IRON BURNS: A PROBLEM IN ADULTS AS WELL AS CHILDREN

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SUMMARY. Burns from domestic irons are potentially preventable injuries which can result in significant morbidity. Several studies have reported these injuries in children but there are no reports to date in adults. Epidemiology, management and outcome of these injuries is described, and possible preventative strategies are discussed. We present a retrospective case note review of 50 adult and paediatric patients with electric iron burns. Cases were identified from data collected for a national burns database. Information regarding demographics, burn characteristics, treatment and long term outcome was gathered from the medical records. 42 children and 8 adults sustained a burn from an iron during the 4-year study period. The majority of paediatric patients were under 4 years of age. Most burns were small (<1% TBSA) but despite this 30 (60%) patients were admitted to hospital and 13 (26%) required at least one surgical procedure. In children, most burns occurred at home and were commonly due to pulling the flex or knocking the iron from its surface. In adults, 50% of injuries were associated with epilepsy. Burns from domestic irons are relatively common and cause significant morbidity despite their small size. A bimodal presentation is seen with injuries occurring either before the age of 4 years or during adulthood, when they are typically associated with an underlying medical condition. Education campaigns and design features such as a retractable cord may further reduce the incidence of this type of burn.

Keywords: contact burns, epidemiology, prevention, adult, paediatric

Introduction

Burns from domestic electric irons are a potentially preventable injury which can result in considerable morbidity. Surface temperatures of electric irons can reach in excess of 200°C, meaning that contact for even brief periods can cause a significant thermal injury. Several previous studies have described contact burns from irons in paediatric populations and have discussed various methods of preventing these injuries. Despite educational campaigns, the incidence and pattern of this type of injury does not appear to be changing significantly and therefore more attention is now being focussed on safety modifications of the appliances.

Although studies to date have been limited to iron burns in children, this type of injury can also be seen in adults. This study describes 50 consecutive adult and paediatric patients who were treated for injuries sustained due to contact with an electric iron. We aim to describe the different pattern of injuries in adults and children as well as reviewing contributing factors and the treatment and outcome of these patients.

Materials and methods

All paediatric and adult patients with a contact burn from an electric iron who were referred from the Emergency Department to a regional burns centre over a 4-year period were included in the study. Patients were identified from data routinely collected within the department for the British Isles Burn Injury Database (BIBID). Information regarding demographics, burn characteristics, treatment and outcome was gathered from a retrospective review of the medical records.

Results

Patient characteristics and contributing factors

42 children and 8 adults received treatment for a burn caused by an electric iron during the study period. Most paediatric patients were under 4 years of age with an average age of 25.4 months and a male:female ratio of 1.6:1. Only one paediatric patient was aged over 4 years; a 14 year old boy who sustained a contact burn whilst under the influence of alcohol. Adult patients had an average age of 34.5 years (range 19-48 years) with equal numbers of male and female patients.

In the paediatric population most burns occurred in the home and were commonly due to pulling on the flex or knocking the iron from its surface. Inadequate supervision or ironing on low surfaces contributed to the injury in 38% of cases. In at least a quarter of cases the iron had been switched off prior to the injury occurring but the child was...
still able to come into contact with the hot surface of the cooling iron. Non accidental injury was suspected and investigated in 13 cases (31%) but was not confirmed in any of these cases. In adults, all injuries occurred in the patient’s own home and were frequently associated with an underlying medical condition. 50% of injuries were associated with epileptic seizures and all of these injuries resulted in full thickness burns requiring excision and grafting. The remaining cases were due to collapse, accidental contact or assault.

Treatment and outcome

The majority of burns in both children and adults were small and measured less than 1% Total Body Surface Area (TBSA) but despite this 30 patients (60%) required hospital admission for either social or medical reasons and 13 (26%) required at least one primary surgical procedure. Patients requiring surgery underwent either surgical excision or debridement with the Versajet hydrosurgery system™ (Smith and Nephew, Hull, UK) and split skin grafting. Length of hospital stay ranged from 1-37 days, with the longest hospital stays in adult patients with complex medical co-morbidities.

The upper limb and hand were the most commonly injured areas in both groups of patients with the palm and dorsum of the hand being equally affected. Seven children and one adult sustained injuries to more than one part of the body.

