

# Retrospective analysis of pediatric road traffic accidents admitted to the emergency department of a university hospital

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## Abstract

**Aim:** Road traffic accidents are common in our country, but there are not many scientific studies related to childhood road traffic accidents. We aimed to report the frequency of road traffic accidents in children, the demographic characteristics of the patients, the physical effects of accidents on children and their results.

**Material and Methods:** Study data were obtained by retrospective screening of the files of pediatric cases presenting to our emergency department because of road traffic accident between September 2017-2018. The cases were evaluated in terms of age, gender, type of accidents, type of injury, radiologic imaging rates, hospitalization and mortality rates.

**Results:** 377 cases were reviewed. 136 (36.1%) patients were female and 241 (63.9%) were male. 36.9% (n=139) of the admissions were in summer. According to the occurrence of accidents, in-vehicle traffic accidents constituted 61.8% (n=233) of the cases. Among isolated injuries the most common site of injury was head and neck region (n=120, 31.8%). In 81.4% (n=307) of the cases tomography, in 72.1% (n = 273) of cases X-ray, in 25.7% (n=96) of cases ultrasound were requested. 270 (72.2%) patients were discharged from the emergency department with the diagnosis of soft tissue trauma. 58 (15.4%) patients were hospitalized in the respective clinics and 43 (11.4%) patients were hospitalized in the intensive care unit. It was detected that 8 patients (2.1%) died, 4 of them occurred in the emergency department.

**Conclusion:** Pediatric road traffic accidents mostly occur in the summer and most of them are in-vehicle accidents. Boys are more exposed to road traffic accidents. Injuries in traffic accidents mostly locate in the head and neck regions followed by extremities. It was found that tomographic imaging was overused in our study. New strategies should be developed to reduce tomography overuse.

**Keywords:** Child; demographic; injury; pediatric; road traffic accident; tomography

## INTRODUCTION

Road traffic accidents are the leading cause of injury all over the world. Increasing number of vehicles every year causes an increase in road traffic accidents. Road traffic accidents cause an average of 1.2 million deaths, 20-50 million injuries or disabilities throughout the World each year. According to the World Health Organization (WHO) traffic accident will be the leading cause of morbidity and mortality of young people worldwide in 2030 (1,2).

Road traffic accident remains one of the most common worldwide causes of pediatric morbidity and mortality. According to the WHO Burden of Disease project, road

traffic accident fatalities globally accounting for 30% of all injury deaths in childhood. Rates are higher in low-income and middle-income countries (3). Compared with economically similar countries, Turkey ranks between top countries in child deaths due to traffic accidents (4). In a study conducted in primary school age children in our country, it was reported that a significant portion of trauma in this age group was caused by traffic accidents (38.3%) (5). As a result road traffic accidents are one of the most preventable health problems, especially in childhood.

Although road traffic accidents are common in our country, there are not many scientific studies related to childhood road traffic accidents. In this study, frequency of traffic

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accidents in childhood, demographic characteristics of patients, physical effects of accidents on children and results are reported. Knowing the characteristics of patients' injuries will help to determine the precautions to be taken before and after these accidents (1). The studies so far have evaluated the frequency of accidents, demographic characteristics, accident occurrence, and characteristics of injuries, hospitalization rates, hospitalization periods, disability and mortality rates in childhood. In addition to them imaging rates and their necessity were also evaluated for the first time in our study.

## MATERIAL and METHODS

The study was conducted in accordance with the Declaration of Helsinki and was approved by the clinical trials ethics committee (approval number: 2019/03/06). This study is a retrospective chart review of children who applied to Kahramanmaraş Sütçü İmam University Faculty of Medicine Department of Emergency Medicine between September 2017 and September 2018 due to a road traffic accident. All forensic case records admitted between these dates were reviewed and patients whose provision was taken as traffic accident were separated. During this period, the total number of applications due to traffic accidents was 1470. Of these patients, 377 patients between 0-18 years of age were included in the study. Patients 18 years or older were excluded from the study. The study data were obtained from hospital files and archived forensic reports. Since our study was designed retrospectively, informed consent was not obtained. An archive commitment was signed regarding to protect the confidentiality of patient information. The age and sex of the patients, the month in which the accident occurred and the type of accident (in-vehicle, out-of-vehicle, motorcycle accident), were recorded. Injuries of passengers and drivers traveling in a motor vehicle defined as "in-vehicle" traffic accident. Pedestrians and cyclists hit by vehicles were defined as "out-of-vehicle" traffic accidents and injuries of motorcycle riders and passengers were defined as "motorcycle accidents".

