



A special type of scald caused by prolonged exposure to slowly heated water



R. Pircher^{a,*}, S. Pollak^a, S. Vogt^a, T. Epting^b, L. Kramer^a, D. Geisenberger^a

^a Institute of Forensic Medicine, Freiburg University Medical Center, Albertstrasse 9, 79104 Freiburg, Germany

^b Division of Clinical Chemistry, Department of Medicine, Freiburg University Medical Center, Hugstetter Strasse 55, 79106 Freiburg, Germany

ARTICLE INFO

Article history:

Received 18 January 2016

Received in revised form 8 April 2016

Accepted 12 April 2016

Available online 19 April 2016

Keywords:

Burn blister

Blister fluid

Protein electrophoresis

Scald

Bath tub

Electrocution

ABSTRACT

When skin is subjected to water temperatures gradually rising from moderate to critical ranges for a prolonged period of time, the resulting scalds will initially present as reddening, followed by blistering and at last by full-thickness burns. On changing from second- to third-degree burn, the blisters stop to become enlarged and solidify due to heat-induced coagulation necrosis. Such gradually intensifying tissue damage results in multiple firm skin blisters together with third-degree burn of the affected area. The initially serous blister fluid assumes a jelly-like consistency as the proteins undergo denaturation. Scalds of this special type may occur in persons taking a bath and becoming incapable to act so that the warm water tap remains turned on or a hairdryer continues to work after having been dropped into the bath water. On the basis of two relevant fatalities (suicidal electrocutions in bathtubs by means of hairdryers), the macroscopic and histological appearance of blisters which only secondarily turned into a full-thickness scald is compared with blisters in genuine second-degree scalds. The blister fluid of the latter ones was also investigated as to their protein composition and hemoglobin concentration.

© 2016 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Scalds are thermal injuries caused either by hot liquids or steam. The degree of local heat damage mainly depends on the acting temperature and the time of exposure, but also on the thermal conductivity, which is especially high in fluids. Compared with burns from dry heat, scalds show some special characteristics: There is no concomitant singeing of hair and no charring, the demarcation against intact skin is mostly sharp and heat penetration is rather even resulting in a uniform appearance. Usually the depth is confined to the upper layers of the integument (erythema and/or blister formation), but full-thickness tissue destruction may occur especially in cases of prolonged contact with the hot medium [1,2].

In clinical medicine, most scalds are accidental and often involve pre-school children, for instance when pots containing hot liquids are pulled off the stove. The forensic practitioner also encounters scalds from (child) abuse such as spill and immersion burns, the latter ones typically showing a horizontal margin

corresponding to the fluid level (“tide-mark”). In adults, scalds may be seen as an unintended side effect of suicidal actions carried out in the bath: Some suicides are committed in the water-filled tub either by drug intoxication (with the hot-water tap possibly remaining turned on after loss of consciousness) or by electrocution (with a still working hairdryer heating up the water). In both constellations, a special type of scald may be observed: initial blistering secondarily converted to full-thickness burn due to the slowly increasing water temperature. To the best of our knowledge, this kind of scalding has not yet been described in the medicolegal literature. The findings of two relevant autopsy cases are therefore presented here.

2. Material and methods

2.1. Case 1

A 51-year-old woman was found dead by her husband when he returned from work in the late afternoon. At 7 a.m. the victim had still been alive. The woman was dressed in a T-shirt and underwear. The body was lying on its back in the bathtub with the head and upper trunk above the water level (Fig. 1). An electric hairdryer, plugged into a 230 V AC outlet, was placed inside the tub. The device was still running until being unplugged by the deceased’s husband. 90 min later, the temperature of the

* Corresponding author at: Institute of Forensic Medicine, Freiburg University Medical Center, Albertstrasse 9, 79104 Freiburg, Germany. Tel.: +49 761 203 6804; fax: +49 761 203 6858.

E-mail address: rebecca.pircher@uniklinik-freiburg.de (R. Pircher).



Fig. 1. (ref. to case 1): Death scene. Head and upper trunk are above the water. The cable visible in the foreground leads to the hairdryer submerged in the bath.

bath-water was still 43 °C whereas the tap was set to a temperature of 34 °C. The water was murky and had a brownish hue. On the rim of the bathtub there was a drinking glass with a sleeping pill next to it. The bathroom was not provided with a ground fault interrupter. The woman had suffered from depression and announced suicide only two days before her death.

