Management of burns

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Abstract

Burns represent a huge global economic and social burden due to the injury severity and the highly resource intensive treatment and rehabilitation required. The World Health Organization is aiming to reduce this with a program of education, burns prevention and first aid measures. Assessment of the size and depth of a burn is paramount to determine the treatment each burn will require but can be challenging, even for experts. Many developed countries have set up regional networks to centralize burns services but in the event of a major incident involving significant burns it is likely that these services would be quickly overwhelmed and support from the national and international community would need to be sought.

Keywords Burns; burns assessment; burns treatment; major incidents

Introduction

Burns are a common type of trauma across the world. The World Health Organization (WHO) estimates that annually, 11 million people suffer a burn that requires medical attention, while there are 180,000 burns deaths worldwide. The WHO classifies burns as the greatest burden in terms of morbidity including disability, disfigurement, stigma and rejection.[1] Ninety per cent of burns occur within low or middle-income countries[2] where the availability of specialist acute or long-term care for burns patients may be limited.

Across all countries the cost of providing burns care remains high due to the need for multiple surgeries, intensive care, long-term follow-up and rehabilitation. The WHO's main aim is to prevent burns across the globe to reduce the economic and societal burden.

Most burns occur within the home and are either preventable or their burden manageable with burn education, first aid and care programs.[1]

Burn epidemiology worldwide

The setting in which burns occur differs based on socioeconomics as well as gender. Broadly across the world, women and children are more likely to sustain burn injuries inside the home where as men are more likely to sustain them in a work setting or during outdoor recreational activities.[3] Only 5% of burns worldwide are as a result of abuse, malicious attacks or deliberate self-burning with the remainder being accidental.

The causes of burns worldwide are summarized in Figure 1.[4,5] Examples of the category labelled 'other' include fireworks and cigarettes.

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Burn injury

Burns are traumatic injuries usually caused by thermal events but may also be as a result of chemical, electrical or radiation exposure. It is also important to note that there are some dermatological conditions of 'skin failure' which present, and are managed in the same way as burns.

The damaged area has an increase in capillary permeability allowing fluid and large molecules such as albumin to leak out of the circulation. This leads to significant fluid loss, especially if a large surface area is affected. The escape of large molecules compounds this fluid loss as it creates an oncotic gradient favouring the tissues, meaning even more fluid leaves the circulation. Left untreated this leads to significant dehydration and cardiovascular collapse.

In larger burns there are also systemic effects brought about by the widespread release of histamine and other inflammatory mediators. This causes a systemic increase in capillary permeability and can lead to pulmonary oedema as well as myocardial dysfunction. Huge release of endogenous steroid and catecholamines leads to increased stress on the cardiovascular system and massive catabolism which is then detrimental to the ongoing healing of the burn.

The loss of the ability to regulate body temperature via the skin may precipitate significant hypothermia, contributing to the impaired immune response propagated by the high levels of endogenous steroids and the loss of the pathological barrier causing a high risk of sepsis in burns patients.

Types of burn

Thermal burns

'Conventional' burns occur as a product of the temperature gradient applied to the skin and the duration of that application. The larger the temperature gradient and the longer that this is applied leads to an increased severity of burn or burn over a larger surface area. This type of burn includes flame, hot objects, hot liquids and steam exposure — the latter two often being referred to as scalds.

Friction burns

Heat is generated as a result of friction forces between the skin and other objects. In addition to this there is direct damage by the opposing surface causing mechanical disruption of the skin compounding the burn injury.

Chemical burns

There is an increasing incidence of the use of corrosive substances in violent acts. These so-called 'acid attacks' usually involve a corrosive substance (either acidic or alkali in nature) and have a predominance of causing injury to the head, neck and face. Chemical burns can also occur in the industrial setting where accidental spillage of a substance can affect any part of the body. Acid burns tend to be less severe than alkali burns as the acid causes a coagulative necrosis compared to a liquefactive necrosis of an alkali burn which tends to penetrate deeper and destroy more tissue.

Electrical burns

Electrical burns usually occur from high voltages and the actual visible injury may be small. The electricity will follow the path of

