

Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <https://orca.cardiff.ac.uk/id/eprint/114578/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Mullen, Stephen, Begley, Roisin, Roberts, Zoe and Kemp, Alison Mary ORCID: <https://orcid.org/0000-0002-1359-7948> 2018. Fifteen-minute consultation: Childhood burns: inflicted, neglect or accidental. Archives of disease in childhood. Education and practice edition , edpract-2018. 10.1136/archdischild-2018-315167 file

Publishers page: <http://dx.doi.org/10.1136/archdischild-2018-315167>
<<http://dx.doi.org/10.1136/archdischild-2018-315167>>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies.

See

<http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



Title page

Title: Fifteen-minute consultation: Childhood burns: Inflicted, neglect or accidental

Author names and affiliations: Stephen Mullen ^{a, *}, Roisin Begley^a, Zöe Roberts ^a, Alison Kemp^b

^a Paediatric Emergency Department, University Hospital of Wales, CF14 4XW, Cardiff, Wales, UK

^bDivision of Population Medicine, School of Medicine, Cardiff University, Cf14 4YS, Cardiff, Wales, UK

*Corresponding author

Corresponding author:

Dr Stephen Mullen. Royal Belfast Hospital for Sick Children, Falls Rd, Belfast.

drsmullen@gmail.com. Contact phone: 02890633266

Five key words:

Child protection; paediatrics; emergency medicine; burns; paediatric burns

Word count: 1 666

Fifteen-minute consultation: Childhood burns: Inflicted, neglect or accidental

Introduction

While we are aware of the literature regarding physical abuse in the form of bruising and fractures, an area that can potentially be missed is the role child safeguarding plays in childhood burns. A burn is painful and distressing injury, enhancing the possibility of focusing solely on the physiology and failing to appreciate the wider safeguarding concerns.

The aim of this article is to review the literature on this topic.

Case

You are on-call for general paediatrics in a busy district general hospital and are contacted by the emergency department (ED). They have an 11-month-old with a burn and have some safeguarding concerns.

On the long walk down, you do a quick literature search on the safeguarding considerations with childhood burns.

Background

There is good epidemiological data on childhood burns in the UK with approximately 50,000 children attending ED each year with a burn.^{1,2} It is estimated that 10% of these are a result of maltreatment with the actual reported figure varying with geographical location³. In the UK estimates of 1-16% are quoted and the United States data estimates between 3-26%.^{4,5,6} Experts agree that the actual number is much higher.

Maltreatment in the case of burn injuries manifests in the form of neglect or physical abuse (PA) with the ratio of neglect to abuse 9:1.⁷ As clinicians we are all too aware of the importance of identifying child protection concerns early recognising that child abuse is an on-going process and not a solitary event.

Burns can be viewed as a marker for future maltreatment. The literatures identifies that if a child suffers a burn before the age of three, by their sixth birthday they are seven times more likely to suffer abuse or neglect and twice as likely to be a 'child in need' compared to a matched cohort.⁸

Case

You further discuss the case with the ED team. The injury is reported to have occurred 2 days ago with no clear history. It is a deep partial thickness burn on both arms and legs, estimated at 2-3% Total Body Surface Area (TBSA).

You consider what in the history and exam can help you differentiate accidental burns from maltreatment burns (inflicted and neglect)

History

A vague or changing history, an injury that does not fit with the history provided or a speculative account of an unwitnessed burn are potentially significant points for abusive burns and scalds. The blame of a sibling or a trigger event (family stress, persistently crying infant) also pose a higher risk for abuse⁹. As with all paediatric injuries, the reported mechanism **must** be compatible with the developmental age of the child. (figure 1)

Burns are a common cause of emergency department attendances, particularly in the under 5s. It is also these children who are most vulnerable with regards abusive thermal injuries with abuse more likely in the younger patient ¹⁰.

Socially, the presence of risk factors such as domestic violence and abuse, drug and alcohol misuse and severe mental health concerns in the carers, concern regarding level of supervision or the involvement of an active social worker for any reason, increase the potential for concern¹¹. Likewise, a history of multiple previous attendances for injuries or previous burns may be indicative of neglect or repeated physical abuse and further clarification should be sought.¹¹

A delay in seeking treatment may be an indication of child maltreatment but in burn injuries, the rationale for delay can be more complex. The lack of pain in full thickness burns and the evolution of a burn from a superficial to deeper injury over time may account for some parents or carers delaying seeking medical advice.

There is some evidence to suggest that certain reported mechanisms may be more likely attributed to child maltreatment. One study found abuse was more likely if bathing (4% accidental vs 14% abusive but less likely if reported to have occurred whilst cooking (25% accidental vs 4% abusive) or due to a spill (7% vs 1%) ¹⁰. Pull down injuries, often from hot beverages, are one of the most common causes of accidental scalds in young children. Whilst most are accidental, neglect and lack of supervision must always be considered. The youngest reported age for a pull-down scald was 8 months and a child able to climb into a bath was 16 months, highlighting the need for a detailed history and developmental assessment.¹²

Whilst the absence of administering first aid may be considered neglectful, there is no current evidence that supports this as a differentiating factor between abusive and non-abusive thermal injuries. Studies show that parents' knowledge about appropriate first aid is poor¹³. Burns first aid measures are simple but effective at reducing burn severity and should be a Public Health promotion priority.

