CRYOGENIC NEUROABLATION

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ASPS
“You’re under a lot of stress. I’m prescribing ice cubes to help you chill out.”
HISTORICAL PERSPECTIVE

CRYOTHERAPY
AS ANCIENT AS THE PHARAOHS

EGYPTIANS in 3000 BCE used cold compresses to treat the inflammation of infected wounds.
HISTORICAL PERSPECTIVE

In the 5th century BCE Hannibals Carthaginian mercenaries experienced the Hemostatic and destructive effects of the cold while crossing the Alps in Route to Rome.
Crossing the Alps in Napoleonic times, cooling was used for Anesthesia and Amputation.
HISTORICAL PERSPECTIVE

- James Arnott mid 1800s
- The father of modern cryosurgery
- Decreased tumor sizes and improved pain management
The first **CRYOPROBE** was developed by COOPER in 1961.

**AMOILS** developed a more practical enclosed cryoprobe based on the **JOULE-THOMPSON** principle.

**NELSON, BRIAN, LLOYD** coined the term **CRYOANALGESIA** in 1970s.
CRYOGENIC NEUROABLATION

CRYOPROBE GAUGES 14, 16, 18

POLYTETRAFLUOROETHYLENE COATED, GAS EXPANSION PROBE ALLOWING THE JOULE-THOMPSON EFFECT

JOULE-THOMPSON EFFECT

A HIGH PRESSURE GAS (N20) PASSES THROUGH A SMALLER TUBE. THIS IS RELEASED INTO THE LARGER LOW PRESSURE OUTER TUBE. MICROSCOPIC APERATURE. THE CRYO GAS QUICKLY EXPANDS AT THE DISTAL TIP DROPPING THE TEMPERATURE TO EXTREMELY LOW TEMPERATURES.
CRYOPROBE TIP

ICE BALL FREEZES TO -70 CELCIUS/-200 FARENHEIT
NERVE INJURIES

SUNDERLAND CLASSIFICATION 1951

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Type 1</td>
<td>Conduction block (neurapraxia)</td>
</tr>
<tr>
<td>Type 2</td>
<td>Axonal injury (axonotmesis)</td>
</tr>
<tr>
<td>Type 3</td>
<td>Type 2 + Endoneurium injury</td>
</tr>
<tr>
<td>Type 4</td>
<td>Type 3 + Perineurium injury</td>
</tr>
<tr>
<td>Type 5</td>
<td>Type 4 + Epineurium injury (neurotmesis)</td>
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CRYOANALGESIA: SECOND DEGREE OR AXONOTMESIS
MECHANISM OF ANALGESIA

PAIN RELIEF FROM APPLICATION OF FREEZING LEADS TO DEVELOPING INTRACELLULAR AND EXTRACELLULAR ICE CRYSTALS


Creates a series of biochemical, anatomic and physiologic events.

Leads to destruction of the Myelin sheath and Schwann cells.
MECHANISM OF ANLAGESIA

DESTRUCTION OF THE AXONS AND MYELIN SHEATH

PAIN RELIEF FOR SEVERAL MONTHS

CRYOLESIONING OF NERVE IS ACHIEVED AT -20 DEGREES CENTIGRADE

ENDONEURIUM, PERINEURIUM AND EPINEURIUM IS PRESERVED.

ANATOMY OF NERVES

- bundles/fascicles of axons & dendrites
  - endoneurium – around individual processes
  - perineurium
    - around fascicles
    - individual nerve fibers with their endoneurium
  - epineurium - outermost covering around entire peripheral nerve

NEUROMAS DO NOT DEVELOP!
Regenerates at 1-1.5 mm/week.

*Sunderlan S. Nerves and injuries. 2nd ed. 1978.*
INDICATIONS FOR CRYOANALGESIA

NON LOWER EXTREMITIES

* FACIAL PAIN: TRIGEMINAL NEURALGIA

* FACET SYNDROME: CERVICAL, THORACIC AND LUMBOSACRAL

* OCCIPITAL, SUPRASCAPULAR, ILO-INGUINAL AND OTHER SPECIFIC NEURALGIAS

* CHEST WALL PAIN

* PHANTOM LIMB PAIN

* ACUTE POST OPERATIVE PAIN FROM THORACOTOMY AND INGUINAL HERNIA REPAIR

* CANCER PAIN
OUTCOME DATA

RESULTS

* 63% PAIN RELIEF FOR OVER 1 YEAR WITH NO PERMANENT SENSORY LOSS.

Journal of neurology, Neurosurgery and Psychiatry
1987;50:485-497

TRIGEMINAL NEURALGIA
83 CRYOSESSIONS

CRANIOFACIAL PAIN – 475
TRIGEMINAL NEURALGIA PATIENTS
OVER 10 YEARS FOLLOW UP

145 SUBMITTED TO CRYOSURGERY
265 SUBMITTED TO RADIO FREQUENCY THERMOCOAGULATION
65 UNDERWENT MICROVASCULAR DECOMPRESSION

* RECURRENCE RATE WAS LOWER WITH CRYO

* NO CRYO PATIENT DEVELOPED ANESTHESIA DOLOROSA

* THIS OCCURRED WITH 8% OF THE RADIOFREQUENCY GROUP

OUTCOME DATA

CRANIOFASCIAL PAIN (TMJ) 17 PATIENTS

* DECREASE IN THE VISUAL ANALOG SCALE FROM 6.8 TO 2 AFTER CRYOABLATION OF THE AURICULOTEMPERAL NERVE


INTERCOSTAL NEURALGIA 43 PATIENTS

* THE MEAN VAS SCORE DROPPED FROM 8.2 (PREPROCEDURE) TO 2.7 IN 3 MONTH FOLLOW UP.

