

ORIGINAL ARTICLE

Medicine Science 2021;10(1):179-83

Evaluation of trailer attached-two wheel tractor (Pat- pat) accident - related pediatric injuries in Turkey's western black sea region**Guleser Akpinar, Mehmet Cihat Demir***Duzce University, School of Medicine, Department of Emergency Medicine, Duzce, Turkey*

Received 26 November 2020; Accepted 07 January 2021

Available online 01.02.2021 with doi: 10.5455/medscience.2020.11.245

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**Abstract**

Traumatic injuries related to agricultural production can lead to serious illness, disability, and even death. Pediatric injuries due to trailer attached-two wheel tractor (Pat-pat) accidents occupy a scarce place in the literature. To contribute to the literature, we aimed to evaluate the demographic characteristics and analysis of pediatric injuries due to a Pat-pat accident admitted to our emergency department in the last decade. The study data were obtained by retrospectively examining patients younger than 18 years of age admitted to the Emergency Medicine Clinic between 01/01/2010 and 31/12/2019 with injuries due to Pat-pat accident. Demographic characteristics, injury sites, injury types, hospitalization status, length of hospital stay, injury severity score (ISS), and mortality status were recorded. Due to the Pat-pat accident, 32 children applied to the hospital. The male/Female ratio was 25/7. The median age of pediatric patients ranging from 9 to 18 years was 17 years. When evaluated according to the injury areas, extremity injuries were the most common. Admissions were most frequently in the summer season (n=21, 65.6%) and in July (n=13, 40.6%). These cases were admitted mostly on Tuesday (n=8, 25.0%) and between 16:00 and 23:59 (n=22, 68.8%). According to the ISS, 20 of the patients had a mild injury (ISS≤3), 3 had a moderate injury (4≤ISS≤8), and 9 had a severe injury (ISS≥9). To prevent accidents, the public should be made aware of this issue, and the authorities should be more careful in making the necessary administrative decisions and in implementation. For young agricultural workers, it should be an obligation to ensure proper education and job security. Pat-pat, which is not well known but often used in rural agricultural areas of the Western Black Sea region, can have dangerous consequences for children. Children should be kept away from such unsafe vehicles.

Keywords: Agricultural machine, pediatric injuries, pat-pat machine**Introduction**

Agriculture is a hazardous industry considering occupational injury and death rates [1]. Traumatic injuries related to agricultural production can lead to serious illness, disability, and even death [2]. Agricultural tractors are the leading cause of occupational deaths in pastoral areas. Tractor accidents are a significant cause of motor vehicle-related injuries on farms, accounting for an estimated 4-14% of non-fatal injuries and a third of fatal agricultural injuries [3]. Trailer attached-two wheel tractor (Pat-pat) is similar in structure to an off-road vehicle; however, it is functionally identical to a farm tractor. The name of the Pat-pat machine derives from the sound it makes [4]. This vehicle has two distinct structures: the fundamental part is an engine, and the other part is a trailer.

It weighs an average of 300-350 kg, has a steering wheel or handlebar, and can carry 1 ton of cargo or 10-15 people [5].

Accidents linked to Pat-pat machine used for agricultural purposes in rural areas in Turkey's Black Sea region, in the presence of organs and blood vessel injury, can be seen high morbidity and mortality. Pat-pat accidents may include children accompanying their family, children allowed to attend the workers, and children working as agricultural workers. Children are affected more than adults in injuries due to Pat-pat accidents because; Children are less capable than adults in protecting themselves during accidents and preventing damage from the accident. In studies published on tractor-related deaths, the 0-19 age group's mortality rate was reported to be between 11.0% and 29.5% [6]. In the study conducted by Dogan et al., this rate was 36.1% [7].

Various scoring systems have been developed to use a common language for trauma patients outside the hospital and hospital settings. Scoring systems provide information about the relationship between treatment and outcomes [8]. The Injury Severity Score

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(ISS) is the "gold standard" among anatomical indicators of injury severity in the trauma population [9, 10]. Glasgow Coma Scale (GCS), one of the physiological scoring systems used in patient follow-up from the moment of admission, is an easy, actual scoring system that can determine the level of consciousness and is widely used the reliable evaluation of the degree of mental status [11].

