Management of burns

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Abstract

Burns are common injuries that vary in severity from small superficial scalds to massive full-thickness flame burns with high morbidity and mortality. The purpose of this article is to review common burn presentations and the pathophysiology of these injuries. In addition it gives the reader an overview of burns management from the emergency department through to the specialist burns centre and describes the latest multidisciplinary approach to treating these injuries.

Keywords Burns; burns surgery; dressings; resuscitation; scalds; scar management; skin grafts

Introduction

Burns are traumatic injuries caused by coagulative destruction of the skin. Injuries are usually caused by thermal damage (heat and cold), but chemicals, electricity and radiation may also damage tissues in similar ways. The cause of a patient's burn may be due to flames or explosions, contact with hot (or cold) surfaces, hot liquid spills and submersions, chemicals, electricity, or exposure to ionizing radiation. Whatever the cause for the burn, there is often an underlying patient vulnerability that puts the patient at risk. A patient with diabetes who sustains a contact burn from a fire after a hypoglycaemic episode is vulnerable due to their poorly controlled medical condition. The toddler who is left unsupervised and pulls a cup of tea onto themselves is vulnerable due to lack of attentive supervision. The alcoholic or drug addict who falls asleep with a lit cigarette following drink or drugs and sustains burns is vulnerable due to their addiction. And patients who are depressed and self-harm or self-immolate are vulnerable due to their mental illness. Such vulnerabilities are varied, but each requires investigation and management in order to reduce the burden of burns on individuals and on society.

Epidemiology

In the United Kingdom each year there are approximately 300 deaths from burn injuries. Two hundred and fifty thousand people present to primary care and to hospitals with burns each year, though this is an underestimation of total numbers, as many people with small or innocuous burns manage their injuries themselves.[1] Twelve thousand patients are treated by specialist burns services in the UK each year, with about 500 of these injuries being described as severe/complex and requiring the very highest level of critical care at a regional burns centre.

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No age group or gender is immune from burns. Two-thirds of injuries are sustained by males.[2] The largest patient group to sustain burn injuries are boys under the age of 2 years who account for 12% of all injuries. The majority of these injuries are hot water and drink scalds, sustained at home in the kitchen. The second largest group are males aged 25–34 years who account for 8% of all patients treated by specialist burns services. While it used to be the case that scald injuries were most common in childhood and then gave way to increasing flame, flash and contact burns as age increased, this is now less apparent. In children, adults *and* elderly patients scald injuries now account for the majority of all burns. The second most common cause of burns in adults and elderly patients are flame injuries, followed by contact burns (Figure 1).

Pathology and pathophysiology

Local effects

Following a burn, tissue destruction is proportional to the temperature of the burning agent and the duration it is applied to the body. For example, water at 48 °C takes 5 minutes to cause a partial thickness burn, but when the water temperature is raised to 70 °C it takes just 1 second to cause a full-thickness injury. Jackson described zones of burn injury related to the degree of tissue damage (Figure 2).[3] The inner zone of coagulative necrosis represents unsalvageable burnt tissue where the blood vessels are thrombosed and the skin is dead. The intermediate zone of stasis represents tissue affected by the burn with static blood flow. This area is amenable to first aid, resuscitation measures and good wound care and is therefore salvageable if cared for appropriately. The outer zone of hyperaemia represents red, hyperaemic tissue that surrounds any acute inflammatory process.

The tissue damage that results following thermal injury results in a marked increase in capillary permeability which is maximal within a few hours following injury and resolves within 2–3 days. During this time small protein molecules leak out of the circulation leading to oedema and significant fluid loss. The fluid loss is proportional to the size of the burn; however, when the size of the burn exceeds 30% body surface area (BSA), the leaking capillaries involve all body tissues and not just the skin. Burn oedema is a result of circulating inflammatory mediators including histamine, prostaglandins, leukotrienes and kinins that result in increased capillary permeability. In addition the oedema is exacerbated by increasing capillary hydrostatic pressure, decreasing tissue hydrostatic pressure, and decreased plasma oncotic pressure (due to loss of albumin from the circulation).

General effects

The local and systemic inflammatory mediators released following a burn (particularly injuries greater than 30% BSA) result in profound systemic effects. Because of ongoing fluid losses cardiac output falls due to decreased venous return, inadequate preload and afterload, and decreased myocardial activity. Because of the 'fight or flight' effects, the patient experiences a catecholamine rush of sympathetic activity that contributes to increasing systemic vascular resistance. Pulmonary oedema develops as a result of the systemic increase in capillary permeability as well as increasing pulmonary vascular resistance, left-sided heart failure, hypoproteinaemia, direct vascular injury, and the added insult of an inhalational burn.

