

Original Research Article

Mixer grinder fingertip injuries and treatment outcome in a rural based tertiary center: a retrospective study

Deepak Hongaiah*, Abhilash, Dharmendra Kumar, Vijay Kumar S.

Department of Plastic Surgery, SDUMC, Tamaka, Kolar, Karnataka, India

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***Correspondence:**

Dr. Deepak Hongaiah,

E-mail: drdeepakh@gmail.com

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ABSTRACT

Background: Early morning mixer grinder fingertip injuries is encountered predominantly in females. Most of these injuries happened due to improper use of the grinder like keeping hands into the mixer when still the blades on run immediately after switching off the machine and sometimes during washing the jar. It can lead to injury of either single or multiple finger and either at single or multiple levels. Early wound debridement and reconstruction is essential for good functional outcome, prevention of the deformity and to achieve good cosmesis. The objective of the study was to classify the mixer grinder fingertip injuries and to assess treatment outcome of different type of mixer grinder fingertip injuries.

Methods: This is a retrospective study involving 12 patients over a period of 2 years. Data was collected from the previous records and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

Results: In the present study most common age group involved is between 26 and 30 years (66.7%) with female predominance and most common hand involved was right hand. D3 involved most frequently and at multiple levels. Most of them were treated under wrist block followed by digital block with very good short term and long term outcome.

Conclusions: The treatment of the fingertip injuries should be aimed at preserving the length of the digit by giving adequate wound debridement and primary suturing/flap reconstruction when possible to provide soft-tissue coverage with protective sensation at a minimum.

Keywords: Fingertip injury, Mixer grinder injury, Treatment outcome

INTRODUCTION

The most common mode of injury to the hand is trauma¹. This trauma can be of different type like crush injuries due to machines at work place, road traffic accident, mixer grinder injury etc². Mixer grinder injury is one of the household injuries which can be encountered in routine practice. The most common cause for such injury is improper use of the mixer grinder i.e. using the machine without going through the operative manuals, accidental injury when patient put their hands in the

running machine etc. The injuries in grinding machine are usually incised wound due to sharp blade which involves deep incised wounds to complete amputation of the fingertip³. Many classifications are there to classify fingertip injury like Allen's classification. Types of fingertip amputations:

- Type A- Dorsal oblique,
- Type B- Transverse,
- Type C- Volar oblique.

Allen’s classification of fingertip injury^{4,5}

- Type I- Involving pulp only
- Type II- Involving pulp and nail bed
- Type III- Involving distal phalanx fracture with pulp and nail bed
- Type IV- Involving lanula, distal phalanx fracture, pulp and nail bed.

The purpose of this study to assess the type of fingertip injuries and to offer the surgical management as per standard protocol and to assess the treatment outcome. The objective of the study was to classify the mixer grinder fingertip injuries and to asses treatment outcome of different type of mixer grinder fingertip injuries.

METHODS

All patients presented with mixer grinder fingertip injury treated in the Department of Plastic Surgery of R.L. JALAPPA Hospital between the study period of November 2016 and October 2018. In this study 12 patients were included in the study span of 2 years. The following patients included in the study- 1) patients who sustained fingertip injury by mixer grinder and 2) age between 12 years and 60 years. Patients who sustained hand injury by other mode of trauma were excluded from the study.

Method of collection of data

All the patients satisfying the inclusion criteria and treated in the department of Plastic Surgery, R L Jalappa Hospital were included. Their records were taken out from the MRD section after taking proper permission and the POF were analysed and recorded as per standard proforma and patient were followed up to assess functional outcome of hand.

Statistical analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.¹³⁻¹⁶

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

In the study majority of subjects were in the age group 26 to 30 years (66.7%), majority were females (75%) and majority were house wives (41.7%) (Figure 1). Most of

the patients were right hand dominant comprising of 83.3% and left hand dominant constitute of 16.7% of the study subjects. In 75% of subjects injured hand was right hand and in 25% left hand was injured. In the study D3 was the single most finger involved i.e. in 8 subjects, second most common finger injured was D2 in 7 subjects. 6 subjects had multiple fingers injured (Figure 2). Most common level of injury was level II and III in 5 subjects respectively (Figure 3).

