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Short Communication

Severe scalds sustained during steam inhalation therapy in an adult population: Analysis of patient outcomes and the financial burden to healthcare services ☆

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ABSTRACT

Background: Steam inhalation therapy (SIT) is a common home remedy for the treatment of upper respiratory tract infections. Literature reports are increasingly discouraging this practice in the paediatric population due to the risk of scalds, however, this is yet to be echoed for adults.
Methods: A retrospective review of patients admitted to a tertiary burns centre from 2015 to 2020 was undertaken identifying all adult patients requiring in-patient specialist treatment for scald injuries sustained during steam inhalation. Cost analysis and long-term patient outcomes were reviewed.
Results: Twelve adult patients required inpatient management with a mean length of admission of 8 nights. One patient required operative intervention, long-term sequelae included scarring, skin sensitivity, pain, or psychological morbidity. The estimated mean cost per patient was £5402 giving a mean cost per year of £12 964.
Conclusion: SIT can be associated with severe scald injuries in adults and incur considerable costs for healthcare providers.

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Introduction

Steam inhalation therapy (SIT) is a long-practised home remedy used to alleviate symptoms of upper respiratory tract infections (URTI).[1] A revised Cochrane review into the therapeutic benefits of SIT found no benefit in improving symptoms associated with the common cold.[2] However, a recent survey demonstrated that it is still commonly recommended by healthcare professionals for the treatment of URTI.[3]

A significant number of children are admitted annually with scalds associated with SIT with the frequency increasing during the COVID-19 pandemic.[4] These patients can suffer permanent sequelae such as scarring or chronic pain, particularly when surgical excision and skin grafting are required.[3,5–8] Furthermore, hospitals can accrue significant treatment costs.[3,7] As such, online patient information sources which previously promoted the practice of SIT[7] have now removed their recommendations or actively discourage SIT in children.[9]

There are limited data on the prevalence or outcomes of scalds associated with SIT in adult populations. It is likely that steam inhalation remains a common practice in adulthood due to recommendation by medical professionals[3]; continuation of childhood practices; and influence from unregulated online sources or social media.

We aim to review data from patients presenting to a tertiary burns centre with scalds secondary to SIT to allow greater insight into the mechanisms of injury, the demographics of these patients, and the burden of this potentially hazardous practice in an adult population.

Methods

This study was conducted at the Newcastle Upon Tyne Royal Victoria Infirmary (RVI), a Regional Tertiary Burns Centre. A prospective database of all admitted patients is maintained.

A Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) compliant retrospective review of the database was performed to identify admissions from scalds occurring during SIT over a five-year period between 1st March 2015–29th February 2020. A chart review included mechanism and indication of SIT, length of admission, burn location, burn total body surface area (TBSA), burn depth, whether first aid was performed, in-hospital management, operative management, complications, and follow-up care.

The cost associated with each inpatient treatment was calculated using data provided by the trust's finance department. Consumables used intraoperatively were identified from the operative records and the cost tallied.

Results

Over a 5-year period, 12 adults were admitted with scalds sustained whilst performing SIT (Table 1). The mean age was 29.3 years (range: 16–56) and 75% (9/12) were female (Table 1). All 12 patients were using SIT to alleviate symptoms of an URTI. The injuries were most common in winter followed by spring and autumn which accounted for 91.7% (11/12) of injuries.

Spillage of recently boiled water typically caused burns over the lower abdomen, genitalia, and medial thighs. Most (11/12) attempted some form of first aid prior to attending hospital, most commonly a cold shower or bath with all immediately attending hospital due to severe pain.

The mean length of stay was 8 nights (range: 1–20), and the mean TBSA was 5% (range: 1–10%). The depth of burn was superficial partial thickness in 11/12 cases which were managed conservatively with dressing care. One patient sustained 6% TBSA mixed deep dermal/full thickness burn requiring operative intervention (Table 1). The patient subsequently suffered hypertrophic scarring requiring multiple steroid injections and camouflage therapy. Catheterisation was required in 33.3% (4/12) due to the involvement of the genitalia (Table 1).

Long-term complications were documented in 85.7% (6/7), including scarring, skin discolouration, pain, and skin sensitivity affecting bathing or wearing certain clothing. One patient reported ongoing psychological morbidity whilst another reported ongoing neuropathic pain requiring medical therapy.

Table 1
Characteristics of scald injuries sustained during steam inhalation therapy for each patient included in the study and the cost associated with their inpatient management.

Patient	Burn location	TBSA%	Admission nights	Bladder catheter?	Management	Estimated cost
Female, 24	Perineum and upper medial thighs	4%	3	Yes	Conservative	£1950 ($2637)
Female, 56	Lower abdomen, medial thighs	1%	1	No	Conservative	£650 ($879)
Male, 32	Dorsal feet	1%	2	No	Conservative	£1300 ($1758)
Male, 18	Genitalia, medial thighs	5%	6	Yes	Conservative	£3900 ($5274)
Female, 24	Left thigh and both calves	6%	20	No	Operative	£14 769 ($19 972)
Male, 25	Genitalia, medial thighs	3%	7	Yes	Conservative	£4550 ($6153)
Female, 45	Lower abdomen, thighs, genitalia	10%	17	Yes	Conservative	£11 050 ($14 944)
Female, 22	Genitalia, medial thighs	6%	8	No	Conservative	£5200 ($7032)
Female, 16	Calves and dorsal feet	3.5%	3	No	Conservative	£1950 ($2637)
Female, 18	Lower abdomen, medial thighs, left calf	8%	12	No	Conservative	£7800 ($10 548)
Female, 39	Medial thighs	5%	10	No	Conservative	£6500 ($8790)
Female, 33	Lower abdomen, genitalia, medial thighs	5%	8	No	Conservative	£5200 ($7032)

The average cost of a night on the burns unit was £650 – including the use of consumables such as dressings. The fully absorbed cost of the burns operating theatre was £13.99 per minute excluding the use of consumables. The total cost incurred by the healthcare trust from the inpatient management of patients who sustained scalds during SIT was £64 819 (Table 1). The cost per inpatient stay ranged from £650–£14 769, with the upper range representing the patient who required operative management. The mean cost per patient was £5402, and the mean cost per year was £12 964.

