Journal of Experimental and Clinical Medicine
Deneysel ve Klinik Tıp Dergisi

Case Report

A burn injury due to 800 degrees molten aluminum

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ARTICLE INFO

Article History
Received 20 / 12 / 2009
Accepted 06 / 02 / 2010

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Key Words :
Foot
Foundry Workers
Molten Metal
Burn
Workers Injuries
Molten Aluminum

ABSTRACT

Molten metal burn cases are preventable injuries. The burns are common among foundry workers. Our case was reported of a foundry worker who suffered from molten metal burn injury. The patient have received a foot injury especially on his dorsolateral foot. The burn wound was second degree and has been recovered only daily wound care in 4 weeks. We suggested that the molten metal burn injury could easily have been prevented by the use of protective footwear.

J. Exp. Clin. Med., 2009; 26:145-147

1. Introduction

A variety of molten metals have been involved, including iron, steel, manganese, brass, aluminum, and zinc. The molt temperatures range from 760°C to 1400°C (Grube et al., 1987; Himel et al., 1992). Molten metal burns remain an industrial injury among workers in foundries especially (Himel et al., 1992). The most commonly injuried areas were the lower extremities (Marqulies et al., 1998). The magnitude of burn injury depends on the mechanism of injury, which affects duration of heat contact (Himel et al., 1992). Aluminum metal tends not to adhere to the skin, but will run downward along the extremity without sufficient contact time to create deep burns (Boss and Arons, 1982). In contrast, Zinc molten metal that adheres to the skin will cause a superficial burn injury. The second method of injury occurs when the molten metal burns through the leather of the protective footwear. Because considerable heat is outspreated as the molten metal burns through the leather, the underlying burn injury is usually superficial (Himel et al., 1992; Marqulies et al., 1998).

It is the purpose of our case report to consider the rare burn of molten metal burn injury and to provide due care to the occupational safety among workers in foudries. Molten aluminum had passed through the foundry worker's shoe laces onto the foot, seeping into his boot. The hot metal temperatures were approximately 800ºC. The molten metal encircled the dorsolateral of his foot. It has caused a second degree burn injury that recovered daily wound care.

2. Case Report

The patient 28-year-old male who slovenly spilled molten aluminum on his right steel tipped safety boot at the foundry. The molten metal passed through his shoe laces onto the tongue of the boot and then seeped into the boot. The molten aluminum temperatures were approximately 800ºC. In this way, the patient has been applied to the emergency service. In physical examination it was observed that 8×7 cm. partial-thickness burn area of the dorsolateral of his foot (Fig. 1). He has exposed 800 degrees molten aluminum for along approximately 2 minutes in order to be removed immediatelly his boot by co-workers. The burn wound was second degree and not circumferential. Both of the foot and toe circulation

Fig. 1 : Partial-thickness burn on his foot

was normal and dorsiflexion and plantar flexion as well. Nitrofurazone (Furacin, Pharmedix, Hayward, CA) ointment was employed as the topical antimicrobial agent and oral antimicrobial agent was only given in 1 week. The wound care has been carried daily and dressing with nitrofurazone ointment was performed everyday. Finally, the burn wound on his foot was recovered succesfully (Fig. 2). At the end of the 5 week of treatment, he was able to return to work.

Fig. 2 : Burn wound has recovered without eschar in a period of 5 week

3. Discussion

Molten metal burn of the feet among foundry workers has first been described by Pap (Himel et al., 1992). The case report involved three patients, that all three workers suffered from full thickness burn injuries requiring skin grafts, only one required amputation of the distal phalanx of one toe. The mechanism is that the molten metal is spilled onto the shoe gaining access via the top of the boot or seeping around the tongue but the typical accident was that of a splatter spill, causing a full thickness burn injury (Marqulies et al., 1998). The collection of molten metal in the shoe prolongs thermal contact insuring the development of deep partial-thickness or full-thickness burn injury (Himel et al., 1992).

