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Original Research Article

A clinical and epidemiological study of upper limb injuries resulting from agricultural accidents

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ABSTRACT

Background: Agriculture remains the most important occupation in India and upper limb injuries occur frequently in agricultural accidents. Agriculture related injuries are important causes of mortality and morbidity in all age groups. These injuries result in major physical and psychological impacts as well as economical burdens. Objectives of the study was to study the pattern and epidemiological basis of agricultural hand injuries, to analyse the prognosis and recovery pattern of agricultural hand injuries in terms of return to work following treatment and to suggest measures for prevention of agricultural hand injuries.
Methods: The study was a descriptive study conducted in the department of plastic and reconstructive surgery, Thanjavur medical college from October 2012 to April 2017. About 220 patients admitted with agricultural upper limb injuries were evaluated. Data on age, sex, injury patterns, anatomical localizations, injury season, length of stay in the hospital, and infections were evaluated.
Results: Agricultural upper limb injuries constituted about 11.25% of total upper extremity trauma. Males were more commonly affected than females. Majority of the patients were in the age group 21-50. Most of the patients were right handed individuals. Hand injuries were more common (73%).
Conclusions: We can reduce agricultural upper limb injuries by shielding the rotating components of farming machinery that cause injuries, informing and educating farming families, forbidding the entrance of children to areas with agricultural machines, providing information about agricultural accidents and their prevention methods, and adjusting the working hours of farming personnel, especially in the hottest months of the year.

Keywords: Agricultural injuries, Economic burden, Hand injuries

INTRODUCTION

India represents about 10% (225 million) of the total world workforce in agriculture.[1] Agricultural work-related injury can be defined as an acute injury that occurs while doing farm work or travelling to or from work. Agricultural upper limb injuries are important causes of mortality and morbidity for all age groups. These injuries result in major physical and psychological impacts as well as economical burdens. Agriculture as an occupation depends on many factors which include perception skills as well as the ability to perform complex and repetitive tasks, and it is one of the most hazardous vocations.[2]

The integration of these skills influences a persons' ability to work safely in the farm workplace, and deterioration of any of these skills may increase the risk of injury.[3] There is a great variety of agriculture

accidents, and this spectrum of injuries consists of simple lacerations to traumatic amputations. Farming accidents depend not only on human factors but also environmental and machinery factors.[4] Because of high morbidity of agricultural upper limb injuries, an epidemiological analysis is necessary to implement strict protocols and conduct prevention programs for public health awareness.

The objectives of this study were aimed to focus on (1) the types and incidences of upper limb injuries due to agricultural accidents (2) the severity of these injuries, (3) description of the treatment required especially for infection and possibility of amputation and (4) outcome of treatment and successful return to work or resumption of prior work capacity.

METHODS

A descriptive study was conducted in the department of plastic and reconstructive surgery, Thanjavur Medical College from October 2012 to April 2017. About 220 patients admitted with agricultural upper limb injuries were evaluated. Data on age, sex, injury patterns, anatomical localizations, injury season, length of stay in the hospital, and infections were evaluated. The main inclusion criterion of the study group was upper extremity trauma necessitating operative intervention, which had happened in the farmyard. Isolated skull, maxillofacial, spine, thorax and abdominal injuries were excluded from the study as well as farm animal bites, agricultural chemicals, and dust and airborne toxin hazards.

Detailed history was taken on the mode of injury, time of injury, time since injury and hospital admission. The patients were subjected to general and local examination to assess the nature of injury and the need for surgical intervention. Assessment of the nature of injury included skin, soft tissue laceration/loss, tendon injury, nerve injury, vascular injury, bony injury, the viability of the distal part and wound contamination. Laboratory investigations, X-ray of hand and doppler study in suspected cases of vascular injury were done.

Wound wash and debridement was done under anaesthesia. Fractures were fixed. Other soft tissue repairs were done according to the nature of injury. Limb was kept in elevation. From the infected wound, pus was taken and sent for culture and sensitivity. Daily saline dressing was done.

Patients were evaluated on alternative days. Sutures were removed on 10th postoperative day. Patients were evaluated with the following parameters-wound healing, wound infection, functional deficit, return to work and psychological satisfaction. Scores were given for - Functional improvements-2 points, Return to work-2 points, Aesthetical-2 points. Scores: 5-6 good results, 3-4 satisfactory, and < 3 poor results. Data's been collected, analyzed statistically, the results obtained, conclusions were derived from the results.

