Medical Aspects of Technical Rescue
Class Goals

• Describe what constitutes a technical rescue.
• Describe the different types of technical rescue.
• Describe Rx problems.
• Describe medical considerations.
• Describe establishing a rehab sector.
Class Goals

• Describe IV access problems and medical treatment of the tech rescue patient.
• Describe medical equipment used in technical rescues.
• Case studies to learn from.
Caveat

- Therapies discussed here may exceed standing orders for your area; ensure the safety and security of your patient and providers by verifying this information w/ your medical director prior to the necessity of their use.

- Prepare now, not react later!
Caveat

This information is meant for technical rescue calls only. FEMA teams run a completely different type of call. Technical rescues call for rapid patient removal and short entrapment times. This is not the type of patients FEMA rescue teams run across.
What is a Technical Rescue?

- Any operation involving extremely high risk for the rescuer with little probability for victim survivability.
- Because of the high risk involved, special training, tools and techniques have been developed to accomplish the rescue while minimizing risk.
Types of Technical Rescue

- Trench Collapse
- Confined Space Emergencies
- High-Angle (rope) Rescues
- Building Collapse Rescues
- Swift Water Rescues
Rx Problems

- Patient location will be hazardous.
- Access and room to work will be minimal.
- Patient will be brought out w/o Rx.
Medical Considerations

- Before rescue, perform a risk / benefit analysis.
- Compassion kills, it starts in the back of the ambulance.
- Priority is rapid removal, little regard for Rx while in danger.
- Immobilization may not be practical.
Risk / Benefit Analysis

• If the risk is high and the benefit is low, we don’t go.
• If the risk is low and the benefit is high, go for it.
• If the risk is high and benefit is high, this is what you get paid for.
Taking Care of the Rescuer
Establish a Rehab Sector

- Set up in a safe area away from the action.
- Should provide suitable protection from the environment.
- Should be easily accessible by EMS units.
- Should allow prompt reentry back to the emergency operation (3 air horn blasts).
Provide Hydration & Food

- 50/50 water and activity beverage. Beware of calorie load. Water alone may be best.
- Caffeine & carbonated beverages will stop operation.
- Provide food if operation is longer than 3 hours.
Provide Hydration & Food

- Soup is digested faster than sandwiches.
- MRE’s provide 2,000 calories and high salt load, good for heavy work but only in the long run, not short calls.
- Fruits provide energy replacement.
- NO PIZZA or BURGERS!
Dehydration

- Recognized by tachycardia, diminished pulse pressure and later… hypotension.
- Changes, rather than single measurements, in the above parameters are especially useful indicators.
- Poor skin turgor is usually only seen in severe dehydration.
Provide Rest

- For every 45 minutes of work time, the rescuer should be sent to the Rehab Area for rest. Rest shall not < 10 minutes and may exceed an hour as determined by the Rehab Officer.
- Fresh crews shall be available in Staging to ensure that fatigued members are adequately rested.
Medical Evaluation

- Evaluate vital signs, examine rescuers, make proper disposition if they can return to the rescue, continue rehab, or Rx and Tx to medical facility.
- If HR exceeds 110, take oral temp. If temp exceeds 100.6 F, no protective equipment is to be worn. If < 100.6 F and HR > 110, continue rehab time.
Psychological Support

- Team members are “doers.” Support for team members is important.
- When efforts are not successful, we take it as a personal failure. This leads to self doubt and loss of effectiveness.
- Don’t forget the families of team members, keep them informed.
Psychological Support

- Often overlooked aspect of response, rescue situations are stressful.
- Establish rapport w/ victim, communication is the key. You are the victim’s link w/ the possibility of survival.
- Tell victim what is going on and what to expect.
- Families need to be informed of progress. Estimates need to be realistic.
Psychological Support

- Humor is important. (Be aware: the blacker the humor, the greater the stress.)
- Personalize the site (the “Mother Slab”). We can then bond.
- Individual acts of bravery happen all the time, recognize them.
The Tech Rescue Victim
Medical Treatment

“Just what kind of medical problems can I expect?”

