

MACHINE-RELATED FARM INJURIES IN TURKEY

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Abstract: Traumas connected with agricultural production can result in serious injuries and mortality. The objective of the study was to describe the characteristics of agricultural machines related work injury cases admitted to the Emergency Department, and to assess factors related to injury severity and hospital admission in the Central Anatolian Region of Turkey. All the cases presented related to injuries caused by work with agricultural machines between January 2006–November 2007 were included in the study. Information was collected concerning the demographic structures of the patients. Injury sites, injury types, and clinical features were recorded. Initial injury severity scores of all the cases were diagnosed at hospital admission. 91.9% of the cases were male. Mean age was 35.8 ± 17.0 . The most common machine causing injuries was a tractor with 46% of cases, and all of these were fall traumas. 18.9% of the cases was considered as slight injury, 43.2% as moderate, and 37.9% as severe. Two male cases resulted in fatality. Our findings suggest that tractors are the most dangerous agricultural machines, and falls from tractors as the most common injury mechanism among machine-related injuries, especially for young people. In the rural areas of our country, Turkey, agricultural machines cause serious injuries that require hospitalization.

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INTRODUCTION

Traumatic injuries related to agricultural production can lead to serious disability and even mortality [1]. Apart from North America, Western Europe and Australia, there are only a few studies on the prevention and characteristics of these injuries [6, 12, 19]. In countries where such injuries are identified, it is considered to be among the leading causes of disability and mortality [8]. In America, injury risk for people working in agriculture (52/100.000) is stated to be higher than that of workers in the mining and building industries [13, 14, 16]. According to data of the Turkish Statistical Institute for 2007, there are approximately 4,000,000 registered agricultural machines and implements in Turkey [21]. 30% of the overall population work in agricultural activities [22]. This rate rises to around 50% in our region [22]. Despite such a high rate of agricultural activities, there are no medical data on occupational diseases in this industry (according to the

PubMed 2009 review). The current paper is the first study that investigates the cases presented to an Emergency Department in Turkey due to injuries related to work with agricultural machines. We aimed to underscore the importance of these injuries, outline preventive measures by describing the kind of lesion, such as injury severity, mechanism, site, as well as age, gender, fatalities, and hospitalization rates.

MATERIALS AND METHODS

The present prospective study was performed in the Emergency Department of the University Hospital, located in the Central Anatolian Region of Turkey, and recognized as the specialist hospital department of the region for trauma patients, and serves approximately 4,000,000 people. This region is known to be an area where people working in the agriculture industry constitute a considerable proportion of the community [23].

All the cases that presented with injuries connected with working on agricultural machines between January 2006–November 2007 were included in the study. The consent of the Ethics Committee of the Medicine School in the University, was obtained for the study (01/254). A predesigned form for people presenting with injuries related to work on agricultural machines was filled out by a senior emergency resident working in the Trauma Division of the Emergency Department. Injuries related to agricultural animals were not included in the study. Information was collected concerning the demographic characteristics of the patients, such as age and gender. Data on injury type, injury mechanism, and the part of the machines that caused the accident, were obtained from the patients themselves where available, and from the witnesses of the accidents when patients were not conscious.

Injury sites, injury types, and clinical examination were recorded. Initial injury severity scores (ISS) of all the cases were calculated on admission. Accordingly, cases were split into 3 groups. Those with an ISS score ≤ 3 were considered slight, cases with $4 \leq \text{ISS} \leq 8$ were acknowledged to have moderate severity, and those with $\text{ISS} \geq 9$ were recognized as severe injuries [17]. Data were recorded and analyzed by SPSS 10.0.

RESULTS

During a period of 23 months, 41 cases presented to the Emergency Department due to an injury connected at work with agricultural machines. Four of those cases were excluded from the study because of insufficient data. Thirty four (91.9%) of the cases were male. Mean age was 35.8 ± 17.0 , 29.7% of the cases were between the ages 20–29. All the injured women were below 29 years of age, and the machines causing the injuries in all these cases were tractors. Twenty six (70.3%) of the injured patients were brought to our Emergency Department by ambulance.

The most common machine causing injury was a tractor in 17 cases (46%), and all injuries associated with a work on tractor were found to be the result of falls. Fourteen (82.3%) persons in these cases were extra riders. Two (11.8%) persons were working on the machines. One person (5.9%) was pedestrian. Agricultural machines as causes of injury are shown in Table 1. The relationship between agricultural machines and injury severity, age, and injury types are shown in Tables 2, 3 and 4.

Twenty (54%) of the injured were not operators, but consisted of passengers and helpers.

