An Unknown Cause of Agricultural Accidents: Hoeing Machine

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Abstract

Aim: The aim of this study was to evaluate the tragic hoeing machine accidents that result in many limb amputations and disability.

Materials and Methods: Ten patients, who were admitted to the emergency department (ED) of Inonu University between March 2012 and September 2016 because of hoeing machine accidents, were examined retrospectively.

Results: During the 4-year period, 10 patients were admitted to the ED because of a hoeing machine accident. All of them were male. The mean age of patients was 41.3 years, and one patient was a child (12 years). The accidents occured in the spring and summer season, mostly in the afternoon (90%). The mean of the time spent in the ED was 91.9 min, and the mean of the hospitalization period was 32.6 days. The patients had many subtotal amputations or open fractures. All the patients were operated on by orthopedic surgeons. Limb amputation was performed in 4 patients. None of the patients died, but many of them were permanently disabled.

Conclusion: Hoeing machine accidents can cause serious lower-extremity injuries. The accidents occur mainly because of the misuse of machines by farmers. To prevent these accidents, farmers must use the machine according to the manufacturer's instructions, and the patients should be admitted to well-equipped trauma centers.

Keywords: Hoeing machine, emergency medicine, agricultural accidents, amputation

Introduction

The agricultural sector is the second greatest source of employment worldwide, and more than a third of the world's labor force is employed in it (1). In developed countries, farming activities are mostly performed by machines, but in developing countries, they are still performed manually (2). According to the International Labour Organization (ILO) statistics, 1.3 billion people are employed in the agricultural sector. A considerable number of laborers are exposed to work accidents and develop occupational diseases with approximately 170.000 deaths annually. The European Union Statistics Office (Eurostat) have determined the agricultural sector as the second most dangerous sector, following the construction sector (3). Across Europe, the number of fatal accidents in the agricultural sector is higher than those in any other industry, except in the construction industry, where it is comparably high, although it continuously declines (4).
The machines and equipments used in this sector are the main cause of the agricultural accidents. Tractors, tillage machines and their

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equipments, planting machines, fertilizer mixer machines, hoeing machines, and harvesting machines are mainly encountered machines (5). According to some studies conducted in America, tractors cause 75% of the agricultural accidents and one-third of the fatal accidents in this sector (6). Similar results were seen in other studies (7, 8).

Hoeing machine structurally looks like an all-terrain vehicle (ATV) and is commonly used for farming activities in Malatya, a city in the east of Turkey This vehicle has 2 separate structures; the main part is an engine and the other part is a trailer or another agricultural equipment that changes with the purpose. For example, it can be used for transportation of people or loads, the expulsion of fields, planting, spraying activities, and removal of water from the soil after adding different equipments to the machine (9). Some farmers add the disks to the machines and form hoeing machines for digging land (Figure 1). These machines are used widely in Malatya region where the study was carried out. . Therefore, the accidents caused by these machines are frequent.

In the present study, we aimed to evaluate demographic parameters, clinical characteristics, treatments, and outcomes of hoeing machine accidents.

Figure 1. Hoeing machine

Materials and Methods

We retropectively examined the patients admitted to Inonu University medical school Emergency Department (ED) between March 2012 and September 2016, with a history of injury caused by a hoeing machine. The study was initiated upon approval of Inonu University Clinical Research ethics committee (approval no: 2016/84). All data were recorded on standard forms and studied in detail with regard to the patient's age, gender, accident time, emergency department (ED) admission time, the manner in which patients arrived at the arrival, vital signs, types of injuries, treatment variations, waiting period in emergency service, hospitalization duration, and hospitalization department.

Statistical analysis

Data analysis was performed with the statistical software (Statistical Package for the Social Sciences for Windows, Version 16.0, SPSS Inc.; Chicago, IL, USA). Descriptive statistics were reported including means±standard deviations (SD), and percentages. Percentages were rounded.