All patients who required surgery or had burns which took longer than 14 days to heal were followed up in outpatient clinics according to departmental protocol. Eleven patients (22%) required non-surgical scar management with topical silicone therapy or pressure garments and six patients (12%) had evidence of hypertrophic scarring documented in their follow up notes. One adult and one paediatric patient underwent surgical scar revision approximately 18 months after the initial injury. A further patient developed a flexion contracture of the fingers but left the country before revisional surgery could be performed.

Discussion

Paediatric patients

Electric irons are the most common cause of contact burns in children, accounting for up to 75% of such injuries. Several studies have previously highlighted the problem of iron burns in young children and discussed methods of reducing their incidence. These injuries are frequently associated with inadequate supervision of the child or ironing on low surfaces allowing relatively easy contact with the surface of the iron. This suggests that it should be possible to reduce the incidence of such injuries through education campaigns aimed at parents of young children and by safety modifications to the appliances.

Hollyoak and colleagues published work in 1994 describing 38 children admitted to their unit due to iron burns over a 3-year period, and advised education campaigns as well as safety measures to reduce the risk of such injuries. A follow up study from the same unit ten years later showed that despite these recommendations the number of patients seen with iron burns had not significantly changed and they once again advised strategies to address the common mechanisms of injury.

The majority of the injuries in our study occurred in children under the age of 4 years. This coincides with a time when children are becoming more mobile and exploring their environment. Although most injuries are accidental, it is important to consider the possibility of non accidental injury in any child presenting with a burn. Non accidental injury was suspected in 13 cases in our unit but was not proven after investigation by the paediatric team and social worker. Gaffney describes a series of 59 children with iron burns
which included 9 proven cases of non accidental injury. This is in contrast to Simons et al., who felt that all of the injuries in their study were of an accidental nature and none were referred for further investigation.

**Adult patients**

Half of the iron burns in adult patients in this study were associated with an epileptic seizure. Previous studies have shown that up to 38% of patients with epilepsy will have sustained a burn during a seizure at some stage in their life, although most injuries will not require hospital treatment. Seizure related burns are most commonly sustained in a domestic setting and are particularly common in patients with poor disease control and high seizure frequency. Epileptic patients are at high risk of sustaining further burns in the future and at least one patient in our study was subsequently readmitted with another burn at a later date which also required surgical treatment. Burns sustained during seizures are usually deep due to prolonged contact with the burning agent and the delay until the return of consciousness when first aid can be applied. In this study, all patients who had a seizure related burn sustained a full thickness burn requiring surgical excision and skin grafting.

Falls and other medical problems contributed to several other injuries in this study. As well as managing the burn, it is clearly also important to recognise and treat the underlying cause of the burn which may require input from other specialty teams. Five adult patients required admission to our unit following their injury with an inpatient stay ranging from 7-37 days. Complex medical co-morbidities and management of surgical complications led to long hospital stays for relatively small injuries, which obviously carry both a financial cost to the hospital and a personal cost to the patient.

**Outcome**

All burns in this study were smaller than 5% TBSA and the majority were less than 1% TBSA. Despite this, more than one quarter of our patients required surgical treatment and 36% were left with permanent scarring. Although iron burns are usually small in size, they frequently affect areas with important functional and cosmetic significance such as the face, hand and upper limb, which may be associated with developmental delay in children. It has previously been demonstrated that even small burns can have long term physical and psychological consequences meaning that iron burns are a perfect example of “small burn, big problem.”

**Safety features and education campaigns**

The surface of a domestic iron can reach a temperature of greater than 200°C and takes up to 90 minutes to cool below the epidermal injury threshold of 49°C. This means that patients are vulnerable to injury even when the iron has been switched off. At least 25% of children in our study were injured by an iron which had been turned off and in some cases had been put into a cupboard to which the child gained access. In some cases it was not possible to determine whether or not the iron was switched off at the time of injury.

Several previous studies have suggested methods of reducing the incidence of contact burns from electric irons. These include the development of a thermoprotective box, a coiled or self retracting cord or even simpler measures such as a written warning attached to the iron itself.