Hot metal injury related lower extremities was described by Grube, Heimbach and Engrav (Grube et al., 1987; Himel et al., 1992). The patients in this study were trateded with two different protocols after skin grafting. They emphasized, that the compression of skin graft with using Unna paste bootis resulted with shortened hospital stay and provided early ambulation than the conventional noncompressive dressing (Himel et al., 1992). Molten metal burn injuries have received relatively little attention in the surgical literature (Marqulies et al., 1998). In a study which reported by Marquiles et al., they performed a retrospective chart review of 150 patients who suffered hot metal burn injuries between 1972-1977. They suggested the burns all occured in male foundry workers and most commonly from molten aluminum. An another large series of molten metal burn was reported by Boss and Arons (Boss and Arons, 1982). This study has involved 20 foundry workers and all of the patients have required skin graft operation (Boss and Arons, 1982). In another study Blomgren et al. showed that threshold temperature elevation of 52ºC for 20 seconds caused a full thickness burn injury that was not amended by immediate cooling (Blomgren et al., 1985). Prolonged time of contact with the molten metal is second factor. After the hot metal encircled the foot or the toes, it takes approximately 5 minutes to remove the safety boot. In our case, his safety boot removed by helping co-workers in approximately 2 minutes.

In almost all these case reports, the skin burns were usually full thickness or deep partially thickness burn injury. Because of this, skin grafting had required in these cases' treatment. The typical accident was that of splatter spill and the mean burn size was 2.3% of the total body surface area (Marqulies et al., 1998). In our case we reported was second degree burn injury on his dorsal foot and the patient was recovered by daily wound care. Acceptable response was obtained in 1 month and was satisfactorily.

The Occupational Safety and Health Administration recommends that all molten metal workers wear flameproof pants and jackets, aluminum knee-length coats and leggings, hard hats, molders shoes with metatarsal guards, gloves, and sweat bands for perspiration (Personick, 1990; Still and Law, 1994; Faulkner et al., 1997). It means that the best treatment of molten metal burns remain prevention.

In conclusion, molten metal burn injuries were frequently seen among workers in foundries and the most commonly reason is aluminum. Molten aluminum passed through the worker's safety shoe laces onto tongue of the shoe, seeping into his boot. We thought that safety boots

or protective footwear have been used in foundries should have been made more reliable and it should be provided for all molten metal workers to use. The best treatment for molten metal burn injuries are prevention.

REFERENCES

Blomgren, I., Bagge, U., Johansson, B.R., 1985. Effects of cooling after scald injury to a dorsal skin fold of a mouse. Stand J. Plast. Reconstr Surg. 19, 1-9.

Boss, W.K. Arons, J.A., 1982. Molten metal safety boot burns: analysis and treatment. J. Trauma. 22, 884-886.

Faulkner, B.C., Drake, B.D., Gear, A.J., Watkins, F.H., Edlich, R.F., 1997. Molten metal burns: Further evidence of industrial foundries' failure to comply with occupational safety and health administration regulations. J. Emerg. Med. 15, 675-677.

Grube, B.J., Heimbach, D.M., Engrav, L.H., 1987. Molten metal burns to the lower extremity. J. Burn Care Rehab. 8, 403-405.

Himel, H.J., Syptak, J.M., Jones, K.C., Jones, J.R., Towler, T.A., Edlich, R.F., 1992. Molten metal burn of the foot :a preventable injury. J. Emerg. Med. 10, 147-150.

Marqulies, D.R., Navarro, R.A., Kahn, A.M., 1998. Molten metal burns; early treatment improves outcome. Am. Surg. 64, 947-949.

Personick, M.E., 1990. Heat burns sustained with in the workplace. Mon. Labor. Rev. 37-38.

Still, J., Law, E., 1994. Management of a burn sustained as a result of contact with 2400 degrees F molten metal. J. Burn Care Rehabil. 15, 523-524.