 (0)		
		3	20 (100)		
	Pulse oximetry	0	10 (12.2)	Lack of equipment	2 (25)
		1	0 (0)		
		2	12 (14.6)	Under repair due to a defect	6 (75)
		3	60 (73.2)		
	Ventilator for children	0	19 (95)	Lack of equipment	19 (100)
		1	0 (0)		
		2	0 (0)		
		3	1 (5)		
	Chest Tube for children	0	14 (70)	Lack of equipment	14 (73.7)
		1	0 (0)		
		2	5 (25)	Equipment with insufficient numbers	5 (26.3)
		3	1 (5)		
Circulatory system	Cardiac monitoring	0	2 (10)	Lack of equipment	2 (50)
		1	0 (0)		
		2	2 (10)	Equipment with insufficient numbers	2 (50)
		3	16 (80)		
	Manometer	0	3 (15)	Lack of equipment	3 (33.3)
		1	4 (20)		
		2	2 (10)	Under repair due to a defect	4 (44.4)
		3	11 (55)	Equipment with insufficient numbers	2 (22.2)
	Intravenous cut-down set	0	10 (50)	Lack of equipment	10 (83.3)
		1	0 (0)		
		2	2 (10)	Equipment with insufficient numbers	2 (16.7)
		3	8 (40)		
	Blood transfusion set	0	7 (35)	Lack of equipment	7 (53.8)
		1	4 (20)		
		2	2 (10)	Equipment with insufficient numbers	6 (46.2)
		3	7 (35)		
	Urinary catheter	0	2 (10)	Lack of equipment	2 (15.4)

Systems	Variables	Score	F (%)	Cause defects	F (%)
		1	7 (35)		
		2	4 (20)	Equipment with insufficient numbers	7 (53.8)
		3	7 (35)	Equipment without an operator	4 (30.8)
Laboratory services	Hemoglobin	0	2 (10)	Lack of equipment	2 (15.4)
		1	7 (35)		
		2	4 (20)	Equipment with part-time operator	7 (53.8)
		3	7 (35)	Under repair due to a defect	4 (30.8)
	Electrolytes	0	0 (0)	-	-
		1	0 (0)		
		2	0 (0)		
		3	20 (100)		
	Urine analysis	0	1 (5)	Lack of equipment	1 (50)
		1	1 (5)		
		2	0 (0)	Equipment with part-time operator	1 (50)
		3	18 (90)		
Imaging services	Medical devices of the chest	0	1 (5)	Lack of equipment	1 (100)
		1	0 (0)		
		2	0 (0)		
		3	19 (95)		
	Portable graphics device	0	19 (95)	Lack of equipment	19 (100)
		1	0 (0)		
		2	0 (0)		
		3	1 (5)		
	FAST	0	9 (45)	Lack of equipment	9 (69.2)
		1	0 (0)		
		2	4 (20)	Equipment with part-time operator	4 (30.8)
		3	7 (35)		
	CT scan	0	17 (85)	Lack of equipment	20 (100)
		1	0 (0)		
		2	0 (0)		
		3	3 (15)		

Lack of equipment: (0)
Inadequate equipment less than 50% of requirement: 1
Inadequate equipment more than 50% of requirement: 2
Adequate and available equipment in all conditions: 3

2-3. Measuring tool

The checklist of the equipment required for traumatic children included:

1) equipment for pediatric respiratory management: endotracheal tube, mask with ambu bag, nasogastric tube, cervical collar, oxygen therapy facilities, pulse oximetry, pediatric ventilator, chest tube for children, 2) equipment for pediatric circulatory management: cardiac monitoring – pediatric blood pressure monitor, intravenous cut-down set, blood transfusion set, and urine catheter, 3)

laboratory equipment: For checking of hemoglobin, electrolytes, and urine analysis, and 4) imaging equipment: Medical devices of the chest, Portable graphics device, FAST (Focused assessment with sonography for trauma), and CT scan.

The availability or lack of availability of the above equipment was rated as follows:

Lack of equipment: 0

Inadequate equipment less than 50% of requirement: 1

Inadequate equipment more than 50% of requirement: 2, and

Adequate and available equipment in all conditions: 3.

In addition, the reason was also explained, if the score was less than 3, for example: 1) lack of equipment, 2) under repair due to a defect, 3) equipment without an operator, 4) equipment with the part-time operator, 5) insufficient numbers of the equipment, 6) due to the high cost, some patients are not able to use it, 7) other case.

