Burns and Recent Nanoparticle Technology

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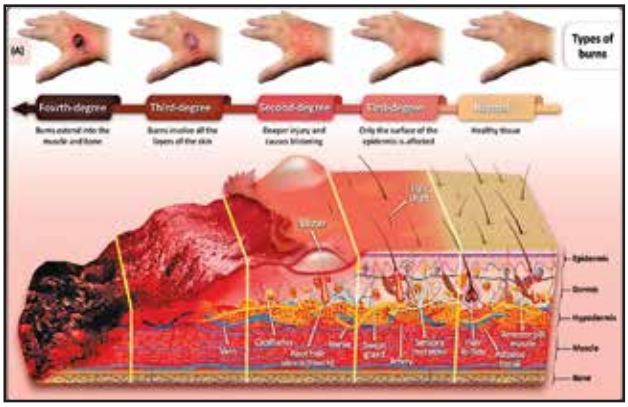
Key points

- Introduction
- Classification of burns
- Old management techniques
- Recent nanoparticle technique

Skin Burns are one of the leading causes of skin damage. According to World Health Organization (WHO) statistics, globally, 300,000 people die of burns annually. In acute burns, blood vessels and cells are often damaged and the blood supply to the wound is disrupted. Many elements, such as nutrition, hormones, aging, infection, and oxygenation, are likely to enhance burn progression and disturb repair with the release of several cytokines and growth factors.1

Classification:

Burns tend to be a dynamic process and are classified based on their depth. During inspection, depth is evaluated based on the appearance, decolonization on applying pressure, pain, and sensation. According to the American Burn Criteria, burns can be categorized according to their thickness using the aforementioned four factors. Some burns, particularly with partial-thickness, may develop over 2 to 4 days, climaxing at day 3.2



Partial Thickness Burns:

There are two types of Superficial Burns: first-degree and second-degree burns. The first degree involves the epidermis of the skin, and only the epidermis is lost. It is dry and appears pink to red, with no blisters. It is somewhat painful. These burns heal within 5–10 days without scarring. The second-degree involves the superficial dermis and the papillary layer of the dermis is affected. It is wet and appears red with blisters. Erythema decolorizes with pressure, and the pain associated with it is grave. Typically, healing occurs within three weeks, with minimal scarring. In contrast, second-degree burns include deep partial thickness, which affects the reticular layer of the deeper dermis. It does not decolorize under pressure, is dry, and appears white or yellow, and presents with minimum pain due to a reduced sensation. These burns heal within 3 to 8 weeks with scarring.2, 3

Full Thickness Burns:

The full thickness of the skin and subcutaneous structures is involved in third-degree burns, and the hypodermis is mostly affected. Under pressure, no decolonization or paleness occurred, and the burns appeared white or black/brown. They are also leathery and dry, with minimal to no pain due to a lessened sensation. These burns heal by contracture and last more than 8 weeks. Full-thickness burns require skin grafting. A possible exposed bone along with charred skin is seen in the fourth-degree burns. Mostly, the muscles, tendons, and bones are affected in this type. Fifth-degree burns show white, charred skin, along with exposed bone whereas, sixth degree shows exposed bone along with loss of skin.2, 3

Figure 2

Treatment:

Currently available therapeutic options include biological approaches for burn wound healing (therapeutic microorganisms, antimicrobial agents, immune-based

antimicrobial molecules, reactive oxygen species, and nitric oxide generators), ultrasound-based wound therapy (phototherapy and shockwave and ultrasound-based therapy), antimicrobial light, stem cell-based burn therapy, and nanoparticles for the treatment of burn infections and wound healing. Other options include skin tissue engineering, pharmacological approaches, negative pressure wound therapy (NPWT), wound dressings, skin grafting and skin substitutes, and surgical approaches. The interaction of nanoparticles with the skin and their lifetime at the site of action are governed by the type and size of the nanoparticles and the degree of injury to the skin. The inflamed and injured skin shows loss of its barrier function and greater chance of nanoparticles engrossment to the systemic circulation and can even be penetrated by particles bigger than the nanometer scale.3

References:

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