

Principle of Microsurgery

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Definition

- Microsurgery
 - Surgery performed on very small structures, such as blood vessels & nerves, with specialized instruments under a microscope



Purpose

- 1st microsurgery, using a microscope to repair blood vessels
 - Jules Jacobson of University of Vermont in 1960
- 1st successful replantation
 - 1964 by Harry Bunke
 - Rabbit's ear
 - Blood vessels < 0.04 in (0.1 cm)
 - ~ vessels in human digit



Numerous Techniques of Microsurgery

- **Otolaryngologists (ENT)**
 - Small, delicate structures of inner ear or vocal cords.
- **Ophthalmologists**
 - Remove cataract
 - Corneal transplants
- **Urologists**
 - Vasectomies (male sterilization)
- **Gynecologists**
 - Tubal ligations (female sterilization)
- **Plastic surgeons**
 - Reconstruct disfigured skin, muscles, or to transplant tissues from other parts of the body



Equipment

- MICROSCOPE

- 5–40X
- Lower magnification
 - Identify & expose structures
- Higher magnification
 - Microsurgical repair

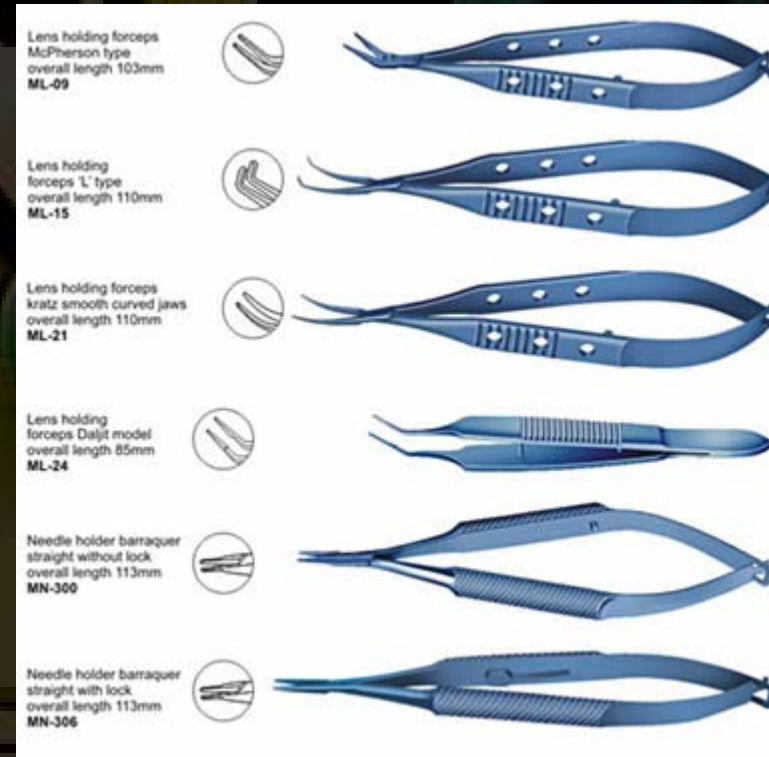
- SURGICAL LOUPES

- 2–6x



Instruments

- Forceps
- Needle holders
- Scissors
- Vascular clamps
 - controlling bleeding
- clamp applicators
- Irrigators
 - washing structures
- Vessel dilators
 - opening up cut end of vessel



Suture

- Diameter (gauge) ranges in size & depends on procedure & tissue
- 2-0 (0.3 mm) - 6-0 (0.07 mm)
- 9-0 (0.03 mm) - 12-0 (0.001 mm) for MS
- Absorbable (broken down in body) vs Non-absorbable (retaining its strength)
- Natural (silk, gut, linen) / synthetic (nylon, polyester, wire)
- Needle shapes (straight/ curved)
- Point types (rounded, cutting, or blunt)
- <0.15 mm for MS