2.2. Case 2

The body of a 50-year-old man was found by his female partner in the bathroom filled with dense steam impairing visibility. The unclothed man was lying in supine position with his head and neck outside the 36 cm high water (Fig. 2). Two hairdryers still running in the bathtub were connected to a double adapter attached to a plugged-in extension cord (230 V AC). The hot water was let out before its temperature could be measured. When the window was opened by the victim's partner, a flowerpot fell off the windowsill and the potting compost soiled the lower parts of the body. The bathroom was not equipped with a ground fault circuit interrupter. The man had complained about burnout symptoms but refused to accept medical help. He left a farewell letter which did not give any details about the suicide motives.

2.3. Histological examination

Apart from specimens of the inner organs, pieces of skin from the scalded body regions (including fluid-filled and solidified blisters) were fixed in buffered formalin (4%), embedded in paraffin, cut into thin slices (4 μm) and stained with hematoxylin-eosin for histological investigation. Additionally, samples from the skin and the lungs were subjected to cryosection and stained with sudan red 7B.

2.4. Blister fluid examination

Large skin blisters located at the border between full-thickness scald and intact skin (corresponding to the former level of the hot bath water) were punctured with a disposable syringe in order to aspirate the yellowish fluid content. Total protein concentration and main protein fractions (albumin, alpha-1-globulin, alpha-2-globulin, beta-globulin, gamma-globulin) were determined using routine laboratory methods (Roche Diagnostics Cobas™ analyzer

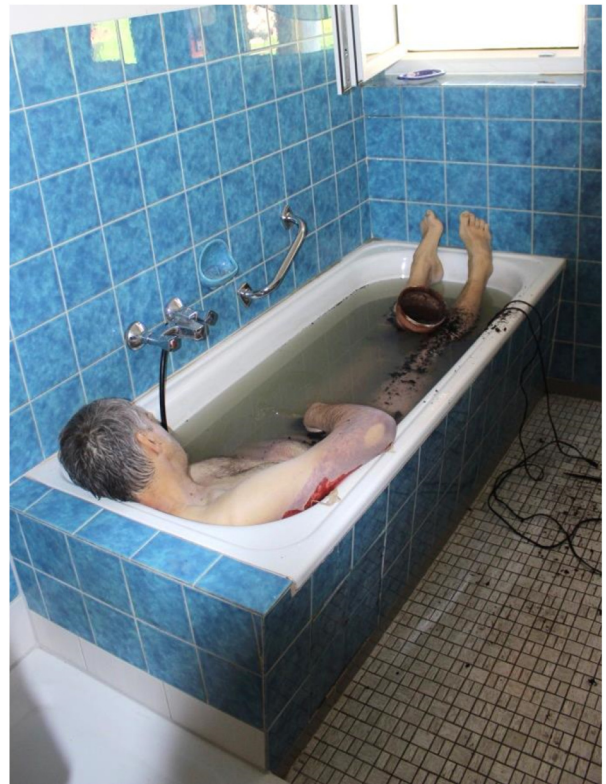


Fig. 2. (ref. to case 2): Death scene. When the man was found, the two hairdryers were still working under water.

and Sebia's Cappilarys™ 2 system, respectively). Samples of blood serum and from pleural effusions were investigated in the same way. Based on the relative proportions of the protein fractions, the albumin-globulin ratio was calculated and compared with literature data concerning the fluids of different blister types [3]. Besides, the concentration of hemoglobin in the blister fluid, the serum samples and the pleural effusions was determined photometrically, using the sodium lauryl sulfate method (Sysmex XN™, Norderstedt).

2.5. Toxicological analysis

Serum samples of blood from the femoral veins were subjected to multi-target toxicological examination. Analyses were performed either with GC-MS or LC-MS/MS. The screening included 700 licit and illicit drugs and metabolites such as analgesics, sedatives, antidepressants and other psychoactive drugs [4].

2.6. Experimental heating of bath water

In order to reproduce the heating effect of a hairdryer running under water, a device of the same make as used in our first case (200 W) was dipped into a filled bathtub where it continued to function. When the test started, the tub contained about 130 l of water and the temperature was 34 °C. The experiment lasted 30 min.

2.7. Water discoloration due to long-term scalding

To simulate any clouding and discoloration of the bath water, the distal part of a slaughtered pig's hind leg was partly submerged in hot water (55 °C). Care was taken to ensure that it was in contact only with intact skin and not with a cut surface of the tissue. The exposure was ended after 150 min.

Download English Version:

<https://daneshyari.com/en/article/95148>

Download Persian Version:

<https://daneshyari.com/article/95148>

[Daneshyari.com](https://daneshyari.com)