

# Burn size calculation

## children

### Burn size calculation: children

The body proportions of children necessitate adjustment of the above-mentioned scales. An infant's head is proportionally larger than an adult's and this adjustment is represented on the modified Lund and Browder chart for children, where at birth the head represents 18% and the lower limbs 13.5% each. For each year 1% is subtracted from the head, with 0.5% being added to each lower limb until the age of 10, when the body proportions are roughly equivalent to those of an adult. Summary box 46.11 Assessing the area of a burn

The patient's hand is 1% TBSA, and is a useful guide in small burns The Lund and Browder chart is useful in larger burns The 'rule of nines' is adequate for a first approximation only

The first indication of burn depth comes from the history ( Table 46.2 ). The burning of human skin is temperature and time dependent. It takes 6 hours for skin maintained at 44°C to suffer irreversible changes, but a surface temperature of 70°C for 1 second is all that is needed to produce epidermal destruction. Taking an example of hot water at 65°C: exposure for 45 seconds will produce a full-thickness burn; for 15 seconds a deep partial-thickness burn; and for 7 seconds a superficial partial-thickness burn ( Figure 46.3 ). Summary box 46.12 Assessing the depth of a burn

Superficial partial-thickness burns The damage in these burns goes no deeper than the papillary dermis. The clinical features are blistering and/or loss of the epidermis. The underlying dermis is pink and moist and will exudate fluid for up to 36 hours post burn injury . The capillary return is clearly visible when blanched. There is little or no fixed capillary staining. Pinprick sensation is normal. Superficial partial-thickness burns heal without residual scarring in 2 weeks ( Figure 46.4 ). The treatment is supportive. Deep partial-thickness burn These burns involve damage to the deeper parts of the reticular dermis. Clinically , the epidermis is usually lost. The exposed dermis is not as moist as that in a superficial burn. There is often abundant fixed capillary staining, especially if examined after 48 hours. The colour does not blanch with pressure under the examiner's finger. Sensation is reduced, and the patient is unable to distinguish sharp from blunt pressure when examined with a needle. Deep dermal burns take 3 weeks or more to heal without surgery and usually lead to hypertrophic scarring. - -

TABLE 46.2 Causes of burns and their likely depth. Cause of burn Probable depth of burn Scald Superficial, but with deep dermal patches in the absence of good first aid. Will be deep in a young infant or the elderly Fat burns Deep dermal to full thickness Flame burns Mixed deep dermal and full thickness Alkali burns, Often deep dermal or full thickness including cement Acid burns Weak concentrations superficial; strong concentrations deep dermal Electrical contact Full thickness burn The history is important: temperature, time and burning material Superficial

burns have capillary refill. Deep partial-thickness burns do not blanch, but have some sensation. Full-thickness burns feel leathery and have no sensation. Figure 46.3 Photograph showing the difference between superficial dermal (S/D) and deep dermal (D). The burn wound is less than 24 hours old and has been meticulously cleaned in theatre. (a) (b) (c) Figure 46.4 (a) A superficial partial-thickness scald 24 hours after injury. The dermis is pink and blanches to pressure. (b) At 2 weeks, the wound is healed but lacks pigment. (c) At 3 months, the pigment is returning.

**Full-thickness burns** The whole of the dermis is destroyed in these burns. Clinically, they have a hard, leathery feel. The appearance can vary from that similar to the patient's normal skin to charred black, depending upon the intensity of the heat. There is no capillary return. Often, thrombosed vessels can be seen under the skin. These burns are completely anaesthetic – a needle can be stuck deep into the dermis without any pain or bleeding. Concept of two burn depths In treatment terms, there are two burn depths. There are those burns which, with optimal support and good wound management, are superficial enough to heal spontaneously and quickly (within 14 days), leaving an excellent functional and cosmetic result, defined in this chapter as group A. Group B includes those burns that are sufficiently deep to undergo prolonged healing by secondary intention. This process takes weeks or months and involves the degradation and separation of the eschar (burned tissue), the formation of granulation tissue and the process of wound contraction. The course of healing by secondary intention must be aborted and replaced as closely as possible by a process of primary intention healing with direct closure, skin graft and skin substitutes. Figure 46.5 is a pictorial representation of this with burns in the pink section to the left of the line belonging to group A and burns in the blue section to the right to group B. Pyotr Nikolsky, 1858–1940, Russian dermatologist.

