Research Article

Alarming Incidence of Paediatric Hand Injuries Due to Domestic Donkey Pump: A Preventable Public Healthcare Issue

Moeez Fatima, Faisal Akhlaq Ali Khan, Maryam Noor

[1-3] *Department of Plastic & Reconstructive Surgery, Dow University of Health Sciences & Dr. Ruth KM Pfau Civil Hospital Karachi, Pakistan*

Abstract

Background: Donkey pumps are commonly used in Pakistan households to pump water but are open the cause of hand injuries especially in children. This article aims to highlight the alarming incidence of such injuries leading to crippled hand in children.

Methodology: This retrospective study was conducted at one the busiest tertiary care hospitals, Civil Hospital, Karachi, from July 2017 to January 2020, by reviewing the medical records of patients. All children, less than 14 years old, who present with hand trauma due to donkey pump in ER or OPD were included. Gender, hand dominance, type of injury, number of involved fingers, and presence of any fracture or tendon injury were recorded. Data analysis was done with SPSS 22.0.

Results: A total of 147 children presented with hand injury due to donkey pumps. 105 (71.42%) were boys and 42 (28.5%) were girls. 75.4 % were right-handed and 24.5 % were left-hand dominant. Most frequent was the involvement of single-digit. Regarding injury pattern, severyl crushed fingers were present in 36.7% of injuries. Fingertip injury without any fracture was present in 22.4%, 34.7% had an injury to distal phalanx with tuft fracture, 6.1% of injuries involved middle and proximal phalanx with fracture. All cases were accidental in nature.

Conclusion: Domestic Donkey Pumps cause an alarming incidence of hand injuries in children, which can be prevented by ensuring these pumps are safe for household use.

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Corresponding Author | Dr. Moeez Fatima, Fellow, Department of Plastic & Reconstructive Surgery, Dow University of Health Sciences & Dr. Ruth KM Pfau Civil Hospital Karachi, Pakistan; Cell: +92 336 0396173, **E-mail:** dr.moeezfatima@outlook.com

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Introduction

The innate response of a child to touch or grasp things that intrigue him may offer assistance in early learning and development but this innocent concern in some cases may end up injuring the child. Consequently, hand injuries are a common presentation in paediatric emergencies.[1] These may be in the form of fingertip injury, subungual injury, bites, lacerations, fractures, burns, etc. Hand fractures account for 15% of all paediatric fractures, and 2.3% of emergency visits.[2,3] Some of these injuries have the potential to cause permanent deformities and life-long implications such as scar contracture, removal of the nail, or restriction of growth of the hand even when the injuries were trivial events.[4,5]

Water is probably God's greatest bounty, and a necessity for life. However, due to exploitation, water resources are depleting rapidly. Pakistan is also facing a water shortage problem for last several years.[6] The repercussion of this is the installation of domestic donkey pumps in many households throughout the country

Donkey pump works on the principle of electric powered motor which, with the help of a belt rotates a wheel. The wheel is connected to the suction body by a shaft. The rotation of the wheel rotates the suction body and sucks water from the well or tank. Figure 1 shows the

shape of a donkey pump which is present in markets and conventionally used in homes. There are no proper safety mechanism in the pumps, in that there is no covering of the wheel, belt or motor, and they are open. Children usually get attracted to rotating wheel and poke fingers in it or try to grab the wheel. Hence unfortunately, these donkey pumps become a source of severe paediatric hand injuries, as shown in figure 2.

Managing pediatric hand injuries can be more challenging as compared to adult injuries owing to factors like the presence of open physis, lack of patient compliance[1], and a shorter time window for intervention[2,7]. Another noteworthy impediment confronted by our country is the absolute shortage of properly trained hand surgeons. Moreover, they are mostly available in major cities[8]. Therefore, the majority of children present late, and are often already operated upon by non-specialists, further complicating the situation.

Together these factors make it difficult for us to restore the functionality of the hand. Hence, critical evaluation, appropriate primary care, and timely referral are of paramount importance to optimize outcomes. Nevertheless, the prevention of such evitable injuries should be the first goal. Due to the non-availability of data in Pakistan with such types of injuries, our study can be a reference that can be used by the public and private sectors for awareness and prevention of these injuries.

Figure 1: *A Donkey Pump*

Figure 2: *Trauma to right hand of a 3 years old child. Fracture was reduced and splintage was done. Bony fixation was avoided due to doubtful vascularity of finger. 4th day after revascularization shows bright red bleeding from needle prick*

Methodology

This descriptive retrospective study was conducted at Dr. Ruth K.M. Pfau, Civil Hospital Karachi's plastic surgery unit. The record was searched for the children aged 1 – 14 years who presented with hand injury secondary to domestic donkey pump from July 2017 to January 2020. The following data variables were extracted from the records: patient's age, gender, dominant and non-dominant hand involvement, number of digits involved, soft tissue involvement, and associated fractures. Some patients visited the emergency department directly while some were referred from other clinics or hospitals after primary care or failed treatment. Statistical analyses of data were performed using IBM SPSS ver. 22.0 for Windows.