Results

During the period of 4 years, 10 patients were admitted to the ED because of hoeing machine accidents. All patients were male. The mean age of the patients was 41.3±21.5 years (range 12 to 67). All of the accidents occurred in spring and summer except one, which occurred in the autumn. Of these, 3 accidents occured in the morning and others in the afernoon. Seven patients were transported to the hospital from the accident location, and the rest of them were referred from the state hospital. The 3 cases (Number 3, 7, and 10) that were referred from the state hospital lost more time after the accident compared with those that directly arrived to our hospital. The mean of the time spent in the emergency service was 91.9±28.7 min (range 41 to 135). The mean of the hospitalization duration was 32.6±26.9 days (range: 5-85). Allthe patients were conscious, but tachycardic and hypotensive mostly because of the bleeding caused by vascular injuries (Table 1).

Table 1. Characteristics of 10 patients admitted to emergency service

	Age	Gender	Arrival Duration (min)	Emergency Service Duration (min)	Hosptitalization Duration (days)	Month	Manner of Arrival
1	28	M	160	135	69	May	Direct
2	67	M	120	71	85	April	Direct
3	24	M	186	107	14	July	Referred
4	62	M	63	41	31	March	Direct
5	63	M	60	52	30	October	Direct
6	66	M	60	94	42	March	Direct
7	18	M	240	105	8	July	Referred
8	31	M	70	100	35	May	Direct
9	12	M	110	110	5	April	Direct
10	42	M	345	104	7	June	Referred

Min: minutes; M: male; Direct: directly from accident place; Referred: from the State hospital

Table 2. Clinical characteristics and operations of patients

Lesion		Operation
1 Left femur subtotal amputation and right femur open fracture	ICU	Left leg amputation
	Orthopedics	Right leg open reduction internal fixation
2 Right femur total amputation and left femur open fracture	ICU	Right leg amputation
	Orthopedics	Left open reduction internal fixation
3 Right tibia- fibula open fracture	Orthopedics	Open reduction internal fixation
4 Right femur subtotal amputation and left foot crush injury	ICU	Right leg amputation
	Orthopedics	
5 Bilateral tibia-fibula open fracture	ICU	Open reduction internal fixation
	Orthopedics	
6 Right tibia-fibula open fracture	Orthopedics	Open reduction internal fixation
7 Left tibia-fibula open fracture	Orthopedics	Left leg amputation
8 Right tibia-fibula open fracture	Orthopedics	Open reduction internal fixation
9 Right tibia-fibula open fracture and left femur fracture	Orthopedics	Open reduction internal fixation
10 Rightfoot open fracture	Orthopedics	Open reduction internal fixation

ICU: intensive care unit

The patients mostly arrived to the emergency service with the part of the machine embedded in the limbs. We did not remove any of the machine parts, and this maneuver was performed in the operating room. In the emergency service, we monitored the patients for hemodynamics, opened 2 large bore vascular lines, and started saline infusion according to Advanced Trauma Life Support (ATLS) The blood samples (for performing tests such as complete blood count, biochemistry, and blood group type) were taken and erythrocyte suspensions were prepared. Tetanus prophylaxis was done and the first dose of antibiotics (cefazolin, ornidazole, gentamicin) was administered. At the same time, the removal of soil and dirt was done and irrigation was lightly performed.

The patients generally had developed injuries in both lower extremities. One patient (Number 2) had total femoral amputation, and 2 patients (Number 1 and 4) had subtotal femoral amputation. The others mostly suffered from open fractures and crush injuries. All the patients were referred to the orthopedics department and hospitalized for surgery. In the operating room, first, the machine parts were removed. The open reduction internal fixation procedure was done for fractures. Amputations were performed in 4 patients (Number 1, 2, 4, and 7). The vascular surgeon managed the arterial and venous damages with orthopedics. The cutanous and subcutanous tissues were repaired regularly. After the surgery, the patients were hospitalized in the intensive care unit. They were referred to the orthopedic service following extubation and after becoming stable hemodynamically. In the orthopedic service, they were followed up, wounds were routinely dressed, and received suitable medications. Some of the patients needed another operation and the surgery performed afterwards. None of the patients died, and all of them were discharged from the hospital, but unfortunately most of them remained disabled (Table 2).