Duzce, plenty of nuts produced an agricultural city is in Turkey's western Black Sea Region. Especially in the mountainous parts of Duzce, Pat-pat is frequently used in hazelnut agriculture. Emergency services are the first places of application for injuries due to Pat-pat accidents. Publications on Pat-pat's pediatric injuries are scarce. By examining the children who came to our emergency service in the last ten years to contribute to the literature and who were injured in accidents related to Pat-pat, which is widely used in rural areas; Demographic data, and mortality rate related to these accidents were noted. We aimed to determine what kind of pediatric injuries occur in using these agricultural tools, convenient but not very safe for farmers, and make suggestions on this issue.

Materials and Methods

This research was a descriptive and retrospective study. The data of a total of 32 patients aged 18 and under, who were admitted to the emergency department with Pat-pat accident between 01/01/2010 and 31/12/2019, were obtained retrospectively via the hospital data processing system and emergency department records. There was no missing data. Patients older than 18 years were excluded.

It was conducted with the Ethics Committee of Duzce University's permission on 19/10/2020, numbered 2020/221.

According to the (GCS), the patients' consciousness level was evaluated. GCS consists of three parts: eye-opening and closing response, verbal response, and motor response. The score ranges from 3 to 15. The lower the score, the worse the patient's consciousness is [12].

The (ISS) was used while scoring the trauma severity of the patients. Patients presenting with multiple injuries were divided into six anatomical regions: head, neck, thorax, abdomen, extremity (including pelvis), and external injuries. It is a trauma scoring system calculated by summing the squares of each of the three most damaged body regions based on the results obtained by physical examination findings and trauma imaging examinations. The ISS was categorized into three groups: ≤ 3 mild, $4 \leq \text{ISS} \leq 8$ moderate, ≥ 9 severe [13,14]. Patients' age, gender, injured body area, consultation notes, hospitalization status, length of hospital stay, (ISS), and mortality status were recorded. While defining the patient's trauma region, it was considered anatomically as the head - neck, thorax, abdomen, extremities, and whole-body trauma.

Statistical analysis

Non-normal variables were expressed as median (minimum value - maximum value). Categorical variables were represented with counts and percentages. The statistical software SPSS version 19 (SPSS Inc., Armonk, NY, USA) was used for frequency analyses.

Results

Between 2010 and 2019, 32 pediatric patients applied to our

emergency department due to the Pat-pat accident. Male / Female patient ratio; It was 25/7. The median age of pediatric patients ranging from 9 to 18 years was 17 years, and 25 (78.1%) were male.

When the patients who applied with Pat-pat accident were evaluated according to the injury areas, extremity injuries were encountered most frequently. Of the 11 patients with extremity injuries, nine had injuries occurring only in their extremities and in 2 other parts. After the Pat-pat accident, soft tissue injury (STI) was the most common in patients. While 17 of these patients had only STI, 1 had head trauma and STI. All findings regarding the injury types of the patients were shown in Table 1.

Table 1. Injured body areas and diagnoses

	n	%
Injured body area		
Head-neck	5	15.6
Chest	4	12.5
Abdomen	2	6.3
Extremity	9	28.1
Multiple areas	12	37.5
Diagnosis		
Pulmonary contusion	1	3.1
Intrabdominal bleeding	1	3.1
Abdominal trauma	1	3.1
Cervical 1st (C1) vertebral fracture	1	3.1
Laceration in the extremities	2	6.3
Pneumothorax	1	3.1
Radial bone fracture	1	3.1
Radial + Ulnar bone fracture	1	3.1
Soft tissue injury	17	53.1
Multiple trauma	5	15.6
Total	32	100

The most frequent admissions of pediatric patients to the emergency department due to the Pat-pat accident were made in 2016. While there were no applications for 2010, it was observed

that applications increased since 2013 when only one admission was made, reaching 15 in 2016, and then declined again. Most frequently, admissions occurred in the summer season ($n=21$, 65.6%) and in July ($n=13$, 40.6%). No pediatric injury cases due to the Pat-pat accident were encountered in February, March, October, and December. Most of these cases were encountered on Tuesday ($n=8$, 25.0%) and at least on Monday and Wednesday

($n=2$, 6.3%) (Figure 1). Applications to the emergency department were made more frequently between 16:00 and 23:59 hours ($n = 22$, 68.8%).