The injury sites were divided into 6 groups as head and neck, thorax, abdomen, pelvic, extremities and vertebrae. Patients with more than one major organ injury or one major bone injury with an organ system were considered to have multiple trauma. Those who did not have any injuries were reported as no injury. Requested radiological examinations were classified as computerized tomography (CT), X-ray and ultrasonography. CT scans were divided into groups as brain, brain and cervical, thorax, abdominal and vertebral tomography. CT scans performed on multiple sites were accepted as multiple tomography requests. Patients without tomography imaging were also grouped. The patients who were consulted with a single department were evaluated as single, and the patients who were consulted with two departments were considered as double, and the patients who were asked for consultation from three or more departments were evaluated as multiple consultations.

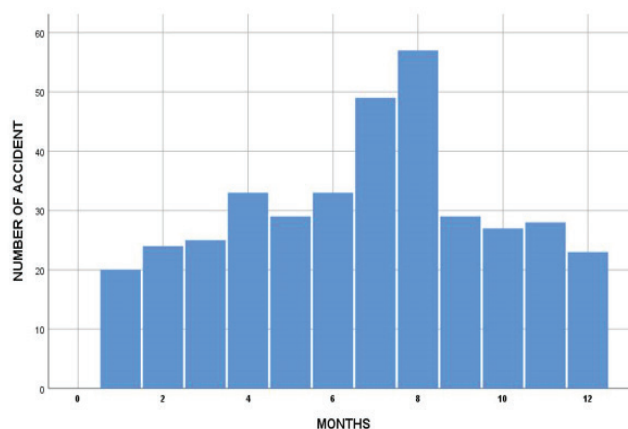
Which departments were requested for consultation, whether patients were hospitalized, intensive care hospitalization rates, and the length of stay in hospital were recorded.

The diagnoses were classified as soft tissue trauma, extremity fractures, thoracic, brain and skull injuries, intra-abdominal organ injuries. Patients with more than one major organ injuries or one major organ and one large bone injury were evaluated as multiple injuries. The results were recorded as discharge and death.

The data obtained at the end of the study were evaluated in SPSS (Statistical Package for Social Sciences) 20 statistical program. Numerical variables were expressed as means  $\pm$  standard deviation, categorical variables were expressed as frequency and percentage.

## RESULTS

Between September 2017 and September 2018, the total number of patients admitted to our emergency department due to a road traffic accident was 1470, of which 377 (25.6%) were pediatric patients. 136 (36.1%) of these patients were female and 241 (63.9%) were male. The mean age of the girls was  $8.76 \pm 4.85$  (1-17) years and the mean age of the boys was  $10.31 \pm 5.06$  (1-17 years). 36.9% (n=139) of the applications were made in summer months. The highest number of applications was observed in August (n=57, 15.1%), while the lowest application was in January (n=20, 5.1%) (Figure 1, Table 1).



**Figure 1.** Distribution of accidents by months

According to the type of accidents, in-vehicle traffic accidents accounted for 61.8% (n=233) of the cases. 26.5% (n=100) of the cases were out-of-vehicle traffic accidents and 11.7% (n=44) were motorcycle accidents. The mean ages of children who had in-vehicle traffic accident, out-of-vehicle accident and motorcycle accidents were  $9.05 \pm 5.21$  (1-17),  $9.31 \pm 4.17$  (3-17) and  $14.36 \pm 3.29$  (3-17) years, respectively.

Of the 377 patients included in the study, 74 (19.6%) had multiple injuries. In isolated injuries, the most frequently injured area was head and neck region (n=120, 31.8%). The second most common site of injury was extremities

(19.4%, n =73). No trauma was found in 99 (26.3%) patients. Tomography was performed in 81.4% (n=307), X-ray in 72.1% (n = 273) and ultrasonography in 25.7% (n = 96) of the cases. 175 (46.9%) patients required multiple CTs and 66 (17.5%) patients did not require CT. In CT scans with one-body region, the most requested imaging was brain CT with 34% (n=127), and 52 (13.8%) of these patients requested cervical CT imaging with brain CT.

