REGION 11 CHICAGO EMS SYSTEM PROTOCOL	Title: Electrical Injuries – BLS/ALS
	Section: Toxins and Environmental
	Approved: EMS Medical Directors Consortium
	Effective: July 10, 2024

ELECTRICAL INJURIES – BLS/ALS

I. PATIENT CARE GOALS

1. Prevent additional harm to patient.
2. Identify life threatening issues such as dysrhythmias and cardiac arrest.
3. Identify characteristics of electrical source to communicate to receiving facility (voltage, amperage, alternating current [AC] versus direct current [DC]).
4. Understand that deep tissue injury can be far greater than external appearance.
5. Have high index of suspicion for associated trauma due to patient being thrown.
6. Determine most appropriate destination for the patient as many will require Burn Center care and some may require Level 1 Trauma Center care.

II. PATIENT PRESENTATION

A. Inclusion Criteria

Exposure to electrical current (AC or DC).

B. Exclusion Criteria

None

III. PATIENT MANAGEMENT

A. Assessment

1. Verify scene is secure. The electrical source must be disabled prior to assessment.
2. Perform primary survey with specific focus on dysrhythmias or cardiac arrest. For ALS: Apply a continuous cardiac monitor and obtain 12-lead ECG as soon as feasible.
3. Identify all sites of burn injury. If the patient became part of the circuit, there will be an additional site near the contact with ground. Electrical burns are often full thickness and involve significant deep tissue damage; there may be multiple burn sites.
4. Assess for potential associated trauma and note if the patient was thrown from the contact point. If patient has altered mental status, assume trauma was involved and treat accordingly.

5. Assess for potential compartment syndrome from significant extremity tissue damage.

6. Determine characteristics of source if possible (AC or DC, voltage, amperage, time of injury).

B. Treatment and Interventions

1. Identify dysrhythmias or cardiac arrest; even patients who appear dead (particularly dilated pupils) may have good outcomes with prompt intervention.

2. Apply Spinal Motion Restriction (SMR) if associated trauma is suspected.

3. Apply dry dressing to any wounds.

4. Remove constricting clothing and jewelry since additional swelling is possible.

5. Administer IV fluids. Remember that external appearance will underestimate the degree of tissue injury, but that electrical injuries do not generally require as much fluid as thermal burn injuries. Some acid and alkali agents may manifest systemic effects.

6. Electrical injuries may be associated with significant pain, treat per Pain Management Protocol.

7. Electrical injury patients should be transported to a Burn Center whenever possible since these injuries can involve considerable tissue damage.

C. Patient Safety Considerations

1. Verify there is no additional threat to patient.

2. Shut off electrical power.

3. Move patient to shelter if electrical storm activity still in area.

VI. NOTES/EDUCATIONAL PEARLS

A. Key Considerations

1. Electrical current causes injury through three main mechanisms:

    a. Direct tissue damage, altering cell membrane resting potential and eliciting tetany in skeletal and/or cardiac muscles.
    b. Conversion of electrical energy into thermal energy causing massive tissue destruction and coagulative necrosis.
    c. Mechanical injury with direct trauma resulting from falls or violent muscle contraction.

2. Anticipate atrial and/or ventricular dysrhythmias as well as cardiac arrest.

3. The mortality related to electrical injuries is impacted by several factors:

   a. Route current takes through the body (current traversing the heart has higher mortality).
   b. Type of current (AC vs. DC)
      i. AC is more likely to cause cardiac dysrhythmias while DC is more likely to cause deep tissue burns, however either type of current can cause any injury.
      ii. DC typically causes one muscle contraction while AC can cause repeated contractions.
      iii. Both types of current can cause involuntary muscle contractions that do not allow the patient to let go of the electrical source.
      iv. AC is more likely to cause ventricular fibrillation while DC is more likely to cause asystole.
   c. The amount of current impacts mortality more than the voltage.

Current level (Milliamperes)	Probable Effect on Human Body of 120 V, 60 Hz AC for 1 second
1mA	Perception level. Slight tingling sensation. Still dangerous if wet conditions.
5mA	Slight shock felt; not painful but disturbing. Average individual can let go. However, strong involuntary reactions to shocks in this range may lead to injuries.
6mA–16mA	Painful shock, begin to lose muscular control. Commonly referred to as the freezing current or "let-go" range.
17mA–99mA	Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go. Death is possible.
100mA–2000mA	Ventricular fibrillation (uneven, uncoordinated pumping of the heart). Muscular contraction and nerve damage begins to occur. Death is likely.
> **2,000mA**	Cardiac arrest, internal organ damage, and severe burns. Death is probable.
Source: *https://www.osha.gov/SLTC/etools/construction/electrical_incidents/eleccurrent.html*	

B. Pertinent Assessment Findings

1. Identification of potential trauma concomitant with electrical injury.

2. Presence of cardiac dysrhythmias.