London Health Sciences Centre
Southwest Ontario Regional Base Hospital Program

PARAMEDIC ROUNDS

Electrocution
Sparking a Conversation about Medical Directives

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Outline

- Objectives
- Introduction
- Case Presentation
- Pathophysiology of Electrocution
- Pre-hospital Treatment
- Medical Directives
- Summary
- Discussion

Objectives

At the end of this presentation the paramedic will be able to:

- Describe the injuries caused by electrocution
- Recognize the signs and symptoms of electrocution
- Correctly apply the General Cardiac Arrest protocol in case discussions

Introduction

- Recent case of high voltage electrocution
- Different interpretation of which medical directive should be applied
- Very helpful interview that led to understanding both points of view
- Helped me to think about how the rationale for the cardiac arrest medical directives could be explained in a different way

Case Study

- Crew dispatched code 4 for a possible electrocution/VSA. The weather at the time of the call would prove to be challenging as thunderstorms along with lighting (in the area) had caused power outages in the vicinity.
- Initial call location in residential area (crew thought electrocution resulted from possible lightening strike)
- Dispatch update – CPR in progress

Case Study

- Upon arrival, crew directed to entrance of transformer yard (which is utilized by hydro linesmen)
- Crew questioned bystanders regarding access to patient as there was a concern regarding safety
- Patient apparently electrocuted while working in a ‘cherry picker’

Case Study

- Assessment
  - Patient found lying supine beside ‘live’ transformer
  - Patient ‘extremely’ hot to touch
  - Chest and torso covered with second degree burns
  - Severe injury to right flank (possible exit wound) approximately 5- 6 ins diameter
  - Full thickness burn right thru to muscle

Treatment

(Performed in back of unit due to weather and limited visibility)

- Oral airway inserted
- Assisted ventilation via BVM/ Good air entry
- CPR continued (adequate CPR performed by bystander)
- Attached cardiac monitor pads
- Patient in PEA of 27
- Closest ER less than 20 mins away
- Transported to ER/ Pt. pronounced in ER

Incidence of Death from Electrocution

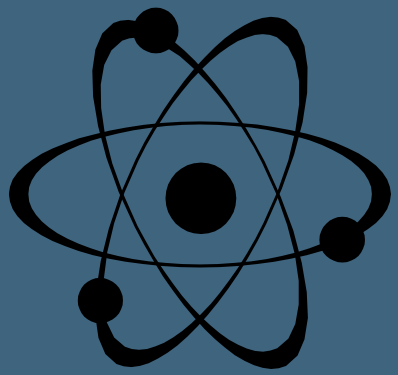
- Hard to get an exact handle on

- NIOSH US data 1980–1992 – average 411 workers per yr
- Rate 0.63 per million pop in US 2001 (US Consumer Product Safety)
- Rate 0.7 per million pop in Ont 2001 (Elect Safety Authority Ont)
- Lightning 5 deaths per yr in Canada 1991–1995 (Bain CMAJ 1998)

Physics

- Electricity is the flow of charge
- Electrical charge travels between 2 points
- Voltage is the work done per charge
- The current is the amount of charge that flows through a cross-sectional area in one second

- Household voltage 120-240V
- High voltage > 1000V
- Lightning voltage 10-100 millionV



- Alternating current
- Direct current

What happens during electrocution?

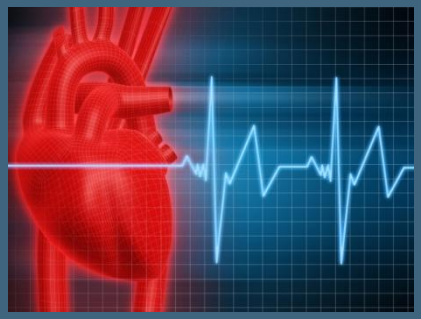
- Current enters the body at one point and exits at another
- Damage is to body's electrical systems
- Burning
- Secondary mechanical injuries

Heart

- Direct effect on electrical system
  - Systole
  - Ventricular fibrillation
- Myocardial infarction
- Late conduction abnormalities

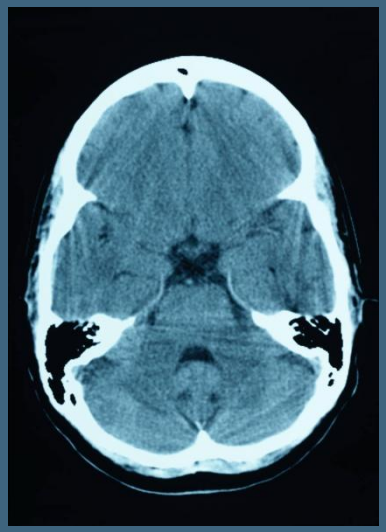
Heart

- VF more common at low voltage AC
- Asystole more common in high voltage AC or DC
- Defibrillator