2-4. Intervention

The checklist was completed for each emergency department in all general hospitals. It included equipment status, defect causes and familiarity of medical staff with pediatric early and advanced life support. Other information was obtained from the Metron, Supervisor and Head Nurse. All patient resuscitation trolleys were controlled and completed separately by a researcher (F.A. who is a pediatric resident). By referring to the laboratory and radiology departments of the hospitals, the sections related to the hospital paraclinic were completed. In addition, the familiarity of medical staff with pediatric early and advanced life support was surveyed.

2-5. Ethical consideration

This study was conducted following receiving the ethical code of the Vice Chancellor for Research Ethics Committee of Tabriz University of Medical Sciences. Completing the questionnaires was done after explaining the goals clearly to the medical staff.

Emergency information was kept confidential (IR.TBZMED.REC.95/3-7/4).

2-6. Inclusion and exclusion criteria

All medical emergency departments belonging to East Azerbaijan Province, which were emergency active and cooperation emergencies were included in this study.

2-7. Data Analyses

The data were statistically analyzed using SPSS version 21.0. Data were reported as descriptive statistics (frequency, percentage, mean and SD). In addition, the analysis of items was performed with SPSS likert for stating the condition of each item in general and the condition of each item in each hospital. Finally, the ranking of 20 hospitals was determined based on the scores.

3- RESULTS

3-1. Participants

In the present study, 20 emergency departments in the East Azerbaijan province were surveyed in terms of management equipment, cause defects and familiarity of medical staff with pediatric early and advanced life support for traumatic children.

The cause of the defects was explained if a score was less than three.

3-2. Equipment of emergency care management for traumatic children

As shown in **Table 1**, the emergency departments had airway equipment suitable for children in more than 50% of cases. Regarding circulatory system management, more than 70% of emergency departments were equipped with heart monitoring and pediatric

sphygmomanometers; however, less than 50% had blood transfusion sets and urinary catheters. Regarding the laboratory services, the condition of the laboratory equipment in most emergency departments was perfect. Finally, the imaging equipment was not fully available in most emergency departments, except for chest X-rays (**Table 1**).

3-3. The defect in emergency care management for traumatic children

In most cases, the defects were related to the lack of facilities and operators (**Table 1**).

3-4. Comparing the emergency centers based on status equipment for traumatic children

Comparing the equipment among hospitals showed that the majority of emergency departments had oxygen therapy and hemoglobin test facilities. In contrast, ventilators and CT scan C were not available in most hospitals.

General comparison of the facilities among hospitals showed that the most and least emergency facilities were related to Bonab and Maragheh hospitals, respectively.

Overall, hospitals were divided into three groups, based on their facilities: lower level (≤35%), normal level (35% -65%) and higher level (≥65%). This division was based on the opinions of experts. 5% of the hospitals were in the lower level, 40% were in the normal level and 55% in the higher level (**Table 2**).

3-5. Pediatric Basic License Surveillance (PBLS) and Pediatric Advanced

License Surveillance (PALS)

As shown in **Figure 1,** only the medical staff of two out of twenty departments had a history of activity in the field of pediatric trauma.

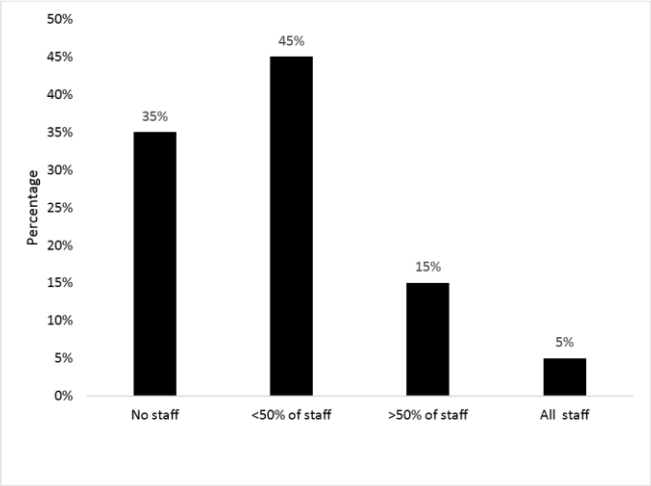

Fig. 1: Certificate of Pediatric Basic License Surveillance (PBLS) and Pediatric Advanced License Surveillance (PALS) among staff in the emergency departments of East Azarbaijan province.

4- DISCUSSION

In the current study, the facilities for the management of traumatic children were examined in 20 emergency departments of East Azerbaijan province, Iran.