Discussion

We determined that the hoeing machine accidents are a definite reason of morbidity because of the high number of lower-extremity amputations and a long convalescent period. In this study, 4 patients were subjected to leg amputations, and the rest of them had long recovery periods and also expectedly long absence from work. None of the patients lost their lives. In similar studies about the agricultural accidents, extremity injuries and substantial amount of amputations were also seen (4, 10, 11). In the present study, we found that the farmers misused the manual gas pedal of their hoeing machines while they were digging the land. Normally, the machine moves and digs the land after the gas pedal is compressed by the farmer. If the farmer wants to stop, they apply the pedal, and the machine immediately stops at that point. But in Malatya region, farmers tie the pedal by a rope to work nonstop for a long time, and with less fatigue of hands. If the farmer falls accidentally, the disks of machine catch and pull in the farmer's feet. After that, the disks start to grind the legs, and this goes on until somebody comes and stops the machine by cutting the rope or in some other way. Therefore, we see numerous tragic lower-extremity injuries caused by these accidents.

In the present study, nearly all the cases (90%) had lower-extremity open fractures. According to literature, these fractures can be accurately assessed in the operating room. Wide-spectrum antibiotics administration, tetanus prophlaxis, and irrigation should be performed in the emergency room promptly, because of a high risk of infection (12, 13). We irrigated the wounds, started the antibiotic therapy in the emergency service, and then sent the patients to

the operating room without delay. The surgeons reevaluated the fractures, irrigated the wound suitably, and removed the foreign materials. The fractures were then reducted and fixated properly. The surgery was performed after the closure of subcutaneous and cutanous tissue.

We determined the latest follow-up time in the ED as 135 min, the earliest as 41 min, and the average for all cases as 91.9 min. Additionally, the longest hospitalization time was 85 days, the shortest time was 5 days, and the average of all cases was 32.6 days. In a similar study (9), the follow-up time in ED was 366 min, and the hospitalization period was 13.2 days. In another study (14), the hospitalization period was 17.1 days. We had a shorter follow-up time in the ED than that in similar studies, because our hospital is a trauma center which has a respectable and experienced team. The average hospitalization period of our patients was longer because of the numerous open fractures and the necessity of repeated surgery.

The average age of the patients in our study was 41.3 years. An England-based study about the agricultural accidents showed that the age groups of 25-35 and 35-45 years were the most exposed to accidents (15). In an Austrian study, it was seen that 67% of patients were older than 40 years (4). Akdur et al. (10) found the average age to be 35.8 years. In our study, half of the patients were over 40 years. Additionally, a patient (Number 9) was a 12-year-old child. According to ILO statistics, the highest rate of child labor (59%) is seen in the agricultural sector (16). The farming activities are done with contribution from all family members. Therefore, child labor in the agricultural sector will continue to be an important global problem.

The accidents predominantly occurred in spring and summer and 70% of the accidents occured in the afternoon. The results of the other studies regarding the agricultural accidents agree with ours (4, 9, 14). There is no specific working time for farming activities, and faemers work from sunrise to sunset.

They get exhausted by afternoon, so most of the accidents occur during that time. All the casualties arrived to our hospital by emergency medical service The patients who were referred to other hospitals and then to our hospital, lost a lot of time. All the cases were hospitalized in the orthopedics service and operated properly.

Study limitations

The main limitation of the study was an insufficient number of patients. If the study is repeated with a higher number of patients and prospectively, more comprehensive conclusions can be drawn.

Conclusion

Hoeing machine accidents do not result in death. But they freqently cause disability because of injuries in the extremeties and a substantial number of amputations. The main cause of these accidents is an inappropriate use of machines, so the farmers should be educated about the machine usage according to manufacturer's instructions. Additionally, the victims of these accidents must be transferred to well-equipped hospitals to avoid losingtime. Thus, the number of these tragic accidents and their effectscan be minimized.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of İnönü University School of Medicine (approval no: 2016/84).

Informed Consent: The informed consent form was signed by all of the patients who participated in this study.

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