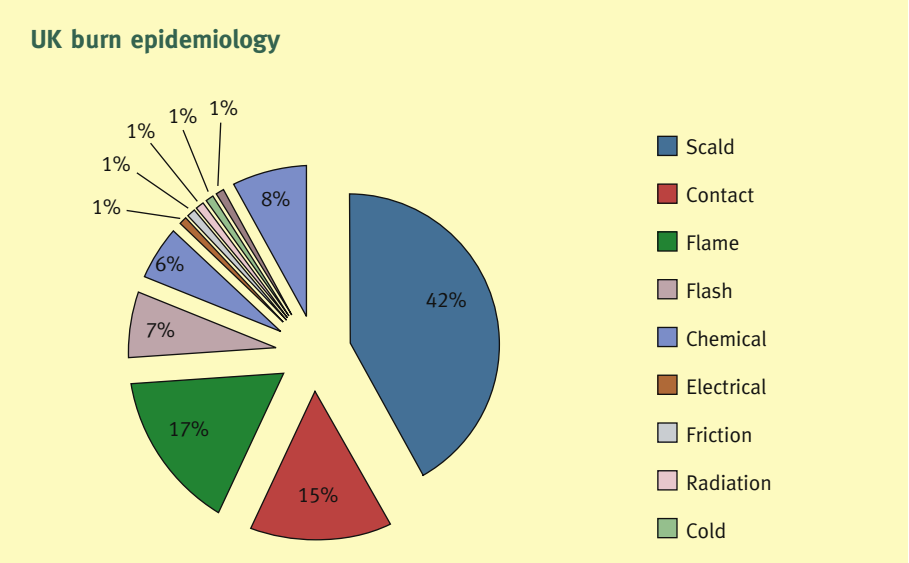

Figure 1

Other systemic effects following major burns include an increase in metabolism, nitrogen loss and poor temperature control due to loss of water and heat through the burnt tissue. The early cortisol rush following burn injury results in protein breakdown and gluconeogenesis. Furthermore in major burns impaired insulin release and impaired glucose tolerance are seen. The catabolic state can last many weeks and months following burns and may result in ongoing weight loss in adults and impaired growth in children. The immunosuppressive effects of a burn should not be underestimated given the high chance of infection following injury. The burn wound is an easy entry point for bacteria and yeasts. This is compounded by the weakened humoural and cellular responses following damage to the local circulation and the normal inflammatory process. Finally, burns patients may lose the protective function of the gut following major injury resulting in translocation of gut organisms into the circulation with increasing morbidity and mortality.

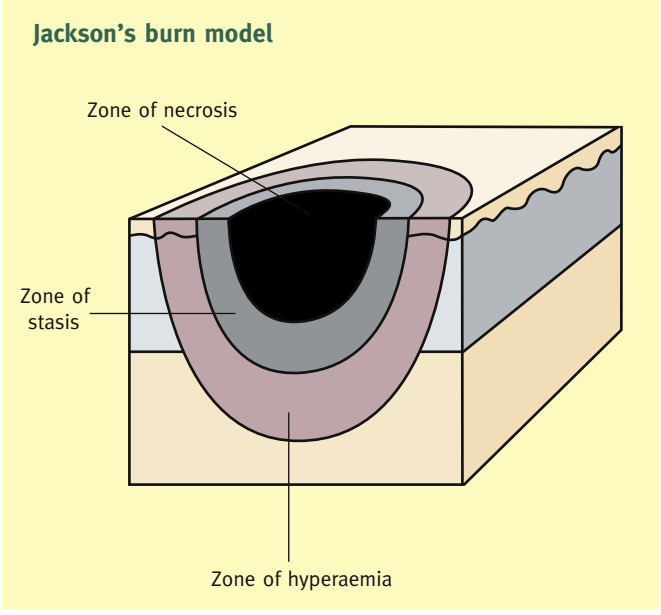

Figure 2

Diagnosis

History

The history of the injury and the circumstances surrounding how the patient sustained their burn are extremely important and can be crucial in predicting the depth of the injury and whether the burn is likely to heal with or without surgery. The time of the injury is very important as the appearance of the burn changes over the subsequent hours and days. What exactly caused the burn is also vital; scalding liquid, flame, explosion, contact, chemical and electric burns will all produce slight differences and this will need to be confirmed during the physical examination. The detail is important; freshly boiled water produces much deeper injuries compared to a cup of tea that has been cooled off. Another detail involves where the burn occurred; if there was an explosion in a confined place such as a building or car, or the patient has been removed from a burning house there will be an inhalational injury until proven otherwise.

Essential to the history of the burn is asking about first aid. Burns that have had appropriate first aid are more likely to heal without surgery, whereas those burns that have not been treated are much more likely to need skin grafting. All burns should have cool running water applied (a mixer tap with running water at 15°C is preferred) for 20 minutes following their injury. This is best done immediately after the injury, but it is still effective up to 3 hours following the burn.[4] Medicated gel sponges provide symptomatic pain relief to a burn but are not a substitute for running water first aid.

Enquiries should be made regarding other injuries the patient may have sustained during the incident and also the presence of medical, surgical and psychiatric comorbidities. A drug history noting any allergies is required, as is tetanus status and other immunizations (particularly children.) A full social history is of utmost importance as it gives an indication as to the patients'