Epidermal	Yes	Thin walled or popped	Type of blister	Thick walled	Superficial dermal	Other signs:
	blanches	Mid-dermal with pressure;	very painful;	very oozy	Other signs:	some mottling; blanching
	sluggish;	darker red base;	some anaesthesia;	less oozy	Figure 46.5	Protocol for assessing depth of
	burn.	The Nikolsky sign refers to detachment of the epidermis from the dermis when lateral pressure is applied to the skin. Is there epidermal integrity?	No (Nikolsky sign)?	Run a gloved finger over the burn	Yes	No
	Is it slippery?	Red	Burn colour	White	Deep dermal	Other signs:
	decreased	Full thickness sensation;	absent or reduced refilling after blanching;	fixed	Other signs:	anaesthesia; no mottling;
	little or no ooze refilling after blanching;	may be amber and translucent with visible black vessels;	may be waxy;	hairs fall out easily;	dry	

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The patient's hand is 1% TBSA, and is a useful guide in small burns. The Lund and Browder chart is useful in larger burns. The 'rule of nines' is adequate for a first approximation only.

The first indication of burn depth comes from the history ( Table 46.2 ). The burning of human skin is temperature and time dependent. It takes 6 hours for skin maintained at 44°C to suffer irreversible changes, but a surface temperature of 70°C for 1 second is all that is needed to produce epidermal destruction. Taking an example of hot water at 65°C: exposure for 45 seconds will produce a full-thickness burn; for 15 seconds a deep partial-thickness burn; and for 7 seconds a superficial partial-thickness burn ( Figure 46.3 ).

**Summary box 46.12 Assessing the depth of a burn**

**Superficial partial-thickness burns** The damage in these burns goes no deeper than the papillary dermis. The clinical features are blistering and/or loss of the epidermis. The underlying dermis is pink and moist and will exudate fluid for up to 36 hours post burn injury . The capillary return is clearly visible when blanched. There is little or no fixed capillary staining. Pinprick sensation is normal. Superficial partial-thickness burns heal without residual scarring in 2 weeks ( Figure 46.4 ). The treatment is supportive.

**Deep partial-thickness burn** These burns involve damage to the deeper parts of the reticular dermis. Clinically , the epidermis is usually lost. The exposed dermis is not as moist as that in a superficial burn. There is often abundant fixed capillary staining, especially if examined after 48 hours. The colour does not blanch with pressure under the examiner's finger. Sensation is reduced, and the patient is unable to distinguish sharp from blunt pressure when examined with a needle. Deep dermal burns take 3 weeks or more to heal without surgery and usually lead to hypertrophic scarring. - -

**TABLE 46.2 Causes of burns and their likely depth.**

Cause of burn	Probable depth of burn
Scald	Superficial, but with deep dermal patches in the absence of good first aid. Will be deep in a young infant or the elderly
Fat burns	Deep dermal to full thickness
Flame burns	Mixed deep dermal and full thickness
Alkali burns, Often including cement	Deep dermal or full thickness
Acid burns	Weak concentrations superficial; strong concentrations deep dermal
Electrical contact	Full thickness burn

The history is important: temperature, time and burning material

Superficial burns have capillary filling

Deep partial-thickness burns do not blanch, but have some sensation

Full-thickness burns feel leathery and have no sensation

**Figure 46.3** Photograph showing the difference between superficial dermal (S/D) and deep dermal (D). The burn wound is less than 24 hours old and has been meticulously cleaned in theatre. (a) (b) (c)

**Figure 46.4** (a) A superficial partial-thickness scald 24 hours after injury. The dermis is pink and blanches to pressure. (b) At 2 weeks, the wound is healed but lacks pigment. (c) At 3 months, the pigment is returning.

**Full-thickness burns** The whole of the dermis is destroyed in these burns. Clinically , they have a hard, leathery feel. The appearance can vary from that similar to the patient's normal skin to charred black, depending upon the intensity of the heat. There is no capillary return. Often, thrombosed vessels can be seen under the skin. These burns are completely anaesthetic - a needle can be stuck deep into the dermis without any pain or bleeding.

**Concept of two burn depths** In treatment terms, there are two burn depths. There are those burns which, with optimal support and good wound management, are superficial enough to heal spontaneously and quickly (within 14 days), leaving an excellent functional and cosmetic result, defined in this chapter as group A. Group B includes those burns that are sufficiently deep to undergo prolonged healing by secondary intention. This process takes weeks or months and involves the degradation and separation of the eschar (burned tissue), the formation of granulation tissue and the process of wound contraction. The course of healing by secondary intention must be aborted and replaced as closely as possible by a process of primary intention healing with direct closure, skin graft and skin substitutes. Figure 46.5 is a pictorial representation of this with burns in the pink section to the left

of the line belonging to group A and burns in the blue section to the right to group B. Pyotr Nikolsky, 1858–1940, Russian dermatologist.

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