RESULTS

Out of the total number of 1955 hand injuries admitted in the hospital between October 2012 and April 2017, 220 patients were admitted due to agricultural hand injuries (11.25 %) (Table 1).

Table 1: Prevalence of agricultural hand injuries.

No. of hand injuries	No. of agricultural hand injuries	Percentage
1955	220	11.25%

Figure 1: Common agricultural hand tools.

Most of the injuries were due to sharp agricultural hand tools (Figure 1). The common machinery injuries were due to paddy thresher, ground nut thresher, rice polishing machine, oil seeds grinder, coir machine, sugarcane juice machine and tractor accidents (Figure 2).

Figure 2: Machinery tools.

Table 2: Age and sex distribution.

Age in years	No. of cases		Total	Percentage
	Male	Female		
0-12	12	3	15	6.82
13-20	24	-	24	10.91
21-50	125	33	158	71.82
above 50	23	-	23	10.45

Table 3: Pattern of agricultural hand injuries.

Site of injury	No. of cases	
	Right hand	Left hand
Finger	70	98
Mid palmar	02	08
Wrist	05	14
Forearm	11	12

The age of the injured patients ranged from 4years to 65years. Majority of the patients were in the age group 21-50 (Table 2). Males were more commonly affected in agricultural hand injuries (83.64%). Most of the patients were right handed individuals. The cut injuries were more in the left hand. Machinery injuries were prevalent on the right side. 27% patients had right handed injuries and 73% had left handed injuries (Figure 3).

Figure 3: Little figure injury.

Finger injuries (76.36%) were the commonest type of agricultural hand injuries (Table 3). Among them left sided injuries were more common than right sided injuries (Figure 4). Most of the finger injuries were common in the thumb and index finger (Table 4).

Figure 4: Thumb injury.

Table 4: Pattern of injuries in fingers.

Fingers	Right	Left	Total
Thumb	12	32	44
Index	26	31	57
Mid finger	9	9	18
Ring finger	4	14	18
Little finger	11	20	31

From January to March 80 patients with agricultural hand injuries were treated. 108 patients were treated for agricultural hand injuries between April and June. About 85.45% patients had treatment for agricultural hand injuries between January and June (Table 5). Maximum number of cases was recorded in first quarter of the year corresponding to peak harvest period.

Cut injuries were more common with cutting palm fruit, and tender coconut. They had seasonal variation with peak in summer. Wood cutting was the second most common cause of agriculture related hand injuries.

Table 5: Period of injury.

Period of occurrence	No. of cases	Percentage
January-March	80	36.36%
April-June	108	49.09%
July-September	14	6.36%
October-December	18	8.18%

Table 6: Types of machines causing agricultural hand injuries.

Machines	No. of cases
Paddy machine	33
Sugar cane machine	24
Coir machine	05
Coconut powder machine	03
Tractor crush	01
Oil engine and hand pump	04

Paddy machine injuries were the commonest cause followed by sugar cane machine, coir machine, coconut powder machine, tractor crush, oil engine and hand pump (Table 6). About 61 % of patients got admitted within 12 hours and 39 % after 12 hours or later. About 38 patients had treatment after 24 hours and infection rate was more among these (Table 7).

Table 7: Time of hospitalization after injury.

Time of admission	No. of cases
Within 6 hours	55
6-12 hours	79
12-24 hours	48
More than 24 hours	38

Table 8: Mode of treatment.

Mode of treatment	No. of cases
Groin flap	26
Hypo gastric flap	11
Posterior interosseous artery flap	1
Cross finger flap	18
Litter's flap	1
V-Y flap	14
Kutler's flap	2
Moberg flap	1
Primary skin Suture	70
Skin graft	12
K-wire fixation	12
Buddy's and other splint	6
Tendon repair	24
Repositioning	5
Vascular repair	1
Nerve repair	3
Shortening closure	12
Amputation	1

Patients were treated with K-wire fixation, various flaps, nerve repair, tendon repair and shortening and closure (Table 8). Groin flap, Cross finger flap, V-Y advancement, skin grafting and primary skin closure were the treatment modalities adopted for the wound coverage (Figure 5).

Figure 5: Flap reconstruction.