The most commonly encountered injury sites were the upper extremities in 21 (56.7%) cases, and they head-neck region in 8 (21.6%) cases (Fig. 1). Eight (21.6%) cases demonstrated multiple injury sites. 37% of the injuries were fractures, 27% amputations, 10.8% crush injuries, and 10.8% lacerations (Tab. 2). Fractures were to the radius-ulna in 5 cases, metacarpal-phalanx in 3 cases, humerus in 2 cases, tibia-fibula in 2 cases, and femur neck in 2 cases. Amputations were at fingers in 7 cases, forearm in

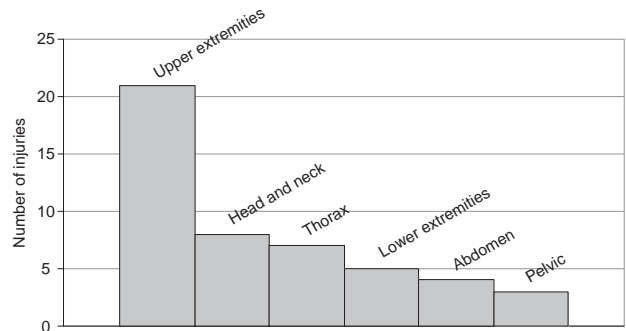


Figure 1. Affected body regions.

Table 1. Distribution of injuries by type of agricultural implement used by victims.

Machines	%	Cases (n)
Tractor	46	17
Haymaker	24.3	9
Auger	10.8	4
Harvester	8.1	3
Seeder	5.4	2
Other (stone picker, harrow)	5.4	2

Table 2. Distribution of machine-caused injury according to injury types.

Injury	Tractor	Haymaker	Auger	Harvester	Seeder	Other*	Percent	Cases
	n	n	n	n	n	n		
Fracture	7	2	2	1	1	1	37.9	14
Amputation	3	4	1	1	–	1	27.0	10
Crushing	2	2	–	–	–	–	10.8	4
Laceration	2	1	–	–	1	–	10.8	4
Multiple trauma	2	–	–	–	–	–	5.4	2
Sprain	–	–	1	–	–	–	2.7	1
Avulsion	–	–	–	1	–	–	2.7	1
Dislocation	1	–	–	–	–	–	2.7	1
Total	17	9	4	3	2	2	100	37

Table 3. Distribution of machines types causing injury according to injury severity.

Machines	Injury severity			Total cases
	Slight cases	Moderate cases	Severe cases	
	n (%)	n (%)	n (%)	
Tractor	3 (17.6)	6 (35.3)	8 (47.1)	17
Haymaker	2 (22.2)	5 (55.6)	2 (22.2)	9
Auger	1 (25)	2 (50)	1 (25)	4
Harvester	–	2 (66.7)	1 (33.3)	3
Seeder	1 (50)	–	1 (50)	2
Other*	–	1 (50)	1 (50)	2

2 cases and ankle in one case. In one case, the patient had an avulsion on the forearm.

While 54.1% of cases were discharged following treatment in the Emergency Department, 45.9% were hospitalized. 11.8% of the admitted cases were female (Tab. 5). Most of these cases were comprised of individuals between the ages of 20–39. 66.7% of injured females and 44.1% of injured males required hospitalization. Two male cases resulted in fatality. One of them was a 65-year-old patient with a crush injury to the head-neck, thorax, and upper extremity, exhibiting a trauma severity score of 57. The other was a 63-year-old case with a crush injury to the head-neck and thorax, demonstrating a trauma severity score of 41.

Mean ISS score for all the cases was 13.3 ± 15.4 . As 7 (18.9%) of the cases had a slight injury (ISS score ≤ 3), 16 (43.2%) had moderate ($4 \leq \text{ISS} \leq 8$), and 14 (37.9%) had severe (ISS ≥ 9) injuries. The relationship between injury severity, age, gender and hospitalization are shown in Tables 6 and 7.

DISCUSSION

In Turkey, 34% of the working population are involved in the agriculture industry [3]. Hence, it is a must to comprehensively identify and study risk factors in agricultural accidents. Agricultural machines are dangerous and the slightest mistake can lead to serious injuries with devastating outcomes. In the present study, our results indicate that agricultural machines cause serious injuries to rural workers in Central Anatolia Region of Turkey.

In the current study, the majority of the cases were males aged between 20–39. The most common machine causing injury was a tractor. The underlying reason for all the injuries associated with tractors, was falls. In some studies, augers have been reported to cause several injuries [2, 18, 25]. Tractors are the most common agricultural machines in our region. Tractors without any protective gear or cabins lead to injuries due to the presence of more than one worker, using them as a means for human transportation, and rough roads. Other reasons contributing to the occurrence of these accidents are especially carelessness, tiredness after work, and the inappropriateness of tractors for transporting people. Tractors should not be used for transporting people and seating placed on wheels must be designed to be safe. A study examining the accidents with agricultural machinery in terms of their costs, also revealed a high rate of tractor accidents in Turkey [7]. Most of the data we obtained are consistent with those in other reported studies [4, 6].