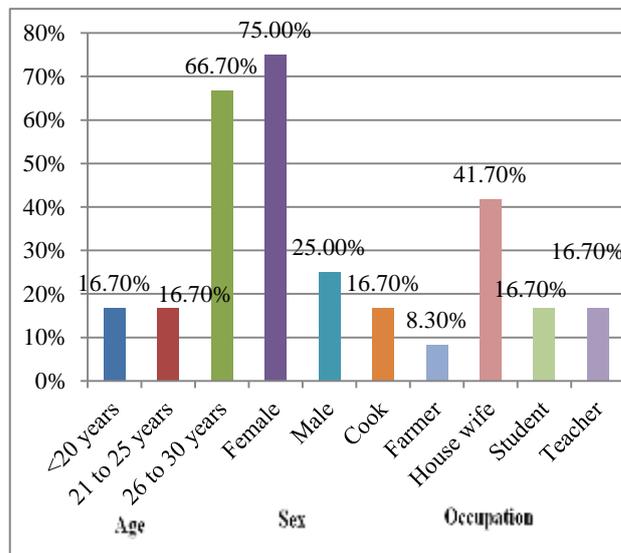


Figure 1: General profile of subjects.

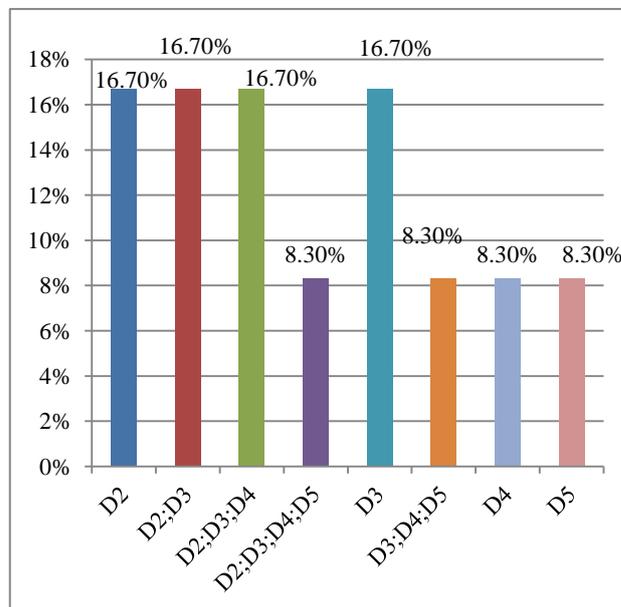


Figure 2: Fingers injured among subjects.

Majority of subjects had deep laceration at D3 (41.7%), nail bed injury at D3 (50%). In the study 16.7% had D2, 8.3% had D3 and D4 partial amputation respectively. 8.3% had near total amputation at D2, D3 and D5 respectively. 16.7% had D4 (Type C), 8.3% had D2

(Type B), D3 (Type A) and D4 (Type C) total amputation respectively.

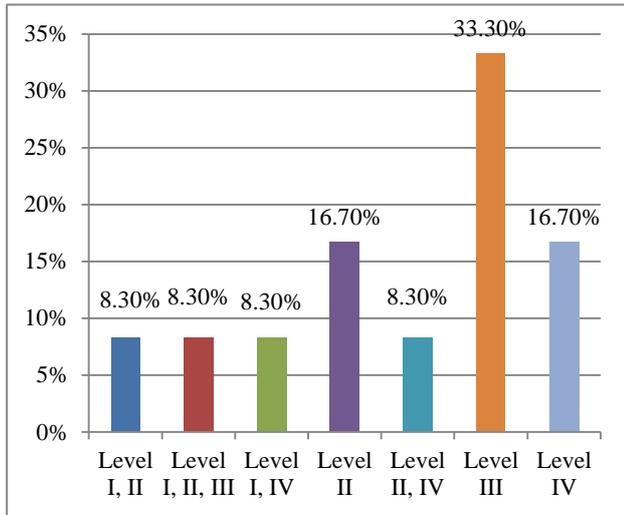


Figure 3: Level of injury among subjects.

Procedure done: Subjects underwent suturing (25%), 16.7% underwent VY advancement, fillet flap, nail bed repair respectively and 8.3% had ext tendon repair, oblique VY flap and staged procedure.

Short term outcome: This study 25% had delayed sensation, 66.7% had regained sensation and 8.3% had normal sensation. 83.3% had minimal joint stiffness, 100% had minimal scar tenderness, 100% had edema and 16.7% had delayed healing (Figure 4).

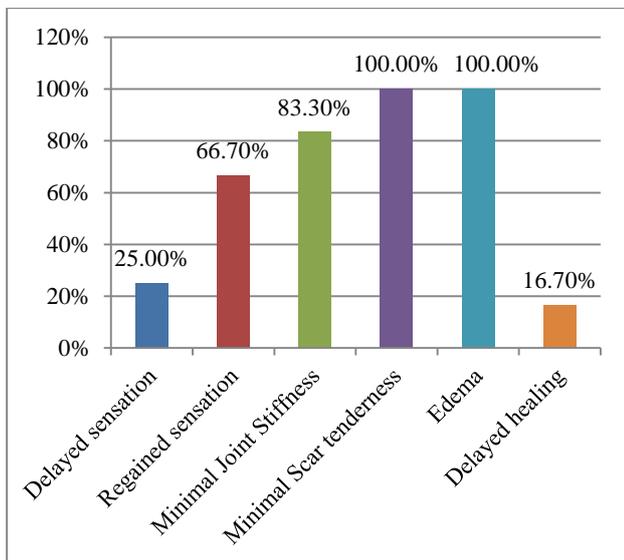


Figure 4: Short term outcome.