**Table 1. Distribution of traffic accidents by months**

MONTHS	FREQUENCY	PERCENTAGE
January	20	5.3
February	24	6.4
March	25	6.6
April	33	8.8
May	29	7.7
June	33	8.8
July	49	13.0
August	57	15.1
September	29	7.7
October	27	7.2
November	28	7.4
December	23	6.1
Total	377	100.0

When the direct radiographs of the patients were examined, it was found that extremity radiographs took the first place with 28.7% (n=107), whereas direct radiographs were not needed in 27.9% (n=104) patients.

Of the 140 (32.5%) patients seen for consultation, for 37.9% (n=53) patients one, for 19.3% (n=27) patients two, and for 42.9% patients (n=60) more than two departments' opinions were requested.(Tables 2,3). The most frequently consultation requested department was neurosurgery.

**Table 2. Number and percentage of patients for whom consultation is required from a single branch**

CLINICS	FREQUENCY	PERCENTAGE
Neurosurgery	21	36.2
Orthopedics	21	36.2
Pediatric Surgery	9	15.5
PlasticSurgery	4	6.9
Ear Nose and Throat Clinic	2	3.4
Ophthalmology	1	1.7
Total	58	100.0

270 (72.2%) patients were diagnosed as soft tissue trauma and discharged from the emergency department (Table 4). Fifty-eight (15.4%) patients were treated in relevant clinics and 43 (11.4%) patients were treated in intensive care unit (Table 5).It was detected that 8 patients (2.1%) died. Four patients were admitted to the emergency department as cardiopulmonary arrest and death occurred. In the other 4

patients exitus occurred in anesthesia intensive care unit. Two patients died in the intensive care unit on the first day of hospitalization, one patient on the fourth day and one patient on the eighth day. The hospitalization diagnoses of the patients were as follows: Patient 1: subarachnoid hemorrhage, pulmonary contusion and cerebral edema Patient 2: Temporoparietal fracture, skull base fracture, pulmonary contusion, right tibia non-deplase fracture Patient 3: subarachnoid hemorrhage, brain edema, bilateral femoral fracture and iliac wing fracture Patient 4: diffuse brain edema, minimal pneumocephalus, intracranial hematoma, hematoma within spinal canal.

**Table 3. Number and percentage of patients for whom consultation was requested from two departments (ENT= Ear Nose and Throat)**

CLINICS	FREQUENCY	PERCENTAGE
Orthopedics+Neurosurgery	9	40.9
Neurosurgery +ENT Clinic	3	13.6
Neursurgery+Pediatric Surgery	9	40.9
Neurosurgery+Plastic Surgery	1	4.5
Total	22	100.0

**Table 4. Frequency and percentage of diagnoses**

DIAGNOSIS OF PATIENTS	FREQUENCY	PERCENTAGE
Soft tissue trauma	270	72.2
Bone fracture	53	14.2
Intracranial injury	13	3.5
Intra-thoracic injury	1	0.3
Intra-abdominal injury	6	1.6
Eye injury	1	0.3
Multiple injuries	33	8.0
Total	377	100.0

33 (8.8%) patients received erythrocyte suspension, 4 (1.1%) patients received platelet suspension, and 30 (7.96%) patients received fresh frozen plasma. Central venous catheterization was performed in 16 (4.2%) patients and thorax tube was inserted in 2 (0.5%) patients.

**Table 5. Frequency and percentage of clinics where patients were admitted.**

CLINICS	FREQUENCY	PERCENTAGE
Neurosurgery	16	15.8
Orthopedics	30	29.7
Pediatric Surgery	4	4.0
Plastic Surgery	6	5.9
Ear Nose and Throat Clinic	1	1.0
Ophthalmology	1	1.0
Anesthesia and Intensive Care	28	27.7
Other intensive Care Units	15	14.9
Total	101	100.0

## DISCUSSION

There are few studies investigated childhood road traffic accidents in our country. However, traffic accidents are the most common cause of death in childhood and are among the leading causes of hospitalization due to trauma (6). There has been a significant increase in the number of vehicles and road traffic accident related injuries in the last two decades. The number of vehicles has increased 7-fold while the number of injuries has increased more than 10-fold in Turkey (7).

