Cryoamputation: Still A Useful And Lifesaving Procedure In Critically Ill Patients - How To Do It And When

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VEITH Symposium 2018
November 17, 2018

Disclosure:

- No financial conflicts of interest to report

Cryoamputation: An “Ancient” Technique

- “Physiologic amputation”
- “Preoperative freezing”
- “Dry ice refrigeration”

- Historical operation?
  - 1938: Dr. Frederick Allen – limb refrigeration as anesthesia
  - WWII: Cooling leg for physiologic isolation
  - 1960: Gibbel, Atkins, Burns – dry ice

Indications for Cryoamputation

1. Existing indication for emergency amputation
   - Septic foot
   - Ischemia with overwhelming myonecrosis

2. Significant, correctable comorbidities that pose an elevated risk for general anesthesia
   - “Too unstable for transport/or the OR”
   - Electrolyte abnormalities
   - Hemodynamic instability

Rationale behind Physiologic Amputation

- Cessation of circulation
- Substantial decrease of venous and lymphatic return
- Prevention of resorption of toxic metabolites
- Limitation of circulatory spread of bacteria and inflammatory mediators
- Suspension of necrotic state
Cryoamputation: Performance Profile

- Hunsaker et al, 1985
  - 56 cryoamputations performed (12 years)
- Historical data:
  - Perioperative mortality rate for major lower extremity amputation with sepsis: 19-29%
  - Mortality rate for elderly patients presenting with acute limb ischemia: 42%
  - Both primary amputation and cryoamputations had overall 11% mortality rate

Cryoamputation: Conduct

- Preparation of leg
  - Tourniquet placement
    - Distal position
    - Contain pathology
    - Maximize healthy remnant tissue
  - Heating pad
    - Limit proximal extent of freeze
  - Placement of leg into freezing chamber

Freezing Chamber

- Insulated containment unit for dry ice
- Leg placed into chamber through side hole
- Ability to monitor leg and add more dry ice

Freezing Chamber

- My construct:
  - Cardboard box with access hatch
  - Leg placed into clear plastic bag
  - Dry ice placed into clear plastic bag, wrapped around leg
  - Dead space filled with towels for insulation and to press dry ice against leg
  - Dry ice replaced q6-8 hrs

Definitive Amputation

- With survival and correction of abnormalities
- Emergent case converted into “Semi-elective” operation
**Potential complications**

- “Frost line” creep
- Cooling of nearby tissues in contracted legs
- Damage to external lines if not kept away from cooled area
- Stump/amputation complications
- Higher amputation level

**Summary**

- Cryoamputation remains a life-saving temporizing measure for patients with nonviable, nonsalvageable legs *in extremis*
  - Physiological substitute for amputation
  - With survival, proceed to anatomic amputation
  - “Tourniquet determines the level of amputation” – T.N.
  - Dry ice, insulation

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**Thank you**

USC
- Josefina Dominquez
- Eric Kuo
- Neil Reddy
- Elizabeth Miranda

Vanderbilt
- Thomas Naslund
- C. Louis Garrard