According to the ISS, 20 patients had a minor injury ($ISS \leq 3$), 3 had a moderate injury ($4 \leq ISS \leq 8$), and 9 had a severe injury ($ISS \geq 9$). The median ages of patients with mild injury, moderate

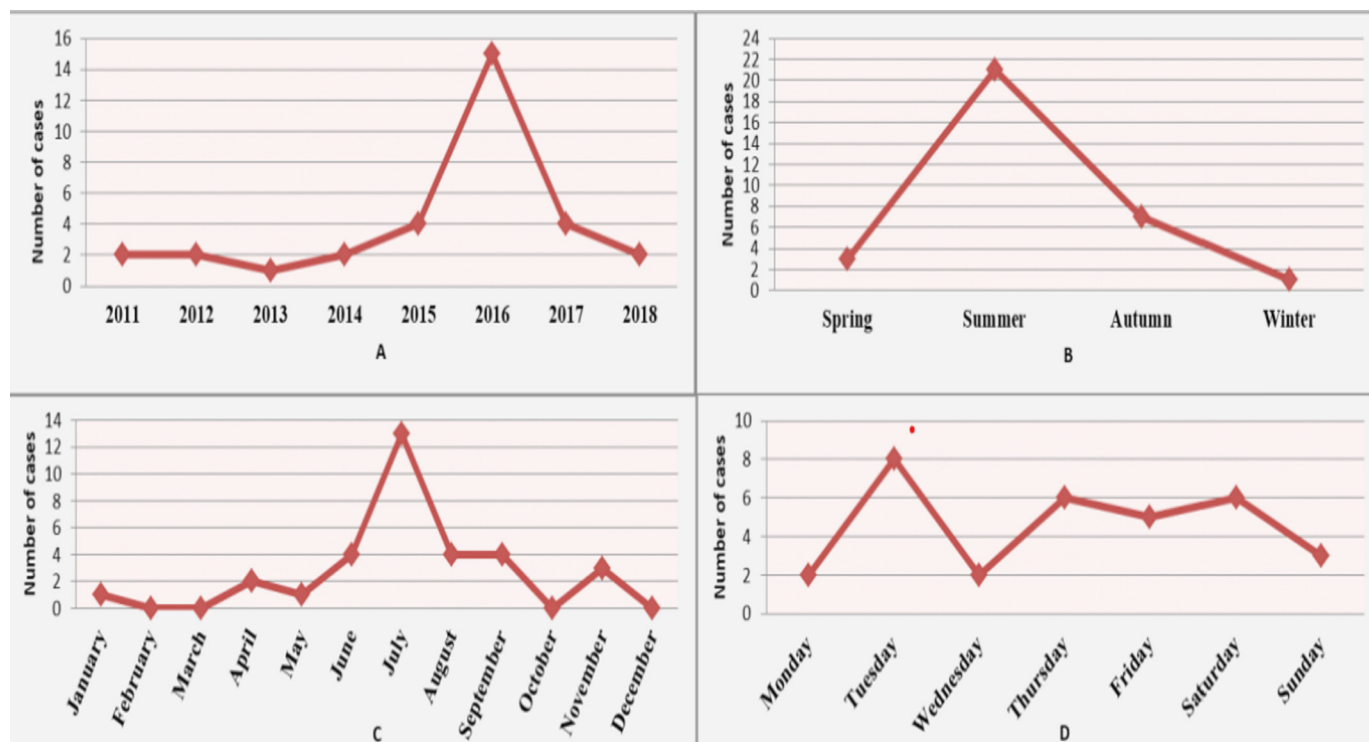


Figure 1. Number of pediatric patients admitted to the emergency department due to the Pat-pat accident A: By years, B: By seasons, C: By months, D: By days

injury, and severe injury were 17 (11-18), 16 (11-18), and 17 (9-18), respectively. 32% of boys and 14.3% of girls were seriously injured. 40% of the patients who applied to the emergency department between 08:00 and 15:59, and 22.7% of the patients admitted between 16:00 and 23:59 had severe injuries. Of the 15 patients consulted, 9 (60%) had severe injuries. The rates of severely injured patients were 37.5% (3/8) and 85.7% (6/7) in orthopedics and pediatric surgery departments, where consultation was requested most frequently. The severe injury was observed in 83.3% of the hospitalized patients and in 15.4% of the patients who were not hospitalized. All of the patients hospitalized in the neurosurgery clinic (NSC) and pediatric surgery clinic (PSC) and 66.7% of those hospitalized in the pediatric surgical intensive care unit (PICU) had severe injuries. The findings regarding the patients' hospitalization status was given in Table 2.