In a study conducted in primary school age children in our country reported that a significant portion of the trauma in this age group occurred as a result of traffic accidents (38.3%) and mortality due to traffic accidents in the 0-14 age group was 14.7% (8). This rate was found to be 4.09% in Germany, 5.86% in the UK, 6.59% in the USA and 2.89% in Greece (8). In a study investigating deaths related to head trauma in childhood, it was found that traffic accidents were the leading cause of the etiology and most of them were caused by out-of-vehicle traffic accidents (9). Yavuz et al determined the death rate due to out-of-vehicle traffic accidents to be 63.8% in our country (7). The mortality of road traffic accidents indicates pedestrians as first (48%) followed by passengers (32%) and cyclists and their passengers (8%) in Europe among the age group of under 15 (7). One of our cases which resulted in death was caused by motorcycle accident, 3 were caused by in-vehicle traffic accident and 4 were caused by out-of-vehicle traffic accident. According to the results of a study carried out in the United States, 50% of all road traffic accident-related deaths occurred where the injury happened and 47% en route to or at the hospital (10). Similarly in our study, 50% of deaths occurred in the emergency department and the other deaths in intensive care units occurred in patients who admitted post CPR.

Although in-vehicle traffic accidents are more common, the lower mortality rate in these types of accidents emphasizes the importance of safety practices such as sitting children in the rear seats, the use of child seats and seat belts (11,12). Proper car seat use reduces the risk for death among infants (aged <1 year) by 71% and among toddlers (aged 1-4 years) by 54%. Booster seat use also reduces the risk for serious injury by 45% among children aged 4-8 years when compared with seat belt use only (13). The use of child car seats in our country has become compulsory since 2010 with the Highway Traffic Regulation relying on the Highway Traffic Law No. 2918. However the rate of child seat and seat belt usage was determined to be low in our country (4). If the awareness and knowledge of the families increases, the rate of child car seat and seat belt usage will also increase.

Although the incidence of out-of-vehicle traffic accidents in the pediatric age group is less than in-vehicle traffic accidents, it has been found to cause more frequent mortality and morbidity than other types of accidents (6). The fact that children have small body masses increases their chances of injury, because they are less visible to drivers and injuries may affect multiple organs. Also

children are more prone to make dangerous movements in traffic (14). Children's education is important to reduce these accidents. Traffic education in our country is given in the curriculum. Trainings are given theoretically. Practical applications should be increased as in developed countries.

While deaths and injuries due to traffic accidents decrease in time in developed countries in America and Europe, it is gradually increasing in developing and underdeveloped countries like our country (14). Countries that have achieved this increased constructed highway kilometers, have developed road traffic injury prevention policies such as graduated driver's licensing, booster seat and helmet legislation. In a study conducted in Canada, it was reported that implementation rates of laws were not standardized in all regions, and therefore the accident and injury rates did not decrease at the targeted level in some regions (15,16).

Mean age of the children was similar regarding in-vehicle and out-of-vehicle accidents though the mean age was higher in motorcycle accidents in our study. Since the school-age children are highly affected, designing safe routes to walk to school, speed limitation in school environments and near children's playgrounds can reduce the frequency of accidents and serious injury rates.

In our study, the majority of the cases were male (63.9%). This rate varies between 65% and 77% in similar studies in our country. This has been explained by some researchers that boys are less likely to obey traffic rules and make more dangerous movements in traffic (6,17). The fact that boys in childhood are more active and spend more of their time outside than girls also affect these results.

Most accidents occurred in the summer months in our province. The highest number of applications was seen in August, the least in January. These findings are consistent with the results of previously published studies in the literature. In another study, it was reported that the accidents occurred mostly in July and February (18). According to the research of Embleton et al, it is stated that 45.6% of the accidents occurred in summer and 7.2% of it occurred in winter (6). We believe that enhancing the traffic controls during the summer months may create deterrence and may contribute reduction of accident rates.

