A Case of Death Caused by 2700°C Molten Magnesite Burns

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ABSTRACT
Magnesite (MgCO₃) is a mineral which is theoretically composed of 52.2% CO₂, 47.8% MgO, and very scarce amounts of Fe₂O₃ with a degree of hardness varying between 3.4-4.5 kgf, and specific gravity of 2.9-3.1 g/cm³. Its color varies between white, yellow or gray, and brown. Magnesite is used in agriculture, and drug industry, brick, iron-steel, paper, and sugar industries. Our case was a 30-year-old male whose death was reportedly associated with exposure to 2700°C molten magnesite in the melting pot of the plant where he was working as a metal worker. At autopsy, on external examination, except from his left forearm, all over his body was charred from severe burns. Both of his legs from ankles, and right forearm from its middle third were nearly amputated, and body muscles were partly detached because of high temperature. Widespread areas of thermal rupture were observed. On internal examination scalded appearance of internal organs was noted. Blood, and urine analysis did not reveal any substance abuse. Herein, we have aimed to discuss, and evaluate death events because of exposure to very high temperatures from the perspective of forensic medicine, and occupational safety.

INTRODUCTION
In studies performed on industrial burn injuries, the authors have indicated that these types of burns have an important place among all cases of burn injuries, and emphasized that these cases are indicators of status of industrial, socioeconomic, and healthcare systems of the country (1, 2). Besides different authors have underlined that workers employed in molten metal processing plants such as foundries are always under increased risk of exposing to burn injuries, and also stressed lack of adequate information related to this issue (2, 3). Magnesite (MgCO₃) is a mineral which is theoretically composed of 52.2% CO₂, 47.8% MgO, and very scarce amounts of Fe₂O₃ with a degree of hardness varying between 3.4-4.5 kgf, and specific gravity of 2.9-3.1 g/cm³. Its color varies between white, yellow or gray, and brown. Magnesite is used in agriculture, and drug industry, brick, iron-steel, paper, and sugar industries (4). Herein, we aimed to discuss, and evaluate death events because of exposure to very high temperatures from the perspective of forensic medicine, and occupational safety.
CASE REPORT

Our case was a 30-year-old male whose death was reportedly associated with exposure to 2700°C molten magnesite in the melting pot of a Mineral Ore Processing Plant where he was working for. Examination of the accident site reports written by the attorney general revealed that the accident happened caused by overturning of one mineral melting pot after an explosion in the Magnesite Ore Processing Plant. First accident site reports kept following explosion disclosed deformation in one of the melting pots. The corpse was reportedly found in the vicinity of the melting pot as he was taken away from the molten mineral ore. During cooling attempts abundant amounts of water had been sprayed on the victim with a hose, however all of his clothes, and almost all of his body had been burnt. As recorded in his legal report, all over his body was coated with yellow-brown bright coloured molten magnesite, and patchy areas of burnt, and charred muscle, and bone tissue were observed. As documented in his legal file, the dead body belonged to a male individual 172 cm tall, and weighing 85 kg at present. After preliminary inspections, upon the request of the local prosecutor, the deceased was sent to our center for autopsy. At autopsy, external examination revealed green-yellow-brown molten metal smudge on his head, and back (Figure 1) and, except from his left forearm, all over his body was charred from severe burns. Both of his legs from ankles, and right forearm from its middle third were nearly amputated, and body muscles were partly detached because of high temperature. Widespread areas of thermal rupture were observed. On internal examination scalped appearance of internal organs was noted. Systemic toxicological blood, and urine analysis did not reveal any substance abuse. The cause of death was reportedly associated with burning from molten magnesite ore.

DISCUSSION

In studies performed on the frequency of industrial burn injuries, the authors have indicated that these types of burns have an important place among all cases of burn injuries, and emphasized that these cases are indicators of status of industrial, socioeconomic, and healthcare systems of the country (1). In addition, Kahn et al. reported a drop in the incidence of industrial molten metal burns thanks to the developments in the field of occupational safety and raising awareness of the metal workers (2). However, as is the case with our victim, different researchers have emphasized the higher risk of metal workers employed in molten metal ore plants like foundries, and also pointed out to the inadequate data on this issue (2,3). In the present case, as the cause of death, magnesite (MgCO₃) is a mineral which is theoretically composed of 52.2% CO₂, 47.8% MgO, and very scarce amounts of Fe₂O₃ with a degree of hardness varying between 3.4-4.5 kgf, and specific gravity of 2.9-3.1 g/cm³. Its color varies between white, yellow or gray, and brown. Magnesite is used in the agriculture, and drug industry, brick, iron-steel, paper, and sugar industries (4). In studies performed on molten mineral ore burns, similar to our case, most frequently burn injuries were reported in foundries, and mineral ore processing plants (5,6). Similar to our case, most often male
workers employed in chemical industries are reportedly exposed to burn injuries (1). Molten metal burns usually involve lower extremities, feet, and ankle, and many researchers have indicated their opinions complying with these literature finding (5-7). However as an important point to be emphasized Munnoch et al. (1) reported upper extremity burns is the most frequently seen burns in chemical industry. However, very rarely encountered widespread molten metal burn detected in our case has a critical importance in that it displays problematic issues of occupational safety in our country (1-3,5-7).

A rarely seen case of molten metal burn caused by inhalation of the vapours of molten copper reported by Gibson et al. (3) is very interesting and didactic example which deserves further investigation with respect to occupational health, and safety in various fields. Contrary to thermal burns occurring at 350-1350°C reported in the literature as exposure to extremely high temperatures, our case was exposed to molten metal at 2700°C (3,6). Many authors have underlined that in cases with molten metal burn wounds, clinically the lesion involves skin layers in full-thickness and at the onset the victim may feel mild degrees of pain because of this full-thickness involvement (2,6,7). In cases where the symptoms of pain are not severe at the onset, as an issue frequently underlined, burn wounds should be properly examined by experienced physicians to prevent erroneous evaluation of the emergency state of the condition and depth of the burn wound which also requires centers specialized in surgical interventions (2,6,7). Beneficial effects of diagnostic radiological examinations for the accurate orientation of the patients to specialized centers have been also indicated (2).

The critical importance of employment of young and unexperienced workers in the molten metal industry for job safety increased incidence of physical injuries for worker’s health and various accidents and losses for the employers have been emphasized. Training of novice workers and experience gained transfer of cases of burn to specialized centers appears to be the most important issues (1-3,5,6).

In conclusion, measures for workplace safety should be increased so as to decrease the number of death events occurring as a consequence of exposure to very hot substances in the workplace.

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REFERENCES