

High Voltage Electrical Injuries of Hand in Children Following Misuse of a Stainless Steel Wiper

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ABSTRACT

Objective: To determine the association of common home floor wiper made up of stainless steel in high voltage electrical injuries of hand in children and to suggest solution for its prevention.

Study Design: Descriptive / case series study

Place and Duration of Study: This study was conducted at the Burns & Plastic Surgery Centre, Hayatabad Medical Complex Peshawar from April 2016 to October 2018.

Materials and Methods: This descriptive case series study was carried out on 15 children \leq than 12 years who presented with high voltage electrical injury to the hand. Cases were admitted and resuscitated in emergency departments and further treated in a specialized hand unit. Thorough history including type and mechanism of injury was taken and examination findings were recorded. Photographs of the involved hand and wrist were taken and the parents were counseled for multi-stage operation.

Results: There were 11 male and 4 female patients with an average age of 8.5 years. In all cases, mechanism of injury was contact of stainless steel wiper by the children with high tension electrical transmission lines while playing on roof top. In 4 cases, emergency faciotomy was performed somewhere else while in the remaining 11 cases, proper faciotomy of forearm and hand was performed by the primary surgeon. Hand involvements were 12 cases on the right and 3 cases on the left sides. Main procedures carried out were serial debridement (average 4 per patient), groin and abdominal flap coverage (13 patients), median and ulnar nerve grafting (9 patients), tendon transfers for median and ulnar nerves (11 patients), arthrodesis of wrist and CMC joints (4 Patients) and amputation (2 patients). The total span of treatment for reconstruction was on average 18 to 24 months.

Conclusion: In our series, we found out that use of floor stainless steel wiper is the major cause of high voltage electrical injuries in pediatric population while playing on rooftop. It is recommended that use of stainless steel wiper should be discouraged and may be replaced by rubber and plastic or wood wipers to decrease the incidence of high voltage trauma. Also the bare electrical transmission lines should be insulated by plastic or rubber pipes when they run near to the roof top or boundary walls.

Key Words: Voltage, Electrical injury, debridement, grafting

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INTRODUCTION

Electrical injuries are one of the most common causes of occupational deaths with incidence of 0.05% among all occupational deaths^{1,2}.

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Reported electrical burns admissions in burn centers are reported to vary from 0.04-32%^{1,3}. Although high voltage burns commonly occur in the occupational settings, in our country, a large number of domestic cases of high voltage electrical burns are on the rise⁴.

The inner cities of Pakistan are densely populated areas with very old buildings. High voltage electrical lines often cross over the roof tops of these buildings. One of the common causes of the high voltage electrical injuries is exposure to these electrical lines over the roof tops. In the previous few years, a lot of patients have presented to us with high voltage electrical injuries. The common mechanism of injury was accidentally touching the metal rods of cleaning wipers with the electric power lines. The metal rods are used to get the clothes off the drying lines. It is also used by kids to dislodge flying kites stuck in the nearby trees.

In these injuries the hand is primary organ that is damaged by the high voltage current. Our aim is to

focus on these injuries and to find out what kind of hand injuries occur because of high voltage electrical current.

MATERIALS AND METHODS

This descriptive case series study was carried out at Burns & Plastic Surgery Centre, Hayatabad Medical Complex, Peshawar, from April 2016 to October 2018. Patients with age less than 12 years who sustained hand injuries due to high voltage electric current were included in this case series. Cases were admitted and resuscitated in emergency departments and further treated in a specialized hand clinic. Thorough history including type and mechanism of injury was taken and

examination findings were recorded. Photographs of the involved hand and wrist were taken and the parents were counseled for multi-stage operations.

RESULTS

There were 11 male and 4 female patients with an average age of 8.5 years. In all cases, mechanism of injury was contact of stainless steel wiper by the children with high tension electrical transmission lines while playing on roof top. In 4 cases, emergency fasciotomy was performed somewhere else while in the remaining 11 cases, proper fasciotomy of forearm and hand was performed by the primary surgeon.



Figure No.1: High voltage electrical injury caused by stainless steel wipers in three different children



Figure 2 (a) Common stainless steel wiper

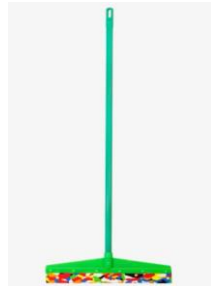


Figure 2 (b): Plastic floor cleaning wiper

Hand involvements were 12 cases on the right and 3 cases on the left sides. Main procedures carried out were serial debridement (average 4 per patient), groin and abdominal flap coverage (13 patients), median and ulnar nerve grafting (9 patients), tendon transfers (11 patients), arthrodesis of wrist and CMC joints (4 Patients) and amputations (2 patients). The total span of treatment for reconstruction was on average 18 to 24 months.

DISCUSSION

High voltage electrical burns are grave injuries. The recovery is long and protracted and may require aggressive debridement⁵. High voltage electrical injuries (HVEI) in children put them at high risk of amputation⁵. We did amputations in 13% of total cases.

Due to HVEI, the damage to the underlying tissue is greater than the findings on clinical examination. The patient may need immediate escharotomy or fasciotomy at the time of presentation⁶. Deep muscle compartments must be released to achieve optimal blood flow to the hand⁷. Skin coverage is the next important step after initial treatment and debridement. We mostly used groin flap and abdominal flaps to cover the skin defects of the hand. Some centers use the groin and abdominal flaps while some have reported using them along-side the free flaps to cover larger defects^{8, 9}. A simple free tissue transfer is also commonly reported in the literature and is becoming the mainstay of treatment^{10, 11}. One study reported the use of Metriderm with skin graft for soft tissue defect of hand¹². The benefit of this technique is that it is a single stage procedure with less donor site morbidity.

Most of our patients needed a nerve graft. Literature has reported loss of neuronal function even in low voltage injuries¹³. Patients with loss of nerve function lose sensations and function of intrinsic muscles of the hand. This presents a bleak picture for future recovery of the hand function. Post-operative physiotherapy is important in these patients and may help recover some functions¹⁴.

The recovery of children with high voltage electrical injuries (HVEI) has a long course and the outcome is usually sub-optimal¹⁴. Public education campaigns, public safety and safe living environments has reduced incidence of such injuries over time¹⁵. There is also a

decrease in the incidence of amputations in such injuries due to better treatment options¹⁵.

CONCLUSION

In our series, we found out that use of floor stainless steel wiper by the children while playing on rooftop is the major cause of high voltage electrical injuries in pediatric population. It is recommended that use of stainless steel wiper should be discouraged and may be replaced by rubber and plastic or wood wipers to decrease the incidence of high voltage trauma. Also the bare electrical transmission lines should be insulated by plastic or rubber pipes when they run near to the roof top or boundary walls.

Author's Contribution:

Concept & Design of Study: Firdous Khan
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 Revisiting Critically: Muhammad Shadman
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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