CRYO 101 LECTURE

Cryosurgery using the CryoPen System
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how does cryosurgery work

• cryosurgery is the selective destruction of lesions by causing cryogenic cell death (killing cells with extreme cold temperatures)

• cryosurgery preserves the tissue matrix which is relatively cold resistant, and therefore allows for proper cosmetic healing with minimal scarring

• after dead tissue is sloughed off, re-epithelization occurs. This extends from the margins of the lesion and hair follicles.

• less office time is needed for lesion removal with cryosurgery as compared to electrocautery, cold knife or laser

• less after care is needed for the patient during the healing phase than electrocautery, cold knife or laser
Dermatologic Cryosurgery is treating lesions in the epidermis, which only extends down a few millimeters.
**effective cryosurgery**

- Tissue temperature changes must be extremely fast (50-100°C/min)

- Final temperature of tissue cells must be colder than -20°C

Cell death starts at -20°C. Holding the temperature below -20°C for some duration, depending on the cell type, allows intracellular changes to occur and cell destruction to adequately take place.
during freeze

• ice crystals form in the cell

• osmotic gradient occurs

• rupture of membranes & organelles

• vascular changes

When the liquids inside the cells freeze, an increased concentration of solutes outside the cell wall causes a transmembrane osmotic gradient. Membranes rupture from ice crystals and osmotic pressure changes. Vascular changes include an initial decrease in flow due to the cold, with flushing after thawing.
After freezing, the lesion appears white due to the frozen water in the tissue. As the ice ball thaws, the area becomes erythematous and hyperemic. A blister forms 2-24 hours after freeze. Blister may take several days to drain or dissolve. Once blister breaks, a crust will form over the lesion. Healing occurs from 1-6 weeks depending on depth of freeze and size of lesion.
clinical change

- re-epithelization
- up to 6 weeks of weeping (0-6)
- loss of pigment

Re-epithelization occurs from lesion margins and hair follicles. Healing occurs from 1-6 weeks depending on depth of freeze and size of lesion. Hypo-pigmented area may persist for 2-6 months. This color loss may take longer to return in darker pigmented skin.
cryosurgery cautions

- Melanoma or suspected
- Recurrent Basal Cell Carcinoma
- Locations/ Pigment cells
- Tissue documentation
- Certain disease states
  - Chronic inflammatory disease
  - Chronic infections
  - Neoplasms
  - Diabetes
  - others
- Poor circulation

**ABCDs of Moles and Melanomas**

Regular self-examination is the best way to become familiar with the many moles and spots on the skin. You should inspect your moles and pay special attention to their sizes, shapes, edges and color.

A handy way to remember these features is to think of ABC and D

- A- asymmetry
- B- border
- C- color
- D- diameter

Asymmetry  Border  Color  Diameter

Concept and Photographs: Robert J. Friedman, M.D., Alfred W. Kopf, M.D., Darrell S. Rigel, M.D. Photographs reproduced courtesy of The Skin Cancer Foundation, New York, NY.
modality temperature

- **LN\textsubscript{2}** -196°C
- **CryoPen** -105°C to -110°C
- **N\textsubscript{2}O** -88°C
- **CO\textsubscript{2}** -78°C
- **Organic Compressed gases** -55°C~ -75°C

Each modality has a different and characteristic temperature and relative effectiveness profile. These temperatures are not the actual temperatures on the surface of the skin.
refrigerant spray

- **Verruca Freeze, Freon 12**
- **Evaporate at -70 degrees C**
- **OTC Wartner, Dimethyl-ether and propane**
  - (Histo-Freezer)
- **Evaporate at -57 degrees C**
- **Advantages:** no storage tank, initial cost low
  - very portable for off site use
- **Disadvantages:** need longer freeze times, not good for malignant lesions
The CryoPen employs a state-of-the-art linear compressor to cool the CryoPen Pen Cores. Using this technology, the CryoPen is able to reach temperatures of -105°C ~ -110°C.
This chart compares skin surface temperatures obtained using the specified techniques. A surface tissue temperature range of -50°C to -80°C is ideal for effective deep tissue destruction.
cryosurgery procedures