General examination

It is important to include a development assessment, with an emphasis on correlating the mechanism of injury with the child's developmental stage. Consideration for child protection principles should be followed. Photographic imaging of injuries should be considered.

Examination of the burn

In this article, we will discuss the most common burns seen in childhood; scalds and contact burns. Remember that other types of burn may also present with child protection concerns.

A meticulous examination of the burn noting the depth, anatomical area involved, TBSA % and pattern is paramount. There are certain characteristics of the burn itself that should evoke concern. Evidence has shown increased likelihood of abuse if a scald has bilateral pattern, TBSA >10% and full thickness depth.⁹

Scalds -Non-inflicted

Scalds are the most common burn injury accounting for 58% of all burns in children.¹² Accidental scalds are frequently caused by spillages of hot drinks or hot liquid in food preparation and are found on the head, neck, trunk, face and upper body from the 'pull down mechanism'. (image 1) The burn pattern may demonstrate irregular margins, an irregular burn depth and asymmetrical involvement. It is important to consider evidence of neglect in the history when examining burns. Children may present with burns characteristic of accidental scalds due to lack of supervision.

Scalds -Inflicted

Scalds due to maltreatment have been described to differ by site, depth, symmetry and the presence of sharply delineated borders. Inflicted scalds can be seen on the lower limbs, buttock and perineal regions and may be unilateral or bilateral. The typical pattern seen in forced immersion is a symmetrical burn to both sides of the body with clear margins, circumferential (glove and stocking pattern), and evidence of skin fold or central buttock sparing with uniform burn depth.¹⁴ (image 2 and 3)

The absence or presence of splash marks is no longer considered pathognomonic of child maltreatment. Children being held in water may struggle to get away from the scalding liquid (and so will have splash marks) and children who jump into a bath with hot water may 'freeze' giving themselves a symmetrical, unsplashed burn distribution.¹⁵ This highlights the importance of collating history, examination and further social and family information of this case and seeking expert advice where child protection concerns arise.

Contact burns

It can be difficult to differentiate between contact burns caused by maltreatment and those not. All contact burns are often clearly demarcated in the shape of the causative agent.

Children suffer accidental contact burns from irons, hair straighteners, oven doors or hobs. Accidental contact burns are predominantly caused by children touching hot objects and therefore seen on the fingers or palm of the hand.¹² (image 4)

The commonest reported cause of inflicted contact burns are from cigarettes, irons, hairdryers or domestic heaters.¹² Burns may also occur from atypical instruments such as a hot spatula.¹⁴ Burns in inflicted contact burns can be found on the limbs, back or trunk and areas where the child themselves cannot reach. Burns are often multiple and may co-exist with other injuries suspicious of abuse.⁹ (image 5)

Case

You have completed your history and examination. You do have some concerns that this case may be an inflicted injury and wonder what investigations, if any, you need to perform.

Investigations

It is important to remember that burns in cases of suspected child abuse are a sign of physical abuse or neglect. We would recommend that you adhere to your local safeguarding guidelines and consider referral to social services and for a child protection medical. The RCPCH companion recommends that in children < 2 years where physical abuse is suspected, investigations to exclude occult injury is required (e.g. skeletal survey in those < 2 years and cranial CT when < 1 year of age)¹⁶. In children > 2 years further investigation should be decided on a case-by-case basis.

Despite these recommendations by the RCPCH, the rate of investigations in children with burns is lower than when children present with bruises and other physical injuries⁹ (table 1). This is despite a comparable proportion of positive findings.

Table 1: Table comparing percentage of diagnostic investigations performed (**bold**) and percentage of positive results (in brackets) for children with burns vs *other, whom were referred to a Child Abuse Paediatricians.⁹

	Burns	Comparison
CT head	25% (+IVE 12%)	61% (+IVE 44%)
Skeletal survey	55% (+IVE 16%)	72% (+IVE 23%)
Transaminases	35% (+IVE 2.6%)	55% (+IVE 4.9%)

*other included the remainder of children referred for child maltreatment investigations i.e other forms of physical abuse, neglect and sexual abuse

Other considerations

A home visit may collaborate facts and allow the collection of further evidence. This should occur in a detailed and forensic manner. A number of conditions have been mistaken for inflicted burns¹¹. It is important to include the MDT in suspected cases of abuse. A formal review by a burns surgeon for their specialist input would be advisable, specifically commenting on the depth of injury, the degree of healing and their interpretation of the case.

Clinical prediction tool (CPT)

The BuRN Tool is a CPT developed to aid clinicians in identifying child safeguarding concerns in children with burns¹⁷. The tool is currently undergoing an implementation evaluation and pending these results, it may play a significant future role in the assessments of burns injuries.