Many injuries occur when children touch an iron which is either unsupervised, used at a low height or cooling down. Therefore, the simplest method to reduce such injuries would be an educational campaign to remind parents of the dangers of hot irons and encourage them to use an ironing board, supervise young children and to place irons out of reach once switched off. A British study of burn patterns in Asian ethnic minorities showed that contact burns from irons were more frequent in Asian than non-Asian patient groups and ironing on the floor was particularly common in this population. It is therefore important for any educational campaign to target at risk groups, and this may require a multilingual and multimedia approach in order to maximise the effectiveness of such a campaign.

Beers and colleagues have recently published work describing the development of a clothing iron safety device which shields the hot surface of the iron during the cooling process. This is designed to house the iron once it has been unplugged and aims to prevent accidental contact with a cooling iron. The authors hope that this type of device could eventually be included with the sale of the iron to avoid the need for people to buy extra equipment.

Measures described above would help reduce the risk to children who are frequently injured by accidentally touching an iron or pulling on a dangling flex. However, in adults the most common pattern of injury is a collapse or seizure followed by prolonged contact with a hot iron which is still switched on. A retractable cord may make it less likely for an iron to be pulled or knocked off a work surface as a patient collapses due to epilepsy or other cause, and therefore may help reduce seizure associated burns. Irons which turn themselves off after a period of inactivity may also reduce the extent of a burn injury, but this effect is likely to be limited by the length of time required for the iron to cool down to a safe temperature. Cordless irons and models with an automatic shutoff feature are currently available on the market but are outnumbered by traditional irons which tend to be less expensive.

A combination of the safety features described above is most likely to reduce the types of injuries described in this study. Patterns of injuries in adults and children are different and require different preventative strategies. A
combination of an educational campaign to raise awareness along with some method of promoting or subsidising safer iron models should minimise injuries in both adults and children. There is clearly a role for the burn community to work with the manufacturers of electric irons as well as becoming involved with education campaigns in order to reduce the frequency of electric iron contact burns.

Conclusion

Burns from domestic electric irons are relatively common and can cause significant morbidity despite their small size. A bimodal presentation is seen with injuries occurring either before the age of 4 years or during adulthood when they are typically associated with an underlying medical condition such as epilepsy. Education of parents about the safe use of these appliances and adequate supervision of young children may reduce the number of injuries occurring. Design features, such as a retractable cord and safety covers for cooling irons, may further reduce the incidence of this type of burn, and there is a real opportunity for the burns community to liaise with industry to guide future product development.

RéSUMÉ. Les brûlures causées par des fers à repasser sont des blessures potentiellement évitables qui peuvent conduire à une morbidité importante. Plusieurs études ont rapporté ces blessures chez les enfants, mais il n’y a pas de rapports à ce jour chez les adultes. L’épidémiologie, la gestion et les résultats de ces blessures sont décrites, et des stratégies de prévention possibles sont discutées. Nous présentons un examen rétrospectif des notes de cases de 50 patients adultes et pédiatriques atteints de brûlures de fer électriques. Les cas ont été identifiés à partir de données collectées pour une base de données nationale des brûlures. Les informations concernant la démographie, caracteristiques de combustion, le traitement et les résultats à long terme ont été recueillies à partir des dossiers médicaux. 42 enfants et 8 adultes ont subi une brûlure de fer à repasser pendant la période d’étude de 4 ans. La majorité des patients pédiatriques étaient de moins de 4 ans. La plupart des brûlures étaient de petite taille (<1% de la SCT) mais malgré cela, 30 (60%) patients ont été admis à l’hôpital et 13 (26%) ont nécessité au moins une intervention chirurgicale. Chez les enfants, la plupart des brûlures se produisaient à la maison et étaient souvent en raison de tirer le cordon d’alimentation ou frapper le fer de sa surface. Chez les adultes, 50 % des blessures ont été associées à l’épilepsie. Brûlures causées par des fers à repasser sont relativement fréquentes et entraînent une morbidité significative, malgré leur petite taille. On a vu une présentation bimodale avec des blessures qui se produisaient, soit avant l’âge de 4 ans ou à l’âge adulte, quand ils sont généralement associés à une condition médicale sous-jacente. Les campagnes d’éducation et les caractéristiques de conception comme un cordon rétractable peuvent réduire l’incidence de ce type de brûlure.

Mots-clés: brûlure par contact, épidémiologie, prévention, adulte, pédiatrique

BIBLIOGRAPHY