Results

A total of 147 children presented with hand injury due to domestic donkey pump during this time period. Amongst them 105 (71.42%) were boys and 42 (28.5%) were girls. Most patients were right hand dominant (75.5%), whereas few were left hand dominant (24.5%). The majority of the injuries involved the dominant hand (82.3%) with injury to the non-dominant hand seen in 17.7% as shown in table 1.

Table 1: *Pattern of injury according to hand dominance*

	Frequency	Percent
Right hand dominant	111	75.5
Left hand dominant	36	24.5
Injury of dominant hand	121	82.3
Injury of non-dominant hand	26	17.7

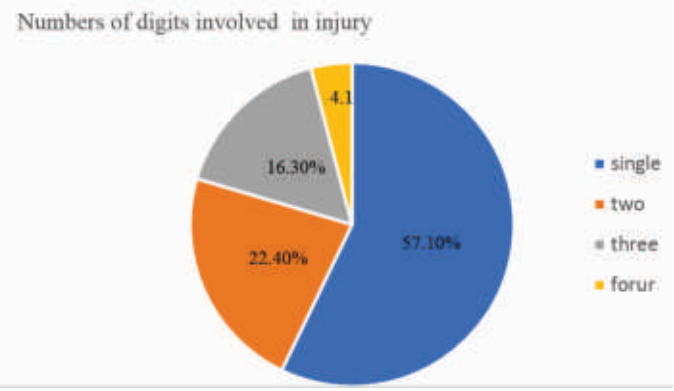

Figure 3 *shows pie-chart that illustrates that 1 digit was involved in most injuries 57.1%, 2 digits were*

involved in 22.4%, 3 digits were involved in 16.3% and 4 digits were injured in 4.1% of the patients.

Injury to the number of digits differed amongst the patients. The frequency of single-digit involvement was most common (n=84), whereas a gradual decrease in frequency of two, three- and four-digit injury was seen with no injury involving all five digits as shown in figure 3.

Table 2: *Extent of Injury*

	Frequency	Percentage
Injury to Fingertip without any fracture	33	22.4
Injury to Distal Phalanx with Tuft Fracture	51	34.7
Injury involving middle and proximal phalanx with fracture	9	6.1
Severely crushed fingers	54	36.7
Total	147	100.0

Discussion

Children due to their innate curiosity to touch and grab objects in their surroundings are susceptible to a wide spectrum of injuries. Lawn mowers,[9] treadmills,[10] sports,[11] and burns[12] can cause injuries to children at home. Up to the best of our knowledge, no data is available on domestic donkey pump injuries in children locally or internationally. In developed countries, the likely reason for this is because such pumps are not used at home.

The huge number of patients presenting specifically with donkey pump injury is alarming, considering this is over a short span of just 30 months. The majority of patients who presented with this type of injury were males and this is similar to other studies conducted.[13,14]

Being a tertiary care unit with well-trained hand specialists, the majority of these patients recovered well. Our treatment protocol was bookish in the majority of these children. Injury to Fingertip without any fracture was managed with primary closure in case of availability of soft tissues. Where there was soft tissue loss, the wounds were managed conservatively with daily dressings with very good results due to the excellent healing capacity of the pediatric population.[15]

For those who had an injury to the distal phalanx with tuft fracture, the management plan was based on the soft tissue availability. If enough soft tissue was present then a simple k-wire fixation was done. If there was soft tissue loss along with fracture then the defect was covered with various flaps and the fracture was fixed using a K-wire.This is standard management for such of injuries.[16] Once K-wires were in place, they were protected with a cast or brace at all times, and removed in 3-4 weeks. We observed that in injuries involving fractures of middle and proximal phalanx, majority of the fractures were displaced, due to the impact of trauma and young age. Priority was closed reduction and fixation with K wire.

Crush injuries often have unfavourable functional outcomes. Unfortunately they are a common injury pattern seen with donkey pumps. 54 children presented with severely crushed fingers in our study. Out of these, we were able to save only 18 fingers that functioned properly, 21 were saved without any significant functional restoration and 15 ended up with amputation.

Those who present with tendon injury recovered well with none of them requiring further surgery for functional improvement. These results are similar to the study by Grobbelaar,[17] but different from Fitoussi et al who reported tendon rupture in 9% of their study population, especially in the very young children with a short postoperative immobilization.[18]

The vast majority of our patients suffered from an injury on the dominant hand which is also seen in almost every study done on the relationship between hand dominance and hand trauma.[13,14,19]

Our main focus was to highlight the very high incidence of such injuries in children so that we can make some recommendations for the prevention of accidental events. We do realize that donkey pumps might be a necessity in our country but we should make them safe for use by following the recommendations given below:

1. Every donkey pump should be fully covered.
2. Every pump should be installed with sensors that make them immediately stop in case of entrapment of anything in its belt.
3. There must be written warning signs about hazards it can cause especially to children.
4. Pumps should not be installed in the areas where they are easily accessible to children.
5. Government should also take immediate measures to overcome water shortage.
6. Government should pass a law and ban sellers who don't obey these recommendations.

Conclusion

Hand trauma with domestic donkey pump has an alarmingly high incidence, with younger male children being especially at risk. The trauma is often severe

enough to cause amputation of involved digits. Prevention by way of safety and protection measures should be developed, and advertisements regarding the danger of domestic donkey pumps should be considered.

Conflict of interest *None*

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