Discussion

This review demonstrates that SIT-associated burns can cause significant morbidity and cost to the treating NHS trust. Typically, these patients are young females sustaining significant trauma to intimate body regions such as the genitalia, medial thighs, and lower abdomen. The resulting sequelae included significant pain, catheterisation, scarring, and psychological morbidity, with most patients reporting long-term complications in follow-up. In one case, split-thickness skin grafting was needed and the patient had troublesome hypertrophic scarring resulting in severe, life-altering disfigurement.

This is the first study that has assessed this injury in a cohort of adult patients. Previous studies of paediatric patients have found a considerable burden of scald injuries from SIT.[6,7] The pattern of injury to the lower abdomen, medial thighs, and genitalia from spillage of a container of water in this study is similar to that sustained in older children.[3,6] Most patients in this study were using a basin with a large volume of water, supporting previous findings that using uncovered containers has an increased the risk of scald injury.[6] This is due to the fact that severe injuries can occur within seconds when water at high temperatures comes into contact with the skin.[10] Techniques such as standing in the bathroom and running a hot shower to generate steam[7] provide a safer option, but still lack evidence of being an effective remedy.

Cost-analysis shows that there are substantial financial implications to healthcare providers due to scald injuries sustained whilst undertaking SIT. The figures obtained in this study are likely underestimated as they fail to include ongoing outpatient dressing changes or the costs of future outpatient follow-up care. A mean cost of £5402 per patient is similar to the £3094 per paediatric patient found in 2016,[3] but our annualised cost of £12 964 is considerably less than the £48 000 annual expenditure found in a Dutch study.[7] However, the authors in this study have expanded their analysis to estimate the total cost of care for each patient, rather than simply their inpatient management. Whilst the direct comparison of these figures is limited, all three analyses have found these injuries to incur considerable costs.[3,7]

There are several limitations of this study. The database maintained for burns patients could only be used to accurately identify patients if they required admission and inpatient care. We are aware that a significant number of similar injuries were likely managed in the outpatient setting; by primary care professionals; or at their local hospitals. Furthermore, there are no data available on the prevalence or practices of steam inhalation within the population covered by our burns service.

Conclusion

This study has found that adult patients can suffer significant scald injuries due to the accidental spillage of water during SIT leading to permanent scarring and psychological morbidity, whilst incurring considerable cost to healthcare providers. It is recommended that clinicians reconsider the promotion of SIT which lacks evidence of therapeutic benefit or alternatively encourage the adoption of safer techniques that avoid the use of basins containing boiled water, especially in the current COVID-19 era.

Declaration of Competing Interest

The authors declare that they have no competing interests.

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Ethics

Ethical approval was not required for this study.

Authors Contributions

ASD and ASN were involved in data collection and analysis as well as drafting and revising the manuscript. SV verified the collected data and analyses and critically appraised the manuscript. All authors have seen and approved the final version.

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References

1. Tyrrell D, Barrow I, Arthur J. Local hyperthermia benefits natural and experimental common colds. *Br Med J*. 1989;298:1280–1283. doi:10.1136/bmj.298.6683.1280.
2. Singh M, Singh M, Jaiswal N, Chauhan A. Heated, humidified air for the common cold. *Cochrane Database Syst Rev*. 2017;2017. doi:10.1002/14651858.CD001728.pub6.
3. Himdani S Al, Javed MU, Hughes J, Hemington-Gorse S, Nguyen D, Falconer O, et al. Home remedy or hazard? management and costs of paediatric steam inhalation therapy burn injuries. *Br J Gen Pract*. 2016;66:e193–e199 doi:10.3399/bjgp16 × 684289.
4. Brewster CT, Choong J, Thomsa C, Wllson D, Moiemen N. Steam inhalation and paediatric burns during the COVID-19 pandemic. *Lancet*. 2020;395:1690. doi:10.1016/S0140-6736(20)31144-2.
5. Murphy SM, Murray D, Smith S, David OJA. Burns caused by steam inhalation for respiratory tract infections in children. *BMJ*. 2004;328:757. doi:10.1136/bmj.328.7442.757.
6. Wallis BA, Turner J, Pearn J, Kimble RM. Scalds as a result of vapour inhalation therapy in children. *Burns*. 2008;34:560–564. doi:10.1016/j.burns.2007.07.016.
7. Baartmans M, Kerkhof E, Vloemans J, Dokter J, Nijman S, Tibboel D, et al. Steam inhalation therapy: severe scalds as an adverse side effect. *Br J Gen Pract*. 2012;62:e473–e477. doi:10.3399/bjgp12x652337.

8. Ebrahim MKH, Bang RL, Lari ARA. Scald accidents during water aerosol inhalation in infants. *Burns*. 1990;16:291–293. doi:10.1016/0305-4179(90)90142-J.
9. Chest infection - NHS n.d. https://www.nhs.uk/conditions/chest-infection/ (accessed July 9, 2020).
10. Andrews CJ, Kimble RM, Kempf M, Cuttle L. Evidence-based injury prediction data for the water temperature and duration of exposure for clinically relevant deep dermal scald injuries. *Wound Repair Regen*. 2017;25:792–804. doi:10.1111/wrr.12577.