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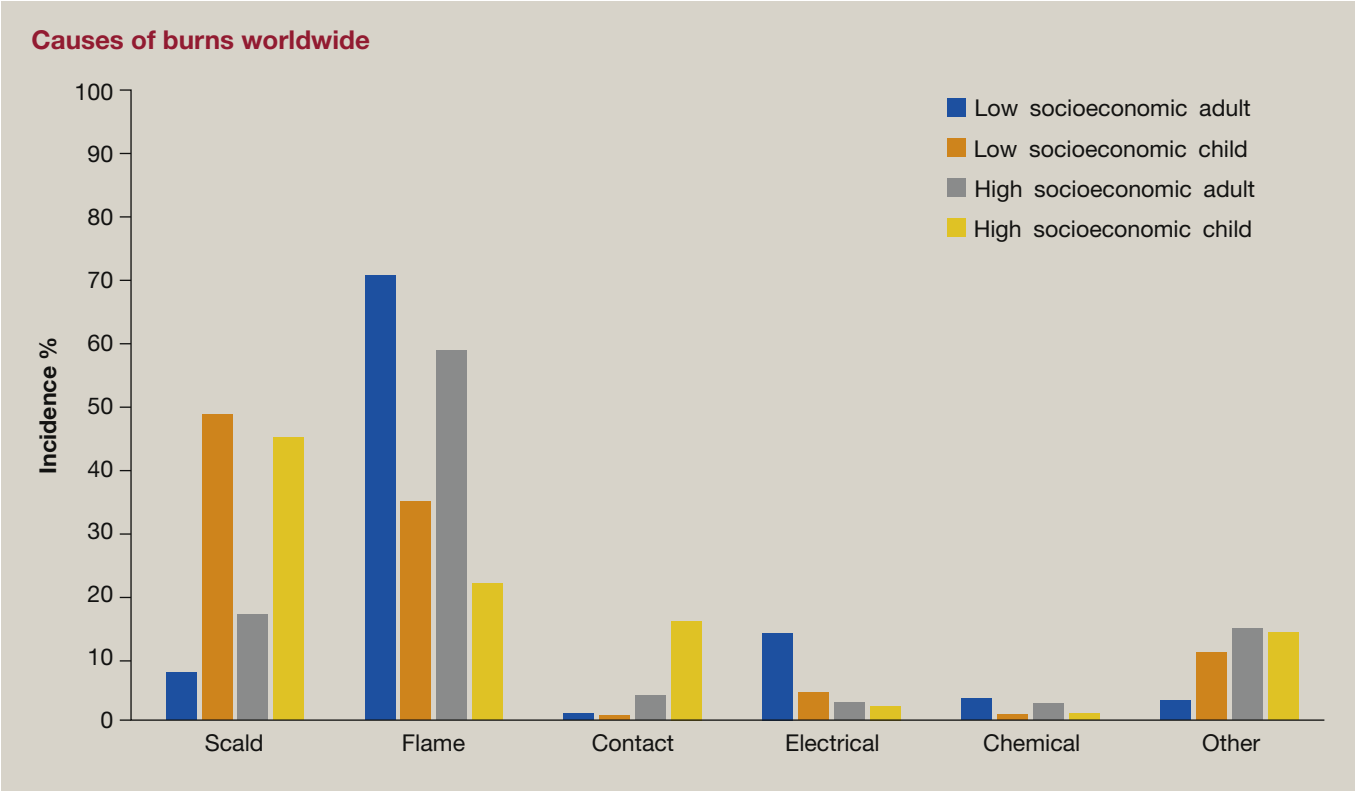

Figure 1

least resistance to earth and may do significant damage as it passes through the body. Notably it can have an effect on the heart's electrical conduction system leading to arrhythmias. There is the potential for huge muscle damage causing rhabdomyolysis as well as the potential for the need for limb fasciotomies if the extent of muscle damage and swelling has led to a compartment syndrome.

Radiation burns

These occur as a result of exposure to electromagnetic or ionizing radiation. The most common example of the form is 'sunburn', which although is often widespread is generally superficial in nature.

Ionizing radiation burns occur more rarely but can affect those who work within the nuclear industry as well as patients receiving repeated or prolonged exposure to therapeutic radiation for diagnosis and treatment. The damage done depends upon the type of radioactive particle the individual is exposed to, the distance they are away from the source and the duration of their exposure. High energy exposure can cause significant internal burns with minimal external effects. All types of radiation burn increase the risk of malignancy.

Burn assessment and classification

Burn depth

The degree of tissue damage can be described via Jackson's description of the zones surrounding a burn injury[6] (Figure 2):

- Zone of necrosis – the area of most thermal damage. The heat energy denatures proteins leading to cell death and vascular thrombosis. This area represents tissue that is unsalvageable.
- Zone of stasis – surrounds the zone of coagulation and represents the area where blood flow is compromised (static blood flow). This area initially becomes significantly oedematous due to vasodilatation and increased capillary permeability but then undergoes a period of hypoperfusion as fluid is lost. If appropriate resuscitation and treatment is initiated this hypoperfusion can be reversed and this area of tissue is potentially salvageable.
- Zone of hyperaemia – surrounds the zone of stasis and is characterized by a prolonged period of increased blood flow and inflammation. It will almost certainly recover unless there is a protracted period of systemic hypotension or localized sepsis preventing its healing.

Clinically more useful is to determine the depth that a burn has penetrated into the skin (Figure 3). This can be challenging even for experts, but is important as the depth of the burn gives surgeons an indication of the potential to heal and which areas may need skin grafting. The burn is rarely uniform in its depth, again making assessment challenging – it may take several days to come to a final conclusion as to the extent and depth of a significant burn.

Previous classification has included terms such as first to forth degree burns but this has now mostly been replaced with the following classification:

- Superficial – These burns only involve the superficial epidermal layer of the skin. They are characterized as being painful, erythematous, dry and blanch white when

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