Conclusions

Burns in childhood are a frequent presentation to emergency departments, with a significant proportion attributed to maltreatment. The recognition and initiation of child protection proceedings in these instances are imperative in preventing future harm to the patient. We recommend a detailed history, examination and a broader consideration of the social and historical background, appreciating that it is not one feature in isolation but an amalgamation of key variables that allows the clinician to appreciate the bigger picture.

References:

- 1) Fenlon S, Nene S. Burns in children. BJA Educ. 2007
- 2) The Royal Society for the Prevention of Accidents. 24TH (FINAL) REPORT OF THE HOME AND LEISURE ACCIDENT SURVEILLANCE SYSTEM [Internet]. Hass and Lass. 2000 [cited 2017 Feb 28]. Available from: <http://www.dti.gov.uk/Pub>
- 3) Hayek SN, Wibbenmeyer LA, Kealey LDH, Williams IM, Oral R, Onwuameze O, et al. The Efficacy of Hair and Urine Toxicology Screening on the Detection of Child Abuse by Burning. J Burn Care Res [Internet]. 2009 Jul [cited 2016 Nov 1];30(4):587–92. Available from: <http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=01253092-200907000-00004>
- 4) Sheridan RL, Ryan CM, Petras LM, Lydon MK, Weber JM, Tompkins RG, et al. Burns in Children Younger Than Two Years of Age: An Experience With 200 Consecutive Admissions. Pediatrics. 1997;100(4).
- 5) Hultman CS, Priolo D, Cairns BA, Grant EJ, Peterson HD, Meyer AA. Return to jeopardy: the fate of pediatric burn patients who are victims of abuse and neglect. J Burn Care Rehabil [Internet]. 1998 [cited 2017 Feb 28];19(4):367-76-7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/9710740>
- 6) Hobbs CJ. When are burns not accidental? Arch Dis Child. 1986;61:357–61.

- 7) Chester DL, Jose RM, Aldlyami E, King H, Moiemmen NS. Non-accidental burns in children—Are we neglecting neglect? *Burns* [Internet]. 2006 Mar [cited 2017 Jan 18];32(2):222–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/16448766>
- 8) James-Ellison M, Barnes P, Maddocks A, Wareham K, Drew P, Dickson W, et al. Social health outcomes following thermal injuries: a retrospective matched cohort study. *Arch Dis Child* [Internet]. 2009;94(9):663–7. Available from: <http://adc.bmj.com/content/94/9/663> <http://www.ncbi.nlm.nih.gov/pubmed/19531525>
- 9) Pawlik A, Kemp AM, Maguire S, Nuttall D, Feldman K, Lindberg D et al. Children with burns referred for child abuse evaluation: Burn characteristics and co-existent injuries. *Child Abuse & Neglect*. Volume 55, May 2016, Pages 52-61. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27088728>
- 10) Hodgman EI, Pastorek RA, Saeman MR, Cripps MW, Bernstein IH, Wolf SE, Kowalske KJ, Arnoldo BD, Phelan HA. The Parkland Burn Center Experience with 297 cases of child abuse from 1974 to 2010. *Burns*. 2016 Aug; 42(5):1121-1127. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27268012>
- 11) Maguire S. Which injuries may indicate child abuse? *Arch Dis Child Educ Pract Ed* 2010; Dec 95,(6) 170-7. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/20926622>
- 12) Kemp AM, Jones S, Lawson Z, Maguire SA. Patterns of burns and scalds in children. *Arch Dis Child* 2014 Apr; 99(4):316-21. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/24492796>
- 13) Davies M, Maguire S, Okolie C, Watkins W, Kemp AM. How much do parents know about first aid for burns? *Burns*. 2013 Sep;39(6):1083-90. doi: 10.1016/j.burns.2012.12.015. Epub 2013 Jan 21.
- 14) Royal College of Paediatrics and Child Health, Child Protection Evidence Systematic review on Burns, October 2016. Available from: https://www.rcpch.ac.uk/system/files/protected/page/Child%20Protection%20Evidence%20-%20Chapter%20Burns_Update_Final_270717.pdf
- 15) [Greenbaum AR](#)¹, [Donne J](#), [Wilson D](#), [Dunn KW](#). Intentional burn injury: an evidence-based, clinical and forensic review. *Burns*. 2004 Nov;30(7):628-42. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/15475134>
- 16) RCPCH. *Child Protection Companion*. Second Edition 2013.
- 17) Kemp, A.M., Hollén, L., Emond, A.M., Nuttall, D., Rea, D. and Maguire, S. Raising suspicion of mistreatment from burns: derivation and validation of the BuRN-Tool. *Burns* 2017 Sep 14. pii: S0305-4179(17)30473-4. doi: 10.1016/j.burns.2017.08.018

Legend for figure1

Figure 1: Features in history and examination that may be suggestive of maltreatment (neglect or physical abuse) in children with a burn

Contribution

SM conceived this review, was an author and reviewer. RB was an author and commented on drafts. ZR was an author and commented on drafts. AK reviewed the final draft and helped develop this review.

Funding

Nil to declare

Competing interest

Nil formally to declare. SM and AK are undertaking research in the BuRN-Tool.