The GCS (GCS) was 15 in 30 (93.7%) patients and 8 in two patients. In the study, a boy who was obtained as GCS 8 and ISS 14 died.

	Injury Severity Score			
	3 or less	4-8	9 or more	Total
Age Median (min-max)	17 (11-18)	16 (11-18)	17 (9-18)	17 (9-18.0)
Gender n (%)				
Female	5 (71.4)	1 (14.3)	1 (14.3)	7 (100)
Male	15 (60.0)	2 (8.0)	8 (32.0)	25 (100)
Admission time n (%)				
08:00-15:59	5 (50.0)	1 (10.0)	4 (40.0)	10 (100)
16:00-23:59	15 (68.2)	2 (9.1)	5 (22.7)	22 (100)
Consultation				
No	17 (100)	0 (0)	0 (0)	17 (100)
Yes	3 (20.0)	3 (20.0)	9 (60.0)	15 (100)
Hospitalization n (%)				
No	20 (76.9)	2 (7.7)	4 (15.4)	26 (100)
Yes	0 (0)	1 (16.7)	5 (83.3)	6 (100)
Total	20 (62.5)	3 (9.4)	9 (28.1)	32 (100)

Discussion

Table 2. According to injury severity score, assessment of the patients' findings regarding gender, admission time, consultation requests, hospitalization status, and length of hospital stay.

Our study determined that accidents associated with Pat-pat, an agricultural tool, cause severe mortality and morbidity in Turkey (particularly in the western black sea region) and generated many injuries, chiefly extremity traumas, especially in the pediatric age group.

30% of our country's population works in agricultural activities. Due to a tractor accident in Turkey, the proportion of deaths due to Pat-pat-related accidents in fatalities is low. This low rate may be because the Pat-pat machine has less technological development than the tractor and is not used in every region of the country [4]. It has also been found that the most crucial cause of Pat-pat accidents is the overthrow of the Pat-pat [15,16].

A troubling aspect of this study is that a significant portion of the people involved in rural agriculture are children and that job security is less than children in other areas. By investigating unsafe working conditions and introducing necessary regulations, the rate of child accidents can be reduced. Still, emergency physicians must be prepared to handle a wide range of injuries in tractor-related incidents [17].

In accidents with agricultural implements such as the Pat-pat accident, the male gender is dominant. In these accidents, the ratio of male / female patients in admission to the emergency department and hospitalization was found to be 7: 3 and 5: 1; in our study, it was found in the ratio of 25: 7 and 5: 1, respectively. Due to the male gender of agricultural workers, there are more male patients in agrarian accidents [4, 17]. In our study, male patients were in the 10-18 age range, and there were 18 male patients over 15 years old. In our study, one patient who died was 18 years old and male. In Fulcher et al.'s study, they found the male patient mortality rate as 98% [18]. This shows us that young men are more active in agriculture. Our study's low number of mortality is due to our study population's shortage, which is the limitation of our research.

A series of scoring systems have been developed over the past few decades to assess the trauma's severity and estimate patient mortality and morbidity. ISS is one of the most commonly used scoring systems [19]. Although an exact score is not specified for the ISS score, it has been reported that as the score increases, the predictability of mortality and morbidity increases. An ISS score above 25 is directly associated with mortality [20]. Some studies highlight that data on injury severity and injured body areas play a crucial role in determining preventive measures [21]. Although fractures, soft tissue injuries, and extremity injuries are frequently reported in accidents with agricultural equipment, severe traumatic injuries are prominent in some studies [5]. In our study, 17 patients had STI, and the ISS was ≤ 3 in 20 patients. In 9 patients with a severe injury, it was $\text{ISS} \geq 9$. Also, 5 (83.3%) of 6 patients hospitalized, all hospitalized in NSC and PSC wards, and 66.7% of those hospitalized in PICU had severe injuries. Of the 15 patients who were consulted, 9 (60%) had severe injuries. The rates of severely injured patients were 37.5% (3/8) and 85.7% (6/7) in orthopedics and pediatric surgery departments, where consultation was requested most frequently. In our study, we saw that patients with high ISS scores were hospitalized and followed up. Despite the identified high ISS, we only observed one death, mainly because most injuries were to the extremities. Although such injuries are common, patients with high ISS should not be abandoned for other damages, and a routine Advanced Trauma

