CASE REPORT

Burns from acetylene gas: more than skin deep

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SUMMARY

Oxyacetylene welding torches are commonly used in industry, yet serious burns are fortunately rare. When dealing with the sequelae of these burn injuries, one must be aware of the high pressure component of these flame burns, which can penetrate and dissect the subcutaneous tissue. Appropriate initial assessment and preoperative planning are, therefore, essential to exclude and identify problems such as, compartment syndrome, subcutaneous emphysema and acute carpal tunnel syndrome. We present a case in which an innocuous palmar burn revealed a penetrating flame injury into the carpal tunnel.

BACKGROUND

Oxyacetylene is a combination of oxygen and acetylene, which is used to cut and weld metals. Acetylene is an explosive gas, and when combined with oxygen generates a temperature of 3000–3200°C.¹

Reports of severe burns associated with the use of oxyacetylene are rare, although excess deaths due to cancer associated with asbestos-lined oxyacetylene cylinders have been reported.² Health and safety regulations concentrate on the necessity for protective eye, face and hand clothing during the use of oxyacetylene welding torches. These measures alone cannot prevent more serious and extensive burns as can be seen from the following case report.

CASE PRESENTATION

A 60-year-old right hand dominant man presented to the plastic surgery department (Queen Victoria Hospital/East Grinstead) after sustaining a 0.5% burn injury to the palmar aspect of his right hand. The patient was employed as a metal foundry worker and sustained the burn while using an ignited oxyacetylene torch at work. The cause of the incident was unknown, but the patient recollected a loud spark or explosion while using the torch. Although he was wearing industrial protective gloves, the oxyacetylene torch had penetrated through these.

The patient reported with a transient 2 min 'numbness' of the right hand, followed by a progressive burning sensation in the palmar aspect of his hand with subsequent blistering over the next hour on the dorsal aspect. Immediate first aid included running the hand under cold water for 15 min. On arrival to our plastic surgery department, the hand had swollen considerably, with generalised erythema and a small central charred sinus in the centre of the palm developed (figure 1). At

Figure 1 Central charred sinus secondary to high-pressure flame burn.

this time no acute carpal tunnel or compartment syndrome was noted at this time.

The patient was taken to the theatre for debridement of the burn and further examination of the wound. A full thickness deficit down to palmar fascia with soot and debris extending into the carpal tunnel was noted (figure 2). Common digital arteries, nerves and palmar arch were intact, but swelling of the tissue around the carpal tunnel along with the history of transient numbness around the wrist at the time of insult (which is attributed to transient neuropraxia of the median nerve) directed us to decompress the carpal tunnel and release the nerve.

Soot and debris were carefully dissected off the palmar structures followed by a saline washout. It was presumed that the soot originated from combustion products of the industrial glove. The hand was subsequently elevated postoperatively in a (Bradford sling) to reduce the swelling and started on intravenous antibiotics. Neurovascular observations were performed on the ward by nursing staff to ensure a satisfactory outcome.

Figure 2 Soot and debris down the palmar fascia extending to the carpal tunnel.

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A second debridement was performed a day later using the microscope, to ensure adequate clearance of any residual soot and debris. Soot had burned throughout the mid-palmar space encasing superficial palmar arch, median nerve, down to the level of the lumbrical muscles, extending laterally into the thenar and hypothenar spaces. The hand was dressed and placed in an intrinsic plus splint, otherwise known as the position of safe splinting, with the fingers in full extension and the metacarpophalangeal joints in 60–70° of flexion and the wrist in extension. This is to prevent hand stiffness in the period of immobilisation. The patient received postoperative hand therapy and subsequently made an uneventful recovery regaining a satisfactory degree of function of his right hand.

DISCUSSION

This case report emphasises the importance of meticulous surgical exploration and debridement when dealing with oxyacetylene burns as the extent of injury can be far deeper (tip of the iceberg) than it appears to the clinician.

In 1998, a case report from India illustrated superficial and deep burn after an accidental leak of acetylene gas from its generator, requiring surgical debridement.³ It was documented that the patient sustained 25% deep dermal burn with a 5×5 cm charred area in the groin. Surprisingly, and during surgical exploration of the charred area, it was found that it extended into the scrotum, the abdomen, the chest from the midline to the posterior axillary line and from nipple to the inguinal ligament. The charring of the subcutaneous tissue extended via pneumatic dissection under normal looking and healthy skin.

A further case report in the literature is documented from Japan involving oxyacetylene burn accident. The steel welder's upper limb sustained a deep penetrating flame injury to the right cubital area. The extent of tissue injury and soot penetration was far deeper than had appeared on the overlying skin. The mechanism of the tissue destruction may be that while the gas explosion burnt the skin, the high-velocity gas flame dissected the tissue along the deep fascia of the biceps muscle leaving overlying skin intact.

From these cases and from our experience, it is highly recommended in such circumstances to assess and document physical examination and signs of subcutaneous emphysema after any traumatic injection injuries, including welding injuries, in order to differentiate from more serious gas gangrene that may occur at a later stage.⁴

In our case, the exact cause of equipment failure was indeterminate, but high-pressure welding torch injuries, have been demonstrated to penetrate industrial 'flame retardant' gloves.

Furthermore, high-pressure injection injuries to the hand from paint and solvents have been associated with an internal chemical burn, particularly with solvents that can cause tissue destruction by lipid dissolution. Amputation rates of up to 21% were reported in one 10-year review of such injuries.⁵ Meticulous debridement under the highly skilled hand with microscopic magnification should be considered allowing removal of microscopic fragments that may contribute to secondary infection or acute carpal tunnel syndrome.⁶

Learning points

- ▶ Reports of severe burns associated with the use of oxyacetylene are rare.
- ▶ When dealing with the complications of these burn injuries, one must be aware of the high pressure component.
- ▶ Meticulous dissection of hand burn injuries can reveal deeper penetrating injuries.
- ▶ The importance of documentation of physical findings associated with oxyacetylene injuries prior to surgical exploration.

Contributors All authors contributed to this case report.

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