Long term outcome: This study had 25% minimal contracture. 16.7% had D2 and D3 shortening of finger respectively, 25% had D4 shortening of finger (Figure 5). Median SF36 score was 88 (Table 1).

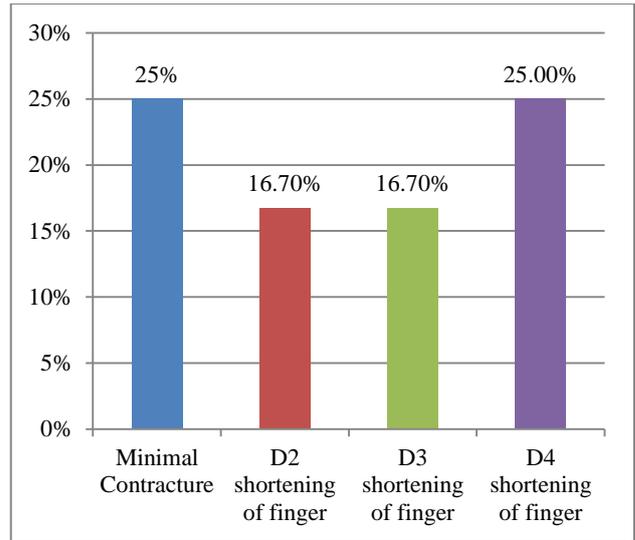


Figure 5: Long term outcome.

Table 1: SF36 distribution.

| SF36 | | | | | |
|------|-------|-------|--------|---------|---------|
| N | Mean | SD | Median | Minimum | Maximum |
| 12 | 88.42 | 2.234 | 88.00 | 85 | 92 |

DISCUSSION

Fingertip injuries are one of the common injuries encountered in emergency room. The most common cause for such injury is road traffic accident and most of the time patient presents with crush injury. Other mode of injury includes finger injuries secondary to machines at work place, road traffic accident, mixer grinder injury, assault etc.

Very few literature are available for fingertip injuries due to mixer grinder incidents. As these injuries may lead to significant deformity and/or loss of function, we intend to do this retrospective study.

Most of these fingertip injuries were encountered in the early morning, when the patient in a hurry (for school/college/office etc.) accidentally put their hand directly in the mixer grinder without turning it off. In our study, 75% of the patients were female (9 out of 12) and 25% were male (3 out of 12). Most commonly injured hand was right hand (75%) because of right hand dominance in majority of the patients which is similar to the study done by Yousuf H et al where 64.1% right hands were involved.⁶

In the study majority of subjects were in the age group 26 to 30 years (66.7%), majority were females (75%) and majority were house wives (41.7%). This finding is inconsistent with other series in which the average age was less than 25 years.⁷⁻¹⁰

In the study most of the patients were right hand dominant comprising of 83.3% and left hand dominant constitute of 16.7% of the study subjects. In 75% of subjects injured hand was right hand and in 25% left hand was injured. The report of hand injuries by Beaton and colleagues showed results similar to ours, where right-hand are dominant by 97.2% with sustained injuries more common than left-hand injuries.¹¹

In the study by Yousuf et al, grinder was the most common cause of hand injury among named machines (36.8%).⁶ This was not the finding of other investigators, who rarely reported grinder injuries to the hand.^{7,10,12} In the study D3 was the single most finger involved i.e. in 8 subjects, second most common finger injured was D2 in 7 subjects. 6 subjects had multiple fingers injured. Finger injuries accounted for almost 83% of cases and mainly seen in middle index and thumb and these are the common used fingers during grinding.¹³

Several classifications are available to classify the fingertip injuries like Allen's classification. Management of the fingertip injuries depends upon several factors like type and severity of the injuries, size and shape of the defect, tendon and bone cover, age, sex, dominant function and cosmesis. The main goals of the treatment includes preservation of useful sensation, maximizing functional length, preventing joint contractures, providing satisfactory cosmesis with minimal functional loss.