In a study by Serinken et al, it was reported that children with road traffic accidents had 34.8% head and neck, 45.1% extremity, 7.2% thorax and 6.9% abdominal trauma (5). Traumatic brain injury as a result of a traffic accident was found to be associated with high mortality and morbidity. Chelly et al. reported that 65% of patients admitted to ICU also had extracranial injuries (2). Isolated head and neck injuries were detected in 31.8%, isolated extremity injuries in 19.4% and multiple injuries in 19.6% of the cases in our study. Similarly head-neck injuries and after that extremity injuries were most frequently reported

injuries in childhood road traffic accidents in different studies (19,20).

When hospitalization and discharge rates of our study are examined, it is seen that 27.8% of the patients were hospitalized and 72.2% were discharged from the emergency department. In the study of Eliaçık et al, the hospitalization rate of the patients was found to be 32.2%. The most admitted departments were orthopedics with 36.3% and neurosurgery clinic with 25.5%, in the same study (1). 67.1% of children injured due to traffic accidents were reported to have soft tissue trauma in another study. The hospitalization and intensive care unit admission rates were determined to be 20.5 to 28.6% and 8.6%, respectively (14). In our study 27.7% of the patients were treated in intensive care unit. The high rates of hospitalization in the intensive care unit may be due to the fact that our hospital is a tertiary center and frequent referral of patients with severe, multiple trauma to our emergency department.

While 72.2% of our patients were discharged with the diagnosis of soft tissue trauma, the 81.4% tomography requesting rate indicates tomography overuse. The increase in utilization of pediatric CT is alarming because children are estimated to be ten times more radiosensitive than adults. A cumulative dose of 50mGy triples the risk of leukemia and a dose of 60mGy triples the risk of brain tumors in children. In the study of Çiçek et al, 83.4% of pediatric patients admitted to the emergency department due to trauma were found to have normal CT results and only 16.6% of them were pathological (20,21). In the study of Arnold M et al, it was found that the desired tomographic imaging rates increased gradually in years in pediatric patients with blunt abdominal trauma due to traffic accident and it has been argued that the reason is the widespread and easy accessibility of tomography (22). In the study of Cellina M et al, it was found that tomographic imaging was performed more than necessary in patients with minor head trauma (23).

A study conducted in America reported the main contributor to overuse was fear of missing a low-probability diagnosis and avoidance of malpractice issues. The less strongly factors were: expectations of family, imaging as standard practice in their medical groups or among their closest colleagues, that the test saves time (24). In a study by Di et al. (25), it was reported that malpractice anxiety and tense patient-doctor relationship increased the tomography request rate. The high rate of tomography request in our study may be due to the fact that all of the cases were forensic cases and a significant proportion of the patients were exposed to multiple trauma.

In order to manage trauma patients we established a separate area in the emergency department of our hospital to evaluate them. We keep here experienced physicians and trauma nurses for the management of trauma patients. We have a trauma observation area separated from other patients. We placed the PECARN rules that designed for isolated head trauma in a visible place in the trauma room. Education of families is important for family insistence, which is another factor that increases the rate

of tomography requests. Public service announcements may be broadcasted about the adverse effects of radiation on children. In order to reduce the malpractice anxiety of physicians, the government should make efforts and legal regulations should be made to protect physicians.

## LIMITATIONS

Our study was a single-center study and included only patients who were brought to our emergency department. It does not include all of the injuries that occurred in our province.

We don't know the death rate at the scene of accident. We could not find the information of previous hospital interventions (catheter, chest tube, blood transfusion) to the patients referred to our hospital for intensive care follow-up. Because our study was designed retrospectively we could not evaluate the child restraint and helmet use of the injured patients. Since we compiled the information of the patients included in the study from forensic report forms, no patients were excluded because of incomplete file information. This is one of the strengths of our stud.

## CONCLUSION

Road traffic accidents are important cause of mortality and morbidity in children. Accidents occur mostly in the summer months and most of them are in-vehicle traffic accidents. Boys are more exposed to traffic accidents. The most common injuries in road traffic accidents locate in head and neck region followed by extremities. When the severities of the injuries were evaluated the tomographic imaging rate was found to be high. With the increase in the number of centers having tomography, the excess of unnecessary imaging becomes a growing problem all over the world. Long-term radiation-induced effects should also be taken into consideration when making a tomographic imaging decision, especially in childhood and new strategies should be developed to reduce tomography overuse.

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