* 50% CONTINUED TO REPORT SIGNIFICANT PAIN RELIEF.

INDICATIONS IN THE LOWER EXTREMITY

TRAUMA

NEUROMA

INTERMEDIATE DORSAL CUTANEOUS NEURITIS

MEDIAL DORSAL CUTANEOUS NEURITIS

DEEP PERONEAL NEURITIS

SURAL NEURITIS

PLANTAR FASCIITIS

PLANTAR FIBROMATOSIS

DERMAL LESIONS
OUTCOME DATA
LOWER EXTREMITY

PROSPECTIVE NEUROMA STUDY
31 NEUROMAS IN 20 PATIENTS
ALL HAD FAILED CONSERVATIVE TREATMENT OPTIONS

RESULTS
38.7% HAD REDUCED PAIN AT 1 YEAR
45.2% REPORTED PARTIAL PAIN RELIEF
16.1% HAD REVERTED TO THE PREPROCEDURE PAIN LEVELS

SUCCESS RATE IS SIMILAR TO SURGICAL EXCISION.
90% WERE SATISFIED AND SAID THEY WOULD HAVE THE PROCEDURE AGAIN.

CAPARUSSO JFAS 2002 SEPT-OCT
OUTCOME DATA
LOWER EXTREMITY

CHRONIC PLANTAR FASCIITIS
59 PATIENTS (61 HEELS)
ALL FAILED CONSERVATIVE TREATMENTS

PHANTOM LIMP PAIN
5 PATIENTS

RESULTS

PAIN RATING ON THE VAS DROPPED FROM 8.38 TO 1.26 DURING THE 12 MONTH FOLLOW UP

Allen BH et al. J Foot Ankle Surg. 2007;46:75-79

THREE OF FIVE PATIENTS HAD 90-100% PAIN RELIEF.
ONE HAD 40% PAIN RELIEF AND THE OTHER 20% PAIN RELIEF.

CRYO EQUIPMENT

Uses Nitrous Oxide as a delivery system

EPIMED
INSTRUMENTS
NEUROMA PROCEDURE

LOCAL BLOCK PROXIMAL TO THE AREA

LIDOCAINE PLAIN FIRST
LIDOCAINE WITH EPI NEXT
NEUROMA PROCEDURE

SMALL STAB INCISION JUST PROXIMAL TO THE NEUROMA

FREE UP THE DEEP TISSUES (SPATULA)

INSERT THE PROBE
NEUROMA PROCEDURE

START THE CRYO MACHINE. PEDAL TO THE METAL.

CRYO FREEZE CYCLE
3 MINUTES OF FREEZE
30 SECONDS TO THAW
3 MINUTES OF FREEZE

THIS RAPID FREEZING THAWING AND FREEZING CAUSES THE DISRUPTION OF THE AXONS AND MYELIN SHEATH
NEUROMA PROCEDURE

FINAL STEPS

IRRIGATE

* STEROID FLUSH VS. SALINE

BANDAGE

* BETADINE SOAKED GAUZE WITH BACITRACIN

* 4X4 GAUZE, GAUZE ROLL, COBAN
NEUROMA PROCEDURE

POST PROCEDURAL INSTRUCTIONS

* BE A “COUCH POTATO” FOR A FEW DAYS
* OK FOR WEIGHT BEARING
* NSAIDS ARE OK
* SHOE GEAR TO TOLERANCE
* REMOVE THE BANDAGE IN 24 HOURS
* APPLY TOPICAL ANTIBIOTIC AND BANDAID
* THEY CAN GET IT WET IN 24 HOURS
PLANTAR VERRUCA
PLANTAR VERRUCA

SMALL STAB INCISION

BENEATH THE VERRUCA
PLANTAR VERRUCA

GO BENEATH THE LESION AT THE BASEMENT MEMBRANE
PLANTAR VERRUCA

ACHIEVE FROSTBITE
(BLANCH THE SKIN)
FOR 2-3 MINUTES
CRYOGENIC NEUROABLATION

ULTRASONOGRAPHY

• CAN PERFORM WITH OR WITHOUT IT

• ESPECIALLY GOOD FOR DEEP TISSUE PATHOLOGY

• PLANTAR FASCIA AND FIBROMAS

WHY NOT USE IT? ICE BALL MEASURES 1 CM AND CAN COVER A LARGE AREA. ABSOLUTE ACCURATE PLACEMENT OF THE ICE BALL IS IMPORTANT BUT REMEMBER THE SIZE.
CAUTIONS

ABSCESS - VERY RARE

SCAR TISSUE FROM PREVIOUS NEURECTOMIES MAY NOT PENETRATE WELL ENOUGH DUE TO ENCAPSULATION

FROST BITE, CHANGE IN PIGMENTATION

DAMAGE TO ADJACENT STRUCTURES IF THE CRYOPROBE SHAFT FREEZES

AVOID ADJACENT INTERSPACES
BENEFITS OF CRYOSURGERY

AVOIDS COSTLY SURGERY

EASY RECOVERY

DOESN’T LEAD TO A “STUMP” NEUROMA

IN OFFICE – QUICK UNDER LOCAL ANESTHESIA

ANOTHER OPTION PRIOR TO SURGERY
BENEFITS OF CRYOSURGERY

AVOIDS THIS!!!!
CRYOSURGERY IS A MINIMALLY INVASIVE PROCEDURE IN THE OFFICE THAT HAS BECOME A GREAT OPTION TO TRADITIONAL SURGERY.

IT IS WIDELY ACCEPTED IN OTHER MEDICAL SPECIALTIES AND ALLOWS A RAPID RECOVERY AFTERWARDS.
CRYOGENIC NEUROABLATION

"He firmly believes laughter is the best medicine."