- dehydration
- hypothermia / hyperthermia
- toxic gas inhalation
- inhalation injuries & complications
- crush injury / crush & compartment syndrome
- electrical injury
IV Access

- If victim is pinned it is necessary, if inaccessible then waiting may be best.
- IV bags will get in the way and hinder the rescue operation.
- Hep-Locks are easy to install, maintain and do not get in the way.
IV Access

- At a minimum, two large bore IV’s should be established and 1-2 L of fluid given to correct dehydration and volume loss from injury.
- Clinical status should guide rehydration. Treat the pt, not the numbers.
- As soon as patient reaches the hospital, all IV access lines must be changed due to increased chance of infection.
Hyper/Hypothermia

- Recognize that one or the other will be present.
- Situation must be corrected ASAP.
- Consider use of electric blanket or water mister.
- Monitor temp with probe.
Causes of Hypothermia

- Conduction – direct transfer of heat
- Radiation – giving off heat to the air
- Convection – air movement
- Evaporation – we always sweat
- Transpiration – breathing
Rx of Hypothermia

- The pt’s CORE should be re-warmed.
- Remove pt from environment, add heat.
- Warm the IV bag (microwave)
- Administer warm O2.
- Watch temp closely.
Hyperthermia

- Usually happens to rescuers.
- Heat cramps, exhaustion, stroke.
- Headache, N&V, dizziness, malaise, myalgias, etc.
- Remove heat source.
- Cool, cool, cool.
Toxic Gas Inhalation

- Present in almost all confined spaces.
- O₂ < 19.5% or > 25%
- Methane
- Carbon Monoxide
- Hydrogen Sulfide
Inhalation Injury

- Building and trench collapses.
- Airway becomes impacted w/ debris.
- Dust dries out airway.
- Be aware of asbestos.
- Wear protective mask, place one on patient as well.
Crush Injury

- Nerve, muscle and skin damage can result from pressure of body weight on a limb or even dependent body parts.
- Time and pressure dependant (usually 4-6 hours).
Crush Injury

Mechanism can range from simple (Saturday night palsy)…
Crush Injury

...to severe
(10-ton block of concrete)
Crush Injury

...and of course the typical calls we run
Effects of Releasing Compressed Limb

- All these effects are local only until the tissue is released and re-perfused by blood.
- Pt may be entrapped for days and looks ok.
- Upon release of compression, blood flow is restored and then...
Effects of Releasing Compressed Limb

- Hypovolemia/hypotension/shock.
- Severe metabolic acidosis causing VF.
- High K level causing asystole or dysrythmia.
- Liver injury from shock.
- Kidney failure from myoglobin.
Treatment

- Crush wounds are best treated with standard first aid practices (control bleeding, splint fractures, etc).
- Watch air/vacuum splints, may impede circulation as edema occurs.
- Amputation only as a last resort.
Treatment

But even the most severe mangling...
Treatment

Has a chance for functional repair.
Crush Syndrome

- Systemic pattern of injury resulting from the physiologic cascade set in motion when pressure is after a prolonged crush injury.
- Rx must begin in the hole
Crush Syndrome

Called the “Grateful Dead Syndrome” because victims of prolonged entrapments are so grateful to their rescuers, but then wind up dead within minutes after they are extracted.
External Pressure on Muscle

Myoglobin Release

Hypovolemia

Kidney Failure

Shock

Organ Systems Failure

TIME*

K Release

Anaerobic Metabolism

Acidosis

Cardiac Arrythmias

DEATH
What To Look For

- M.O.I.
- Time of entrapment (>1 hour).
- Limb is cold, cyanotic.
- No feeling in limb.
- Peaking t-waves, increasing P-R, increasing QRS.
Crush Syndrome

- Patients survive entrapment for days with this injury.
- Patients may die shortly after rescue if not treated BEFORE the crush mechanism is released.
- Counter-intuitive to begin Rx first and delay extrication. Educate your rescuers!
Goal of Treatment

- Priorities are same (ABCDE’s), time is longer.
- Prevention of sudden death.
- Start the Rx BEFORE the extrication, close coordination w/ rescuers is key.
- Salvage limbs.
- Docs must know how long you will be out there – very important!
Pre-Treat Pre-Release

- Rx in place is the key, start w/ O2.
- Start 2 large-bore IV’s w/ NSS (Ringer’s no good – contains K) 20cc/kg start then 3cc/kg/hr to maintain. Watch for fluid overload – hydration is most important!
- Pain meds will allow movement of extremity.
Good Treatment

- NaHCO3 (1 meq/kg to 1L NSS) if cardiac dysrhythmia or confirmed acidosis.
- Mannitol (200mg/kg IV over 5 min) to increase urine flow. Make the kidneys work, best way to clean them out.
- Ideal = 5% dextrose ½ NSS w/ 50 meq Sodium Bicarb and 10 grams 20% Mannitol per L fluid.
Bad Treatment

