

# Skin Reactions Following Defibrillation or Cardioversion



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Healthcare staff experienced in cardiac defibrillation with traditional hard paddles are familiar with “paddle burns” after therapy. These paddle burns are usually seen as an erythematous ring or area on the patient’s chest, outlining the area of paddle placement. Skin burns can be a side effect of electrical therapy. The tissue changes are a common reaction to defibrillation although the issue is rarely addressed in textbooks and teaching on emergency cardiac care, perhaps because minor skin burns seem unimportant as compared to a life-threatening arrhythmia. However, the burns can be quite uncomfortable for the patient and their treatment becomes an important part of patient care as the more serious health problems are resolved.

Erythema following electrical therapy is due to hyperemia and edema of skin and subcutaneous tissue as a result of the flow of current and the heat generated. Factors that determine the degree of skin change include the magnitude and duration of the current, the resistance of tissues, patient skin type and condition, and technical skill of the clinician. Current magnitude affects the amount of electrical energy sent to the heart. Duration is the length of time, measured in milliseconds, that electrical current is delivered. Resistance is the opposition to the flow of current through a material and is a component of the total electrical impedance. The higher the skin resistance, the more likely there will be skin burns. Fragile skin conditions and clinical technique will be discussed.

Redness and edema are commonly classified as a first-degree skin burn and involve only the epidermis. They may appear immediately after therapy or develop slowly over a few hours. The redness and discomfort usually subside over 48 to 72 hours.

Second degree burns involve the epidermis and dermis. Superficial dermal burns include the upper layers of the dermis and usually form blisters filled with fluid at the interface of the dermis and epidermis. Blistering may develop immediately or as late as 12 to 24 hours after initial erythema. The area is quite painful to touch and patients often appreciate a mild analgesic. Infection is a concern in this susceptible area as it heals over a two to three week period.

Deep dermal burns may also have blistering but the area is usually a mottled pink and white immediately after injury. These second degree burns may be difficult to distinguish from full-thickness third degree burns. There is usually some discomfort but less pain with this injury. Again, it is important to observe and treat for any signs of infection. Healing takes three to nine weeks and often leaves a scar formation. Deep dermal burns from defibrillation are extremely rare when care guidelines are followed.

People with fragile or sensitive skin such as those with very fair complexions, infants, the elderly, poorly nourished or dehydrated patients and those on medications that alter skin integrity are more susceptible to skin burns. Patients who develop redness and blistering under tape, damp dressings, or ECG electrodes are more likely to show skin reactions to external defibrillation and cardioversion procedures. These people may develop burns at electrical therapy sites despite all care measures. The risk of burns is identified in operating manuals and instructions by all manufacturers of defibrillation equipment and electrodes. It is important to discuss this with patients prior to their undergoing elective procedures such as synchronized cardioversion.

The present trend is to replace hand-held hard paddles with self-adhesive, disposable defibrillation electrodes for hands-free therapy. These disposable electrodes are backed with an adhesive gel strong enough to hold the electrodes firmly in place for several hours of monitoring, defibrillation, and/or noninvasive pacing. Patients with fragile skin, dermal allergies, or a history of skin reactions to adhesive tapes may show a dermatitis reaction to the adhesive in addition to possible side effects from the electrical current.

Clinical measures to decrease skin resistance and decrease risk of tissue injury include:

- 1. Apply paddles or electrodes to clean dry skin that is free of injury.** The area should be washed with soap and water only. Excessive hair should be clipped or shaved. Avoid breaking the skin. Gently abrading the skin with a towel or gauze decreases skin resistance. Do not apply alcohol, tincture of benzoin, or other topical preparations as they increase skin resistance and risk of burns.
- 2. Apply an appropriate coupling agent such as defibrillation paste or gel pads to paddles completely covering the metal electrode surfaces. (Disposable electrodes are pre-gelled and additional gel should not be applied.)** Defibrillation gels contain salt and decrease the resistance by up to 20%. Other agents such as ultrasound gel do not have adequate sodium chloride content and should not be used. When using hard paddles, apply defibrillation gel or gel pads to clean, smooth paddle metal surfaces only. Avoid smearing gel on other surfaces. Pitted, scarred, or dirty hard paddle surfaces can cause uneven current delivery.
- 3. Correctly apply the electrode or paddle.** For hard paddle application apply firm pressure during discharge; the American Heart Association recommends 25 pounds (12 kilograms per European Resuscitation Council) of pressure per paddle.

For disposable electrodes, check the electrode package for the expiration date. Open electrode packages immediately prior to use. Place one end of the disposable electrode on the skin and firmly smooth across to the other end of the electrode, removing all air. Any area of the disposable electrode not in direct contact with the skin has increased resistance, which may cause a burn and less current through the heart. Once an electrode has been applied it should not be repositioned as this will decrease adhesiveness and increase skin resistance. Replace disposable electrodes according to the manufacturer's recommended time duration and number of shocks.

- 4. Set the current to minimum therapeutic threshold.** The risk of skin burns increases with higher current. Start at the lowest current setting recommended by the AHA or the local medical advisor. Repeated shocks through the same site are more likely to result in skin burns. The longer the skin is in contact with current, the greater the risk of burns.
- 5. Remove disposable electrodes by gently peeling them from the skin surface immediately after therapy is complete.** Support the skin surface with one hand and slowly peel the electrode away at a 180° angle. If therapy is to be repeated over a prolonged period of time (such as repeated defibrillations on an unstable patient), check the skin, and replace the electrodes in a different location according to manufacturer's recommendations.

Check the skin surface area at the defibrillation site periodically. Note any skin alterations; document and monitor for continued change and signs of infection. Treat skin changes according to organization protocol or specific medical direction.

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