Electrical/Lightening Injuries

**EMERGENCY MEDICAL RESPONDER (EMR)/ EMERGENCY MEDICAL TECHNICIAN (EMT)/ ADVANCED EMT (AEMT) / INTERMEDIATE/ PARAMEDIC**

1. Verify scene is secure. The electrical source must be disabled prior to assessment. Move patient to shelter if electrical storm activity still in area
2. Identify dysrhythmias or cardiac arrest – even patients who appear dead (particularly dilated pupils) may have good outcomes with prompt intervention – see appropriate protocol for additional information
3. Immobilize if associated trauma suspected. See Initial Trauma Care protocol
4. Apply dry dressing to any wounds
5. Remove constricting clothing and jewelry since additional swelling is possible

**EMERGENCY MEDICAL TECHNICIAN (EMT)/ ADVANCED EMT (AEMT) / INTERMEDIATE/ PARAMEDIC**

6. Electrical injury patients may be taken directly to a burn center, since these injuries can involve considerable tissue damage
   a. When there is significant associated trauma, trauma takes priority if local trauma resources and burn resources are not in the same facility

**ADVANCED EMT (AEMT) / INTERMEDIATE/ PARAMEDIC**

7. Establish IV/IO** for burns more than 10 %, or moderate-severe pain not relieved by other means (ex. IN or inhaled medications).
8. Administer fluid resuscitation per burn protocol (see chart following).
9. Remember that external appearance will underestimate the degree of tissue injury

**PARAMEDIC**

11. If injury concerning for rhabdomyolysis, give 1 amp Sodium Bicarbonate added to 1 liter Normal Saline IV wide open.

**Notes/Educational Pearls:**

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

**IO is an additional skill at the AEMT level requiring additional training approved by the Medical Director and State Approval.**
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 victim 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

<table>
<thead>
<tr>
<th>Current level (Milliamperes)</th>
<th>Probable Effect on Human Body of 120 V, 60 Hz AC for 1 second</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mA</td>
<td>Perception level. Slight tingling sensation. Still dangerous if wet conditions.</td>
</tr>
<tr>
<td>5mA</td>
<td>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.</td>
</tr>
<tr>
<td>6mA - 16mA</td>
<td>Painful shock, begin to lose muscular control. Commonly referred to as the freezing current or &quot;let-go&quot; range.</td>
</tr>
<tr>
<td>17mA - 99mA</td>
<td>Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go. Death is possible.</td>
</tr>
<tr>
<td>100mA - 2000mA</td>
<td>Ventricular fibrillation (uneven, uncoordinated pumping of the heart.) Muscular contraction and nerve damage begins to occur. Death is likely.</td>
</tr>
<tr>
<td>&gt; 2,000mA</td>
<td>Cardiac arrest, internal organ damage, and severe burns. Death is probable.</td>
</tr>
</tbody>
</table>