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Lower limb injuries secondary to hoeing machine accidents**Ali Gulec, Fatih Durgut, Ali Ozdemir, Ahmet Yildirim, Bahattin Kerem Aydin***Selçuk University Faculty of Medicine, Department of Orthopaedics and Traumatology, Konya, Turkey*

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Abstract

Agricultural accidents are important for Turkey as more than 20 million people are involved in agriculture. The aim of this study was to evaluate orthopaedic lower limb injuries related to hoeing machine from a trauma centre localized in Middle Anatolia Region. 15 patients who hospitalized for hoeing machine were included to study due to lower limb injuries between April 2012 and May 2017. All the medical records were scanned retrospectively to evaluate “the demographic, epidemiologic characteristics of patients, cause of accidents, type of injury, duration of hospital stay and also hospital costs were evaluated retrospectively”. According to database, fifteen patients were hospitalised for lower limb injuries (14 were male, 1 female). The mean age was 45.2 (19-64) years old. The most frequent injury was tibia fracture (64 %). The mean hospital stay time was 14 days (between 1 and 53). The mean cost was 11.140,16 (500 and 27.115,08) Turkish Liras. The rate of knee dislocation was 26 %. Most prevalent injury was tibia fracture. Simple precautions can be effective for preventing this kind of injuries. Meticulous examination is important as the rate of knee dislocation is high in these types of traumas.

Keywords: Hoeing machine, knee dislocation, agricultural injury, fracture**Introduction**

Agricultural accidents are related to fatal/non-fatal injuries. International Labor Organisation (ILO) reported that nearly half of work related deaths are associated with agricultural injuries (170.000/335.000 deaths) [1].

Advanced researches indicate that agricultural machinery is responsible for most of these accidents [2]. Tractor and other machinery which powered or operated by tractor power take-off such as threshing machine, pulverizator, hoeing machine and combine harvester are commonly held responsible for agricultural injuries [3]. Hoeing machine is one of the commonly used devices in farmery in order to weed cleaning and preparing the soil for planting. Hoeing machine is also named as “Pat Pat” because of its sound. This machine is becoming popular, as it is rather cheap and economic. Although the use of this machine seems to be easy, the operator of this machine has to be very careful due to the configuration of this machine. Accidents and lethal consequences arise in the inadequacy of the security measures.

In English literature, there are limited numbers of orthopaedic papers related to agricultural accidents from Turkey. All of the recent studies were about Black sea region. Selçuk University is one of the main trauma centres of Middle Anatolia Region located in Selçuk University located at the crossroads of main highways and also have a helipad.

In this retrospective study we planned to investigate lower limb traumas secondary to agricultural accidents related to hoeing machine of a single center located at Middle Anatolian Region where agriculture is main source of living.

Material and Methods

This retrospective study was carried out following the approval of local institutional review board. Medical records retrospectively reviewed for patients presenting with lower limb injuries caused by a hoeing machine between April 2012 and May 2017. Patients who were hospitalized in orthopaedics and traumatology department of Selçuk University Hospital. Age, gender, season of accidents, presence of fracture, nerve/vascular damage, additional tissue injury, extent of treatment, number of operations, length of hospital admission, presence of infectious disease state, presence of knee dislocation cost of overall treatment parameters were investigated.

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Results were stated as mean $\pm$ SD. In the data evaluation, the “SPSS” (Statistical Package for Social Sciences) software (Version 16.0; SPSS Inc, Chicago, IL) was used. Regression analysis was used in the evaluation of data with each other and in paired relationships.

Results

15 (1 female, 14 male) patients hospitalized for lower limb injury secondary to hoeing machine accidents. Mean age was 45.2 (19-64 years). 12 patients admitted in spring and 3 patients in autumn. One patient died soon after admission secondary to femoral artery and vein rupture in the operating room. One patient had pelvic fracture. Tibial fracture was diagnosed in 9 patients. Femur fracture was seen in 2 patients. Peroneal nerve injury was diagnosed in 2 patients, tibialis posterior artery injury was seen in one patient.

Amputation was performed in one patient with crush syndrome at below the knee level of left lower limb (amputation rate, 6.6 %). Open wounds in different locations of affected lower limbs were present in 12 of 15 patients (open wound rate, 80%) (Figure 1 a, b). Osteomyelitis occurred in one patient and soft tissue infection was diagnosed in another one. Knee dislocation injury seen in 4 patients (26.6%) of which was bilateral in one patient (Figure 2 a, b). Mean number of operations was 3.07 and number of operations performed for two patients with osteomyelitis and soft tissue infection were 12 and 5 in order. Open wound injuries detected in 11 patients; 7 patients were primarily closed while skin graft needed in 3 cases. In one patient urethra and anus were repaired by urologist. Blood transfusion required in 4 cases, and fresh frozen plasma transfusion was done in 3 cases. Mean length of hospital stay was 14 days and average cost of cases was 2950 USD (11,140.16 TL) (Table 1).