This study demonstrated that 19 (95%) of emergency departments had appropriate equipment for diagnosis and treatment of traumatic children. More than 70% of them were equipped with adequate respiratory and cardiac instruments; however, less than 50% had a blood transfusion set and a urinary catheter. In addition, two hospitals had held early and advanced pediatric resuscitation workshops for staff.

A study conducted by Haidar et al. found that children were more prone to injuries than adults due to differences in physiology and anatomy. On the other hand, because they are not able to express their problems and medical history, it seems very necessary to use appropriate and timely treatment strategies in the emergency departments for children. Therefore, equipping these centers with

tools related to children and training emergency staff to use the equipment and gaining experience in contact with traumatized children seem essential (12).

The first steps in evaluating traumatic patients are the examination and management of the airway (13). The results of the present study showed that the emergencies are equipped with airway tools in a suitable size for children in more than 80% of cases.

A study performed by Ankomah et al. found that the shortages of pediatric equipment were common in emergency departments (14). The study of Dolatabadi et al. showed that it is necessary to provide complete facilities for centers to manage the airway and prevent the possibility of increased mortality of traumatic patients and this should be considered in future health system decisions (15).

The most common reasons for injuries among children are falls and pneumothorax which happen frequently. In these types of accidents, implantation of a chest tube was reported to treat and prevent further complications in these patients.

Considering the fact that falls are the most common accidents among children, the treatment facilities for pneumothorax which is highly probable in these types of accidents is strongly required. Among the treatments, the installation of a chest tube to treat and prevent further complications in these patients is recommended (15). However, in the present study, more than 70% of the emergency centers did not have chest tubes and ventilators suitable for children, despite having oxygen therapy equipment. This indicates that emergency departments have the equipment for oxygen therapy but they are facing a shortage of complementary facilities such as chest tubes and ventilators suitable for children. In addition, devices for cardiac and circulatory monitoring in pediatric patients were observed in more than 70% and less than 50% of emergency departments, respectively. In a study performed on 3388 traumatic children admitted to the emergency centers, the most common interventions were accessibility of blood vessels and fluid administration. Intubation was the most common airway intervention and red blood cell injection was the most widely used blood product (16).

Long et al. showed that the completeness of the equipment used to maintain the airways in children according to the standard checklist leads to an increase in the action speed of emergency staff in the resuscitation of children, and a reduction in the storage of unnecessary equipment for children. These factors are effective in improving the management of children with trauma (10).

The lack of facilities in the centers was the main reason for the lack of diagnosis and treatment which requires providing the basic equipment (17). Because in many cases, the costs imposed on the health system due to unnecessary dispatches due to the lack of facilities, are much higher than the costs of equipping these centers. It should be noted that the costs are much higher for unnecessary dispatches due to the lack of facilities, than the costs of equipping the emergency departments (18).

Providing the necessary equipment suitable for children, especially the equipment needed to save the airways and oxygenation and to control the hemodynamic condition in the centers, leads to a rapid response to emergencies (19). In addition, training efficient staff to use the equipment is necessary. The unavailability of trained staff leads to the failure of children's emergency management programs (19).

Table-2: Comparison of the equipment status for traumatic children in emergency departments of East Azarbaijan province