One study showed that only 50% of agricultural injuries were presented to Emergency Departments [10]. Hence, some of the injured people may have been treated in other medical centers without ever visiting our hospital. Considering the fact that our hospital is an institution providing specialist trauma care for serious injuries, we intimate that the real number of injuries associated with agricultural

Table 4. Distribution of machines types causing injury according to age groups.

Age (years)	Machines types					
	Tractor	Haymaker	Auger	Harvester	Seeder	Other*
	n	n	n	n	n	n
0–9	1	–	–	–	–	–
10–19	2	1	1	–	–	–
20–29	5	3	2	1	–	–
30–39	3	2	1	1	1	1
40–49	2	1	–	–	–	–
50–59	1	1	–	1	–	–
60–69	3	1	–	–	1	–
≥ 70	–	–	–	–	–	1
Total (N)	17	9	4	3	2	2

*Stone picker, harrow.

Table 5. Gender distribution of cases admitted to the hospital and treated on an outpatient basis.

	Hospital admission		Outpatient treatment		Total
	n	%	n	%	
Male	15	44.1	19	55.9	34
Female	2	66.7	1	33.3	3

Table 6. Age and hospital admittance distribution of injury severity.

Age (years)	Injury severity					
	Slight		Moderate		Severe	
	n	%	n	%	n	%
0–9	–	–	–	–	1	100
10–19	–	–	2	50	2	50
20–29	3	27.3	6	54.5	2	18.2
30–39	1	11.1	5	55.6	3	33.3
40–49	1	33.3	1	33.3	1	33.3
50–59	–	–	2	66.7	1	33.3
60–69	2	40	–	–	3	60
≥ 70	–	–	–	–	1	100
Hospital admission	–	–	5	29.4	12	70.6

Table 7. Gender distribution of injury severity.

		Injury severity		
		Slight	Moderate	Severe
Male	Cases (n)	7	14	13
	%	20.6	41.2	38.2
Female	Cases (n)	–	2	1
	%	–	66.7	33.3

machines is considerably higher in our region. Our study has particular importance due to the fact that it is the first investigation supplying data on the characteristics of such injuries in our region.

Unlike others, agriculture is a particular industry in which people of all ages in a family participate [9, 11]. There is no legislation regulating this issue. Hence, the age range of people injured in this industry is considerably wide. Many studies show that young farmers are affected more with non-fatal injuries than older ones, whereas older farmers are more commonly receive fatal accidents [1, 4, 17]. The mortality rate associated with agricultural accidents has been shown to demonstrate a gradual increase above the aged 60 [24]. Our results are consistent with those in the literature. The causes of high mortality among people of advanced ages are probably physiological inefficiencies, unwillingness to decrease experience, and the slowing of reflexes. Delayed medical care and transportation from rural areas are other factors contributing to the overall severe injuries and mortality.

The majority of our cases exhibited a high ISS. Even if we consider that patients with slight injuries may not have presented to the hospital, our results still suggest the stark reality that those machines cause serious injuries which can even lead to fatalities in our region.

The ISS scores of patients admitted to the hospital were high and consistent with the literature, a finding supporting of the belief that it could be adequate for determination of cases to be hospitalized [15, 17]. As the age increases (advanced ages) and decreases (paediatric age group), the admittance rate of injured patients elevates.

We believe the data we obtained on injury severity as well as injury sites, will play a key role in identifying preventive measures. It was remarkable that injuries occurred mostly to the upper extremities, and particularly in the form of fractures and amputations. While biomechanic and ergonomic precautions have an important place in the prevention of industrial accidents, it is certain that they would not matter so much in accidents associated with agricultural machines due to major contributing factors, such as willing to finish a work in the shortest time, exhaustion, and stress [20].

The educational status and incomes of most people working in agriculture is lower in Turkey [3]. There are too few epidemiological studies investigating the potential risk factors of agricultural injuries in our country [5]. Therefore, our results bring to the attention of our government, research institutions, and local administrations, the important role they should play in the prevention of such injuries.

The main limitation of the present study was the inclusion of cases treated only in one medical centre. Although the number of cases appears to be low, we believe that our data should be sufficient to outline the distribution and importance of injuries associated with agricultural machines in our region. We consider our study as a guide for future multicentre studies encompassing longer periods.

CONCLUSION

In performing the present study, we aimed to supply data to a field where there is an evident lack of studies in Turkey, where agricultural machines cause serious injuries that require hospitalization, particularly in the rural areas. Our findings suggest tractors as the most dangerous machines and falls as the most common injury mechanism, especially for young people. All tractors driven by agricultural workers should be fitted with an approved safety cabin, and use safety belts to prevent injuries. Therefore, the regulations concerning the use of agricultural machinery should be reviewed and revised, along with providing regular and adequate education to individuals operating these machines. As a strategy for preventing injury caused by farm-machines, intervention and research programmes which include the participation of healthcare professionals should be started and supported in Turkey. By focusing on these subgroups, regional injury prevention programmes should be initiated.

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