Table 1. Demographic data and injury types

	gender	age	season	knee	additional injury	large bone	medium/ small	infection	operation session	hospital	cost
				dislocation		fracture	bone fracture		number	time	
1	male	19	spring	no	peroneal nerve dysfunction	no	no	no	2	11	2553.0
2	male	24	spring	no	peroneal nerve dysfunction	left femur diaphysis	no	no	4	25	25,228.21
3	male	38	spring	no	extensive soft tissue injury	right femur diaphysis and right tibia diaphysis	right patella	soft tissue	5	25	27,115.08
4	male	56	spring	no	soft tissue injury	tibia plato and pilon	distal fibula	no	3	11	14.000
5	male	62	autumn	bilateral	left lower limb circulatory disorder	no	proximal fibula	no	4	24	19,915.77
6	male	50	spring	no	no	bilateral tibia diaphysis	no	no	1	4	4801.26
7	male	64	autumn	right knee	bilateral lower limb skin cuts	tibia diaphysis	fibula	no	2	9	5343.72
8	male	32	autumn	no	no	tibia diaphysis	distal fibula	osteomyelitis	12	53	25.000
9	male	67	spring	left knee	no	left tibia diaphysis	no	no	5	27	10,554.64
10	male	48	spring	no	raight lower limb open wounds	right tibia diaphysis	no	no	1	3	3831.81
11	male	43	spring	no	left lower limb crash injury	left tibia diaphysis	no	no	1	5	2800
12	male	23	spring	no	no	no	no	no	1	1	1500
13	male	58	spring	no	posterior tibial artery cut	left tibia diaphysis	no	no	1	3	1212.0
14	female	50	spring	no	no	no	no	no	1	3	500
15	male	53	spring	left knee	acl, pcl, mcl, lcl, posterolateral corner	no	no	no	3	13	23041
average		45.8								14.46	11,140.16



Figure 1. Open wound with patient after treatment



Figure 2. Knee dislocation (2a) and vascular injury (2b)

Discussion

Agricultural injuries have significant role on work related mortality and morbidity for all age groups and International Labor Organization (ILO) reported that the highest rate of mortality occurs in developing countries. Agricultural injuries are important cause of serious physical and psychological outcomes and economical burdens [4].

The demographics, mortality rate and admission period were similar with the literature. Von Essen et al. investigated medical records of 294 patients suffered from agricultural machine related injury in North Carolina between 2006-2010 years [5]. Overall mortality rate was 5.1% and most of these cases were emergency (68.4%). Most of the admissions were between April and September which is the period of main farming season in North Carolina. Majority

of the patients (76%) were aged forty years and older and most of the patients were male (89.8%). According to our results 93.3 % of the patients were male and the mortality rate was 6.6%. All of our patients admitted to our department in April and October.

The correlation between age and injury rates were studied in previous studies [6]. Virtanen et al. [7] reported a correlation between only 50-54 age period and higher injury rates. Kogler et al. [8] reported that majority of injured farmers were over 40 years old (86%). Also Marsh et al. [9] stated that farmers/workers aged 65 years and older were at increased risk for machine related mortality and injuries. In our study mean age of patients was 45.28 years and although we could not assume a statistical significance because of small number of patients- older ages can be a risk factor for agricultural injuries. Visual impairment, gait and balance disturbances, osteoporosis, slowing of reaction time are all age related physiological changes and can lead accidents in farmers.

According to our results hoe machine injuries are rare in female gender (6.6 %). This is similar with previous studies [10,8].

Kogler et al. [8] showed that most of agricultural accidents occurred in summer months which is also the primary harvest season in Turkey. But in our study 12 accidents were occurred in spring and 3 in autumn. In contrast to machines used for harvesting, hoeing machines are used in spring and autumn, which are appropriate seasons for hoeing the soil. So injuries related with hoeing machine occur in these seasons.

Machines like hoeing machine or power-driven cultivators can cause serious lower extremity injuries that can result in amputation, severe nerve/vessel damages and death [11]. In our study open wounds, dysfunction of peroneal nerve, arterial injury and femur, tibia, patella or fibula fractures were diagnosed and subsequently treated, only one patient was suffered from crush injury and amputation was performed for this case.

Soft tissue infection was another problem for agricultural injuries. In our case series, due to infectious state of the patients, multiple surgical operations were performed. Mean hospital stay is also tends to be longer in patients with infections. In our study mean hospital stay was 14 days, however for the infected cases mean length of hospital stay was 53 days, respectively.

Knee dislocation is one of the important injuries about lower limb traumas. Knee dislocation can be overlooked during first examination in emergency settings however experienced orthopaedics can easily diagnose the dislocation. Also nerve injury/rupture with or without vascular trauma can accompany osteoarticular lesions. Previously Baque et al. [12] reported posterior dislocation of knee in 10 of 23 injured limbs following accidents related with power-driven cultivators. In our study we diagnosed 4 cases of knee dislocation (one bilateral, others are unilateral). As it is a very serious clinical condition, diagnosing the knee dislocation is really important. An extensive and careful first examination in the emergency department helps to identify the diagnosis and the magnitude of injury [13,14]. Because of possible vascular damage, blood loss, large tissue injury which can cause crush syndrome, a patient with lower limb injury caused by hoeing machine has to be urgently transported to medical center after doing first aid requirements.

There are also some limitations of our study. One of them is the small number of the patients included in the study. Only including the lower extremity injuries, which require hospitalization, is another limitation. But up to now, there is not any published study about Middle Anatolia Region where most of the people deal with agriculture.

Severity of lower extremity injuries caused by agricultural machinery is important. These injuries can be decreased with simple preventing precautions. Urgent transportation to a trauma center, careful physical and radiological examination in emergency room carefully, especially for open wounds, nerve/vascular damages are crucial for better clinical outcomes. It is important to remember that the rate of knee dislocation rate is high in such injuries.

Conclusion

Most prevalent injury was tibia fracture. Simple precautions can be effective for preventing this kind of injuries. Meticulous examination is important as the rate of knee dislocation is high in these types of traumas.

Competing interests

The authors declare that they have no competing interest

Financial Disclosure

The financial support for this study was provided by the investigators themselves.

Ethical approval

Before the study, permissions were obtained from local ethical committee.

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