NO.	Emergencies	Endotracheal tube	Mask	Nasogastric tube	Cervical collar	Oxygen therapy facilities	Pulse oximetry	Ventilator	Chest Tube	Cardiac monitoring Monitoring	Manometer	Intravenous cut-down set	Blood transfusion set	Urinary catheter	Hemoglobin	Electrolytes	Urine analysis	CER	Portable	FAST	CT-scan	Total
1	Sina (Tabriz)	0	100	33.3	100	100	100	0	0	100	33.3	100	100	33.3	100	100	100	100	100	100	0	70
2	Shafa (Tabriz)	33.3	100	33.3	100	100	100	0	0	100	100	0	0	100	100	100	100	100	0	0	0	58.3
3	Talegani (Tabriz)	100	100	100	100	100	0	0	66.7	100	100	0	100	100	100	100	100	0	0	100	0	73.3
4	Bonab	100	100	100	100	100	100	0	0	100	100	100	100	100	100	100	100	100	100	100	100	90
5	BostanAbad	100	100	100	100	100	100	0	0	100	100	0	100	100	100	100	100	100	0	0	0	70
6	Kaleybar	100	100	100	33.3	100	100	0	66.7	100	0	0	0	66.7	100	100	100	100	100	66.7	0	66.7
7	Osku	100	100	100	66.7	100	66.7	0	0	100	100	100	33.3	33.3	100	100	100	100	0	0	0	65
8	Shabestar	100	100	100	66.7	100	66.7	0	66.7	66.7	66.7	66.7	66.7	66.7	100	100	100	100	100	66.7	0	65
9	Azar Shahr	100	33.3	100	33.3	100	0	0	0	0	100	0	0	0	100	100	100	100	0	0	0	43.3
10	Ajab Shir	100	100	33.3	100	100	100	0	0	100	0	0	100	33.3	100	33.3	100	100	100	100	0	65
11	Sarab	100	100	100	100	100	100	0	0	100	33.3	0	0	100	100	100	100	100	100	100	100	76.7
12	Maraghe	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	0	90
13	Varezegan	33.3	100	0	0	100	100	0	0	0	100	0	0	0	100	0	0	0	0	0	0	26.7
14	Marand	100	100	100	100	100	66.7	0	0	100	33.3	0	0	100	100	100	100	100	100	100	100	75
15	Jolfa	100	100	100	66.7	100	66.7	0	0	100	100	100	33.3	33.3	100	100	100	100	0	0	0	65
16	Hadi Shahr	100	100	100	66.7	100	66.7	0	0	100	100	100	33.3	33.3	100	100	100	100	0	0	0	65
17	Ahar	100	100	100	100	100	100	0	0	100	33.3	0	0	100	100	100	100	100	100	100	100	76.7
18	Miyaneh	100	100	100	33.3	100	66.7	0	66.7	100	0	0	0	66.7	100	100	100	100	100	66.7	0	66.7
19	Hashtrood	100	100	100	66.7	100	66.7	0	0	100	100	100	33.3	33.3	100	100	100	100	0	0	0	65
20	Heris	100	100	100	66.7	100	100	0	66.7	100	66.7	66.7	66.7	66.7	100	100	100	100	100	66.7	0	75
Total (Mean±SD)		3.6 ± 0.8	3.9 ± 0.4	3.5 ± 0.9	3.2 ± 0.9	4 ± 0.0	3.3 ± 0.9	1.1 ± 0.6	1.6 ± 1	3.6 ± 0.9	3 ± 1.1	2.2 ± 1.4	2.3 ± 1.3	2.9 ± 1	4 ± 0.0	3.7 ± 0.7	3.8 ± 0.6	3.8 ± 0.6	2.6 ± 1.5	2.4 ± 1.3	1.6 ± 1.2	67.9 ± 14

All numbers are as a percentage.

Out of the 20 centers investigated in the current study, only one center had familiarity with the PBLS and PALS courses and 18 centers had not any experience with pediatric trauma patients. Only one center had familiarity with the PBLS and PALS courses, and in 18 out of 20 centers, the emergency staff lacked experience in working with pediatric trauma patients, which shows the significance of the issue of practical training in this field.

Patterson et al. conducted a study on an emergency department with a large number of traumatic children. In this study, in order to reduce the error, a training program was implemented based on communication and teamwork programs focused on simulation-based education for the medical staff, which showed continuous improvements in participants' knowledge and attitude (19). Reducing the errors of personnel through participation in training classes seems necessary (19, 20).

In the mentioned study, to reduce the error, a simulation-based training program focusing on teamwork was implemented, which showed continuous improvements in the knowledge and attitude of the participants (20). Therefore, in order to improve team behaviors and reduce errors, staff participation in training courses seems necessary (16, 20).

In a study of multicenter emergency departments in Europe, more than 80% of emergencies were able to present standard emergency medical care for children. The best results in the evaluation were related to equipment, department policies, protocols, and skills. It was stated that most European emergencies met the basic standards of pediatric emergency care.

However, in our region, the biggest problem is related to lack of skills or lack of sufficient experience in patient management (21).

5- STUDY LIMITATIONS

This study has a number of limitations. It has been performed in an Iranian province and the findings have not been compared to other standard hospitals in the world.

6- CONCLUSION

This study showed that many emergency departments have basic therapeutic and diagnostic equipment for traumatic children. The level of accessibility to pediatric facilities in emergency departments for 5%, 40%, and 55% was low, normal, and high, respectively.

However, the staff of these centers did not have enough experience in the pediatric emergency field. The health systems should have plans for the development of training programs, especially for Pediatric Basic License Surveillance (PBLS) and Pediatric Advanced License Surveillance (PALS).

7- ABBREVIATION

WHO: World Health Organization, FAST: Focused Assessment with Sonography for Trauma, PBLS: Pediatric Basic License Surveillance, PALS: Pediatric Advanced License Surveillance.

8- ACKNOWLEDGMENTS

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