Table 9: Postoperative complications.

Complications	No. of cases
Edema	35
Wound infection	42
Skin necrosis	17
Suture dehiscence	5
Partial flap necrosis	2
Stiffness in hand and finger	29

Postoperative complications included oedema, wound infection and skin necrosis (Table 9). Staph. aureus, Pseudomonas and Klebsiella were the organisms isolated from the infected wounds. About 29 patients had stiffness of hand and fingers. Prolonged physiotherapy helped these patients to recover from the stiffness.

Table 10: Return to routine work.

Duration	No. of cases	Percentage
3-6 weeks	62	28.18%
7-10 weeks	74	33.64%
11-16 weeks	40	18.18%
16 weeks and above	44	20%

About 80% patients returned to work between 3½ to 4 months. The remaining patients who had multiple fractures, wound infection, joint stiffness and secondary procedures needed prolonged time to recover (Table 10).

DISCUSSION

India has over 640,000 villages and represents about 10% (225 million) of the total world workforce in agriculture. Sharecroppers, tenants and the landless laborer constitute the primary workforce.[5] Crop production involves seedbed preparation, sowing, planting, weeding, harvesting, threshing, livestock and materials handling, tools and machinery operation and maintenance, fertilizer and pesticide application, water lifting and irrigation, crop processing, storage and transport, and other jobs.

Agriculture related hand injuries are due to man, machine, crop, toxic chemicals or environmental factors. Most of the injuries occur while working with spades, sickles, manual and power operated chaff cutters, bullock carts, tractors and diesel engines. The primary events of farm incidents (fatal and non-fatal) are (a) entanglement of loose garment, hair or limbs, in moving machines, (b) cut with hand tools, (c) fall from tractors or into wells, (d) run over by tractor, (e) overturning of tractor, (f) hit by moving machine parts or falling objects, (g) snakebites, (h) electrocution due to live electric wires, etc.

The tractor run over incidents are (i) the tractor operator or the extra rider falls off the tractor, and (ii) a person already on the ground (children playing around the farmstead) is run over by the tractor. A very high incidence of grain thresher accidents has been reported from the southern India (41.85 accidents/1,000 threshers/year.

Agricultural hand injuries are common in young and elderly members of the family.[6] In our study majority of the patients were in the age group 21-50 years. Most of the agriculture related injuries are experienced by males.[7] In our study 83.64% patients were males.

Due to the time-dependent nature of the farming activities like harvesting, farmers may work for long hours causing fatigue and carelessness which may lead to serious accidents.[8] There may be a seasonal dispersion pattern of the farm injuries depending on the harvesting time. Richter et al.[8] noticed in their study that January and February are the slow months for farmers. Our study revealed 85.45% patients had treatment for agricultural hand injuries between January and June. Maximum number of cases was recorded in first quarter of the year corresponding to peak harvest period.

Open fractures are associated with an increased risk of infection and healing complications.[9] Hartling et al. stated that open wounds to an upper limb were the most common reason for admission to a hospital.[10] In a study by Hansen 45% of the injuries involved the upper extremity, and 45% of these injuries were traumatic amputations and lacerations.[11] Infection in a wound delays healing, causes wound breakdown, and increases trauma care and treatment costs.[12] In our study Staph. aureus, Pseudomonas and Klebsiella were the organisms isolated from the infected wounds.

Management of agricultural hand injuries includes expedient administration of antibiotics, tetanus prophylaxis, wound debridement and delayed wound closure.[13] Due to the high microbiological load and high incidence of crush-type injuries, repetitive debridement and long duration of hospital stay are needed. Hospitalization time should be minimized as much as possible, to limit secondary infections. This can be managed by aggressive initial debridement to reduce hospital stay and reduce the risk of secondary infection.

Most farm accidents and fatalities involve machinery. Proper machine guarding and equipment maintenance can help prevent accidents.[14] An accident-prevention strategy must take into consideration issues regarding the high-risk times.[15] High impact of farm accidents ends with physical and emotional disability.

CONCLUSION

Agricultural upper limb injuries can be reduced by shielding the rotating components of farming machinery that cause injuries, informing and educating farming families, forbidding the entrance of children to areas with agricultural machines, providing information about agricultural accidents and their prevention methods, and adjusting the working hours of farming personnel, especially in the hottest months of the year.

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