- basic procedure for cryosurgery is straightforward. Specific procedures are dependent on product used

1. lesion is identified

2. heat is extracted from the desired tissue at a rapid rate

3. ice ball forms

4. in some situations a five minute waiting period occurs, then second freeze could be performed
When selecting a CryoPen, desired depth of freeze should be considered. As shown in the diagram, the larger the tip, the deeper and wider the ablation zone.

penetration depth at 30 seconds
deepen penetration can be achieved with longer freeze times
how long do you freeze lesions

Initial freezes should be treated conservatively. Adjustments can be made according to the patient’s response to freezing.

variables to consider:
- skin type
- lesion type
- lesion height
- vascularity
- malignancy

cryopen freeze time guidelines
what can be frozen using the cryopen

**non-recurrent basal cell**
basal cell carcinoma may be treated with cryosurgery. But if there is a history of basal cell the patient should have biopsy & surgical excision.

**actinic keratosis**
actinic keratosis due to sun damage is typically responsive to cryotherapy. Some consider it pre-squamous cell.

**dermatofibroma**
is a dense raised lesion. It is responsive to treatment but usually requires 2-3 repeat treatments with 23 weeks healing intervals between treatments.

**seborrheic keratosis**
seborrheic keratosis due to sun damage is typically quite responsive to cryotherapy.

**lentigo**
depending on size and location, test freezes may be helpful to determine freeze times.

**plantar warts**
multiple treatments after debridement and or chemical treatment are usually needed.

**warts**
warts are epidermal but push and extend by displacement deeper into dermal tissue usually requiring multiple freeze sessions.

**keloid**
scars and keloids frequently respond better if preceded by adjunctive therapy with intralesional steroids and multiple cryo procedures.

**skin tag**
make sure to freeze the base of the skin tag.

**molluscum contagiosum**
Freeze Time: 3-5 second

**condyloma accuminatum**
Freeze time: 30-45 seconds

**Other lesions that can be treated using the CryoPen**

**Freeze times:**
- 90-180 seconds
- 10-45 seconds
- 30-60 seconds
- 60-90 seconds
- 20-30 seconds
- 30-90 seconds
- 10-30 seconds
- 45-60 seconds

Above freeze times are guidelines. Times vary according to many factors such as, but not limited to: lesion size, height, skin type, age and concurrent medical conditions.

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# Dermatologic Cryosurgery Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Advantages</th>
<th>Disadvantages</th>
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| Cryopen               | ● No cryo gasses or liquids  
                           ● Simple, safe, effective  
                           ● Ideal temperature  
                           ● $2 procedure cost | ● Capital investment required |
| Pressurized Organics  | ● Small  
                           ● Low capital cost | ● Expensive - $4-6 procedure cost  
                           ● Technique dependent – requires training or experience  
                           ● Inadequate freezing temperature |
| Compressed (N₂O)      | ● Good freezing temperature | ● Dangerous (impairs judgment, reduces fertility)  
                           ● Massive, heavy tanks and large equipment  
                           ● Requires ordering and maintaining gas supply |
| Compressed (CO₂)      |                                                                    | ● Inadequate freezing temperature  
                           ● Massive, heavy tanks and large equipment  
                           ● Requires ordering and maintaining gas supply |
| LN₂ (spray)           | ● Effective with good technique  
                           ● Low procedural cost | ● Too cold – can be dangerous  
                           ● Capital investment required  
                           ● Technique dependent – requires training  
                           ● Requires ordering, maintaining, storing and handling liquid nitrogen.  
                           ● Liquid nitrogen not widely available worldwide |
| LN₂ (q-tip)           | ● Low procedural cost | ● Inadequate freezing temperature  
                           ● Technique dependent – requires training or experience  
                           ● Requires ordering and maintaining LN2 supply |