The most important aspect in any form of injury is thorough wound wash with normal saline and examination to look for the viability of the finger. After providing appropriate and adequate analgesia (digital nerve block), thorough cleaning with copious saline solution and debridement of all non-viable tissue is to be performed. Debridement of the nail bed is avoided to prevent any scarring adhesions and nail deformity. Dressing in both surgical and conservatively treated fingertip injuries must be non-adherent to granulation tissue and semi occlusive while maintaining moist wound surface to promote healing. Simple laceration without skin loss of the fingertip injuries are sutured in emergency department with nonabsorbable monofilament sutures and it is removed on 7 to 10 days (Figure 6 and Figure 7). The wound should be protected for 6 weeks.¹⁷ Primary closure in tip amputation provides the advantage of sensation but tight closure will result in flexion deformity, finger stiffness and cold sensitivity.¹⁸ Small defects less than 1 cm² of the pulp without bone exposure can be treated with non-adherent dressing.¹⁷ The wound heals by secondary intention with scar formation.¹⁹ The healing process takes 3-6 weeks and it is effective in children and adults with minimal tissue loss and well vascularized surrounding tissue.¹⁹⁻²⁰ The disadvantages are delay in returning to work, chance of infection, scarring and pulp's soft tissue loss.¹⁴ Wounds larger than 1 cm² where bone or tendon are not exposed, split or full thickness graft can be used. The advantage being faster wound healing, less chances of cold sensitivity, no need

for shortening of bone but has some complication of donor site scarring, loss of pulp contour, paraesthesia.²¹



Figure 6: Laceration at single level for which wound debridement with primary suturing was done.



Figure 7: Deep lacerated wound at the multiple level and post primary suturing picture.

Local flaps are a good choice in traumatic amputation of the fingertip with exposed vital structures like tendon, nerve and bone. The plane of amputation and the

condition of the tissue at the injury site determine the best repair technique for these injuries. The V-Y plasty technique is used to repair amputations with dorsal or transverse planes as shown in Figure 8.²² The V-Y plasty advancement flap technique is used when the injury leaves more pulp than nail bed. The V-Y plasty technique preserves the normal sensation, contours of dorsal finger and helps pad the fingertip.²³ The major disadvantage of local flaps is limitation in length of advancement and size of the flap.



Figure 8: Transverse amputation for which VY advancement flap was done.



Figure 9: Partial amputation with nail bed injury and nail bed repair.

Cross finger flap is good option if the local flap is not available. Lee et al in his study comparing innervated

cross finger flap with non-innervated cross finger flap concluded that sensory and two point discrimination was better in innervated cross finger flap.²⁴ Island flaps are fine instruments, technically demanding and time consuming, has the disadvantage of second procedure for to donor wound, finger stiffness, sacrificing major artery of the finger, hypersensitivity at the grafted donor area and unsatisfactory appearance.²⁵ For larger defects that cannot be approximated by direct closure and local flaps, distant flaps like abdominal and groin flaps are used. These flaps require multiple operations and prolonged immobilization. However, free flaps using the tissues of the plantar area and the toes is preferred in cases with large defects and in cases that need reconstruction of finger nails.²⁵

The integrity of the nail bed is important for proper formation of smooth, uniform and compact nail.²⁶ An intact nail is important for normal functioning of fingertip as nail provides dorsal support for delicate functions of fingertip.²⁶ Loup magnification (4X) should be used to repair nail bed laceration to prevent nail abnormalities as shown in Figure 9. Wherever possible the nail plate if clean, should be preserved. The nail not only acts as splint for associated distal phalanx fracture but also allows the nail bed to remodel anatomically. Occasionally, large defects of the nail bed require split-thickness graft from an uninjured area of nail bed or from the second toe. In some fingertip injuries revision amputation is preferable to allow tension-free closure of the soft tissues and adequate padding in an effort to minimize recovery time and hasten return to work.

CONCLUSION

The treatment of fingertip injuries are complex due to the variety of injury patterns and many number of different surgical treatment options. Treatment of fingertip injuries has to be individualized to each patient by taking into consideration the patients age, sex, co-morbid medical illness, profession, hand dominance, digit injured, mode of injury, configuration and size of the defect to get best clinical outcomes.

Management of the fingertip injuries should be aimed at preserving the length of the digit when possible and providing soft-tissue coverage with protective sensation at a minimum. Injuries involving the nail bed, attention must be given to the nail bed to prevent cosmetically unappealing and painful nail deformities. Patients should be counselled on the high likelihood of cold intolerance, scar tenderness and nail deformity despite adequate treatment.

After tip reconstructive surgery, splintage of the involved finger for 2-3 weeks should be considered for early and safe recovery. All nail bed lacerations need to be meticulously repaired using 6-0/7-0 absorbable sutures under loupe magnification.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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