Central and Peripheral Nervous Systems

- Brain stem
  - Respiratory Centre – paralysis
  - RAS – unconscious
- Seizures
- Temporary paralysis



Musculo-Skeleton and Skin

- Burns
- Mechanical – Fractures
- Secondary Injuries from falls

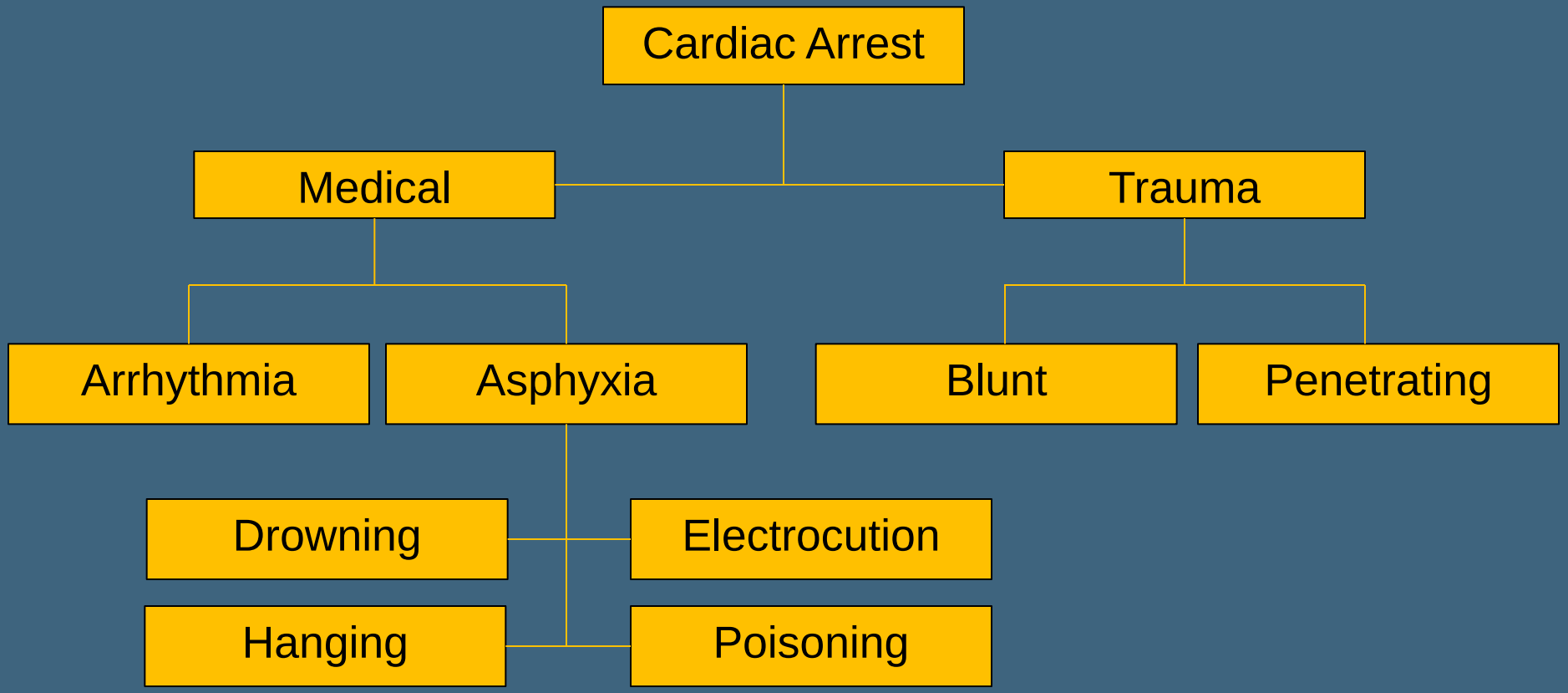
Causes of Immediate Death in Electrocution

- Arrhythmias
- Hypoxia

Paramedic Treatment

- Ventilation
- Defibrillation
- Burns
- Mechanical Injuries

Medical Directives for Cardiac Arrest



Rationale for Which 'Medical' Directive to use

- Penetrating – enters body – causing bleeding or mechanical puncture of chest or head
- Blunt – force applied to body – sheering, bleeding, ruptures
- Electrocution – force applied to and through body – arrhythmia or stops respiratory drive

Summary

- Cardiac Arrest from electrocution is rare
- Problems are:
  - cardiac arrhythmia
  - Respiratory arrest
  - Burns
  - Mechanical injuries
- Medical Cardiac Arrest Directive is the one to use!

Discussion and Questions?