Life Support protocol should be applied.

Carlson et al. determined that most tractor-related injuries (82%) occurred between 06:00 and 17:59 [22]. However, other studies have reported that most agricultural injuries happen in the afternoon and evening [5]. We found that accidents were most frequent on tuesday (n = 8, 25.0%) and between 16:00 and 23:59 (n = 22, 68.8%). The reason why most of the accidents occur in the evening is that the gathered product is transported for storage and the workers are exposed to increased road traffic during this time, and the Pat-pat is also used as a normal means of transport outside of agriculture. To prevent accidents, the public should be made aware of this issue, and the authorities should be more careful in making the necessary administrative decisions and implementation.

Unlike the tractor accidents that increased when planting and garden-field preparation operations were carried out in the spring, most of the Pat-pat incidents occurred in the summer and autumn months. However, Karapolat et al, reported the most frequent hospitalizations after injury was in July, August, and September; Brandenburg et al, stated that the most frequent applications were in July and August [4, 23]. In this study, the Pat-pat accident occurred most frequently in the summer season (n=21, 65.6%) and in July (n=13, 40.6%), especially during the harvest season. This period was compatible with the crop harvest time for our geography. The use of Pat-pat machines for human and material transfer increased during these periods. This seasonal situation was consistent with similar studies conducted in our country [7, 24]. According to the research of Rorat et al, it was determined that 65.8% of the accidents occurred between May and November. This difference has been attributed to the geographical location and climates of the places where the studies were conducted [25]. Information on body areas affected by injury is crucial to identifying and evaluating preventive actions. Akdur et al, noted that the most common injury sites are the upper extremities; Shults et al. reported that the arm-hand and leg-foot were the more common injury sites [21, 26]. Like other studies, we found that the most common types of injuries were extremity fractures and lacerations caused by overturning the Pat-pat. Of the 11 patients with extremity injuries, 9 had additional injuries only in their extremities and 2 in other parts. Agriculturalists should consider working with extremity protective equipment to protect the victim's extremities from damage.

Injuries to the head, chest, abdomen, or spinal cord often result in death in a Pat-pat or tractor-related accident [23, 27]. There was also chest trauma in our ex case. Pat-pat machines have an unbalanced center of gravity and do not have seat belts or a protected structure in case of overturning.

Limitations

We examined only the child casualties of all Pat-pat accidents in our city located in the Western Black Sea region. Besides, some of the injured may have been treated in other medical centers without ever coming to our hospital. Considering that our hospital provides specialist trauma care for serious injuries, we estimate that the number of injuries associated with Pat-pat machines in our area is significantly higher because we only evaluated child injuries and Pat-pat accidents. The casualties who died before admitting

to our hospital were also excluded from the evaluation. Another limitation was the small sample size. The last limitation was that the cost analysis could not be done.

Conclusion

This study showed that the use of Pat-pat is hazardous, especially for children. Appropriate legal regulations; additional engineering work on the mechanics, design, and safety of vehicles; having a license requirement for vehicles can prevent such accidents. Also, parents should be educated to protect children better and raise awareness of children against Pat-pat accidents. For young agricultural workers, it should be an obligation to ensure proper education and job security. Finally, emergency physicians, first responders, and other healthcare providers raise awareness of the dangers and possible consequences of Pat-pat-related injuries, particularly in rural health systems, leading to faster diagnosis-treatment times and more comprehensive care.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

All authors declare no financial support.

Ethical approval

Ethical approval obtained from the Duzce University Ethics Committee (numbered 2020/221; dated 19/10/2020).

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