Clinics in Dermatology (2015) **33**, 122–127

ELSEVIER

Clinics in Dermatology

CLIO DERMATOLOGICA
Edited by Mauricio Goihman-Yahr, MD, PhD

Struck by lightning: Lichtenberg figures on a 19th-century wax model

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Abstract Wax models in dermatology were used to a large extent until the 1930s as three-dimensional models to illustrate various pathologic conditions and in particular cutaneous signs of disease. As an example, a young woman who was struck by lightning and developed Lichtenberg figures is presented. Lichtenberg figures are a fernlike pattern on skin, characteristic of lightning. Such a wax model housed in the German Hygiene Museum Dresden, Germany, illustrates the significance of wax models and how, even today, they can play an important role in medical education.

Lightning, which creates high-voltage injuries, is the second most common cause of death related to storms. The afflicted may end up in cardiorespiratory arrest, develop cardiac asystole or fibrillations, sustain muscular injury and hemolysis, which may lead to renal insufficiency, and even experience neurologic complications. Cutaneous lesions are seen at the site of entry and exit wounds with surrounding burn ulcers. Severe burns are rare.[1,2]

Indirect strikes are more common than direct hits in electrical storms. The mortality rate for lightning victims ranges between 10% to 30%. Population-based mortality has been estimated between 0.2 and 1.7 per million inhabitants per year.[3]

One pathognomonic lightning-induced cutaneous phenomenon is a painless erythematous fernlike pattern visible on the skin. It is also referred to as Lichtenberg figures (LF), named after the physicist Georg Christoph Lichtenberg (1742-1799) who in 1777 first observed comparable patterns on an electrified insulating plate covered with dust.[4] LF represent a temporary fractal pattern and may develop within

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http://dx.doi.org/10.1016/j.clindermatol.2014.10.004
0738-081X/

20 min after injury, persisting up to 48 hours. Histopathologic study is usually nonrevealing.

LF are thought to be due to the development of accelerated electrons that accumulate in the skin as long as the electrical field exceeds the electrical breakdown strength of keratinocytes.[5] Although the underlying cause of the pink-red color may be due to a temporary vascular reaction, the chemical nature of this bizarre occurrence remains unknown.

Case report

The German Hygiene Museum Dresden houses in its collection a wax model depicting a young woman struck by lightning (Inv. No. DHMD 2010/965). The model is dated around 1900 and is probably of German origin, its maker being unknown.

The model measures about 140 cm from head to toe, making it life size, a most unusual size for wax models. She is posed in a lying position with her legs stretched and one arm behind her head. She is covered by a dress with a waist belt (Figure 1). She does not wear shoes or socks. We cannot tell if she is dead or simply unconscious from the lightning bolt. Skin marks of both the entry and exit points of lightning can be seen. (Figure 2) On the lower part of the legs and even more prominently inbetween the breasts, there are reddish blue lines branching to resemble a fern plant. There are shiny yellow marks on the sternum that may depict ulceration from the thermal burn (Figure 3). There are areas of dark bluish hyperpigmentation on her left ring finger, wrists, and earlobes. This suggests that the jewelry she was wearing melted, only to be impregnated into her skin (Figures 4-6).

Fig. 1 A 19th-century wax model depicting a young woman struck by lightning.

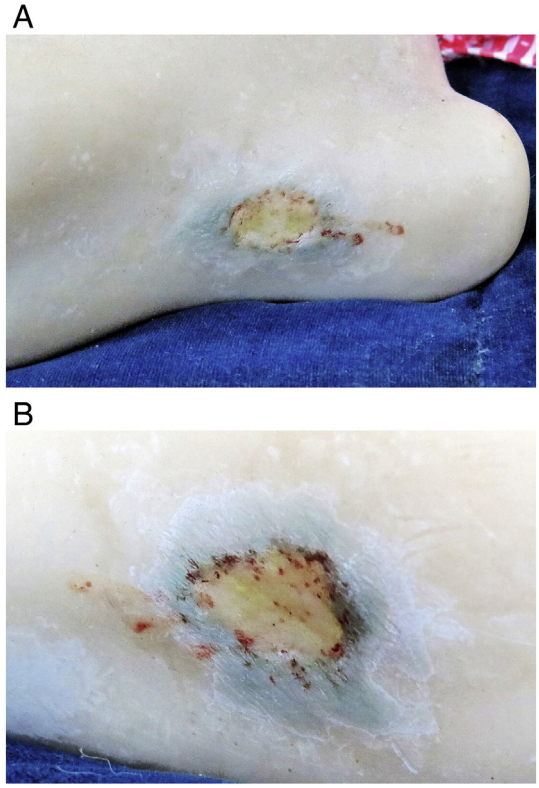

Fig. 2 Points of entry and exit on the soles. Panel A, right foot; panel B, left foot.

Discussion

The patient

We present a rare 19th-century wax model of a young woman who suffered a deadly lightning strike.

Lightning represents an extremely high-voltage direct current electrical discharge. Historically, there are five different means by which a lightning strike can injure a person: (a) direct strikes, (b) contact voltage, (c) side splash, (d) ground strike, and (e) weak upward streamer.[6] More recently, concussive blast effect, or lightning explosive barotrauma immediately surrounding a lightning channel, has been considered as the sixth type of lightning injury mechanism. Such injuries seem to be responsible for rupture of the tympanic membrane observed in many lightning strike victims.[7]

This wax model also depicts the effects of a ground strike with points of entry and exit on the soles, such as happens when a person is standing with feet apart or walking on the ground. In this wax model, the marks are about 4 cm in diameter (Figure 2).

We can only speculate that the subject was struck by lightning in a mountain terrain. Such surfaces can be