- Rotating Tourniquets – anyone remember doing this for CHF patients?
- Fasciotomy – lead to very bad infections
- Amputation / Disarticulation – Big in France, here we work to save the limb. Do you have the proper equipment & training to do it anyway?
- Not giving pain relief when necessary.
Pain Control

Benefits
- Alleviation of pain & anxiety
- Better cooperation
- Less catecholamine stimulation
- Less muscle spasm (fractures)

Risks
- Masking of symptoms
- Respiratory depression
- Hemodynamic instability
- Less muscular protection of fractures
Pain Control

• Must balance analgesia w/ potential for respiratory depression.
• IV route is preferred, IM is erratic in shock situations.
• Narcotics = MSO4, Fentanyl
• Probably the most effective for the types of injuries encountered.
Pain Control

- Non-Narcotic = Toradol (30 mg IV q 6 hrs)
  - reduces swelling but increases bleeding
  - excellent for Fx’s, especially ribs
- Narcotic = MSO4, Fentanyl
  - You always have narcan if problems!
- Sedatives - Versed or Valium
  - causes amnesia, watch respiratory status closely
Pain Control

- Nitrous oxide has a quick onset of action and quick elimination and has few side effects. It should NOT be used in confined space rescue because the environment will become contaminated and rescuers intoxicated.
- Controversial and difficult to obtain.
Inverted Patient

- Looks harmless but it isn’t.
- Lack of “atrial kick” and weight of internal organs on diaphragm causes decreased cardiac output = shock.
- You have 20 minutes to get them down.
Electrical Injury

- AC current induces tetany, freezing victim to source.
- DC current causes single twitch.

Where do you find each?
Electrical Injury

Specific Injuries to Tissue

- AC = VF  DC = asystole
- fractures / dislocations
- paralysis & parathesias
- Compartment Syndrome
Compartment Syndrome

- Closed space compressive injury.
- Localized, due to swelling.
- Most frequent in burn injuries.
- Can have warm skin.
- Sequela = “The 6 P’s”
The Six P’s

- Pain
- Pallor
- Parathesia
- Paralysis
- Poikilothermia
- Pulselessness
Electrical Injury

Prolonged aggressive resuscitations indicated, the victim is usually young and healthy.
Patient Movement

- Usually done the easiest and quickest method.
- Medic should be w/ pt at all times, especially when the pt is being moved in a stokes litter.
- Use rope only as a last resort.
Horizontal vs. Vertical
Medical Equipment

- SKED stretcher
- LSP half-back
- Stokes litter
- Miller Board
- Skate Board
SKED Stretcher

- Just a rolled up piece of plastic.
- Can hold a pt in a backboard.
- Good luck getting it back in its sock!
LSP Half-Back

- A KED on steroids (very heavy duty).
- Designed to allow the rescuer to vertically lift an immobilized patient.
- Expensive.
Stokes Litter

- Standard not useful for con-space rescue (25” – manhole is 23.5” wide)
- One on the right is a con-space litter (19” wide).
- Know how to package patient.
Board Sizes

- Miller Board = 14” wide
- Wood Backboard = 16” wide
- Plastic Backboard = 16.5” wide
Miller Board

- Small profile makes it very useful for confined space rescues.
- Small backboard on steroids, comes complete w/ Velcro straps.
Skate Board

Now…. What can you do with a skateboard in a confined space rescue?
Case Study #1

April 6\textsuperscript{th}, 16:00 hours

child is unconscious inside a confined space
Case Study #2

June 13th, 13:15 hours

two victims trapped inside a trench collapse on Riverdale Drive
Case Study #3

November 8th, 2002

200 lb. cow falls into a 55’ well, attempted rescue by untrained bystanders
Case Study #3

- The plan was to send a member down the well (with a line and safety), have him secure two large belts around the cow, attach a hook to the wrecker, pull the member up and out, and finally lift the cow up.

- IC - “Well, I guess you'll have to go down there since you are the only one certified in confined space.”
Case Study #3

- IC - "The cow is still breathing and alive....it should be fine." At no time was the quality of the air tested.
- They sent a firefighter down the well....about 10' from reaching the cow he had to be yanked back up because he couldn't breathe. "The methane was too strong."
Technical Rescue

The difference between and hero and a fool is training.
For more information or to download these slides see the CARS web site at www.rescue1.org