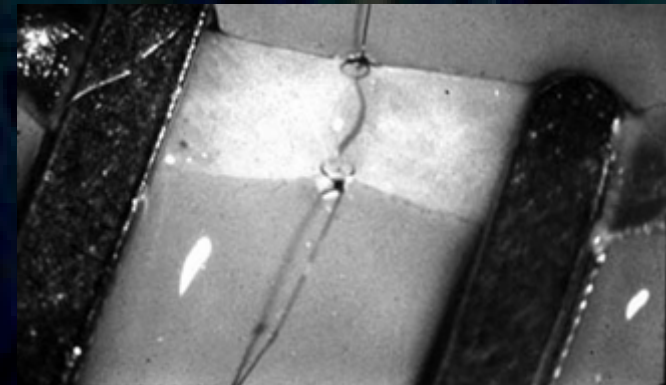
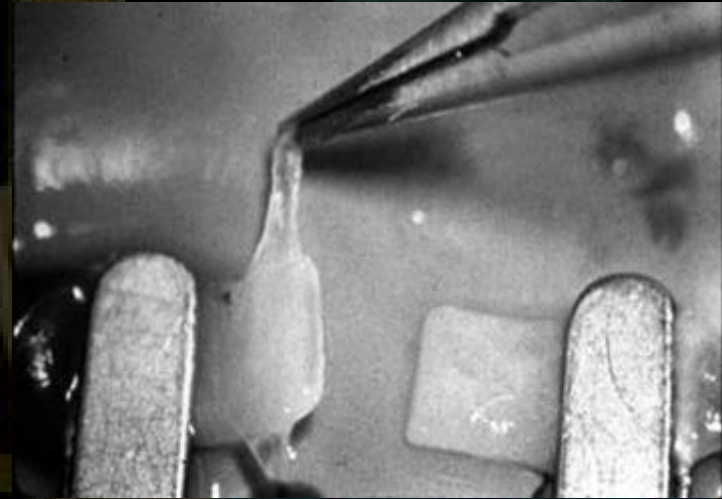
Techniques

- **BLOOD VESSEL REPAIR**

- Anastomoses

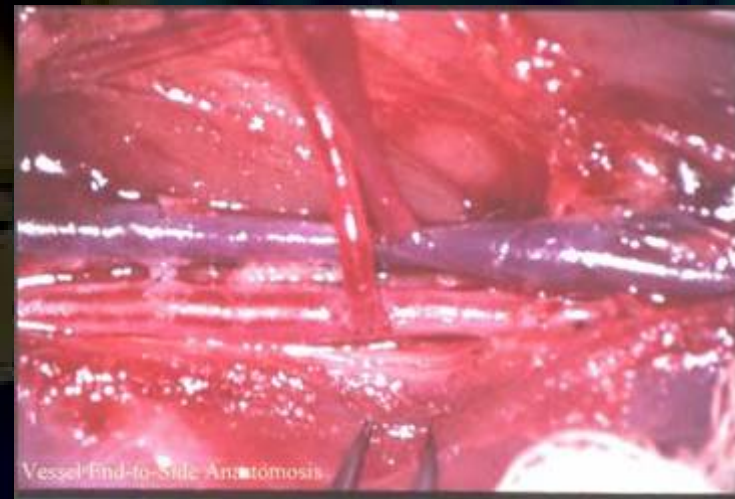
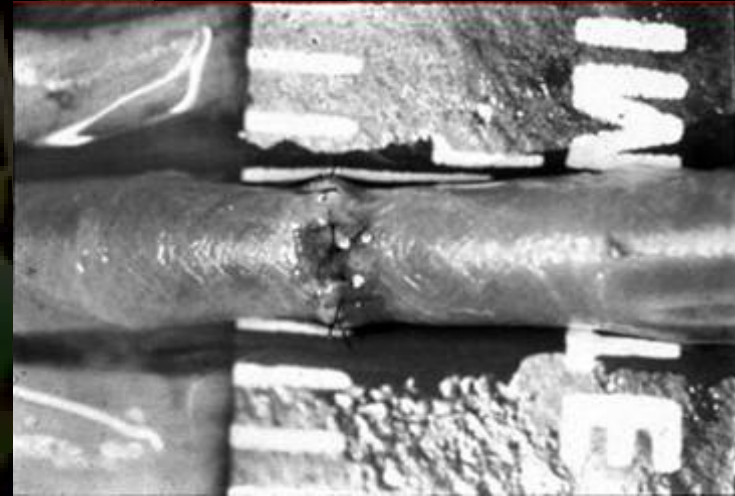
- End-to-End (between two cut ends)
- End-to-Side (connection of one cut end to the wall).

- Expose the vessel
- Irrigation
- secured with clamps
- Contrast material placed behind
- 1st suture - full thickness
- 2nd & 3rd sutures - 120°



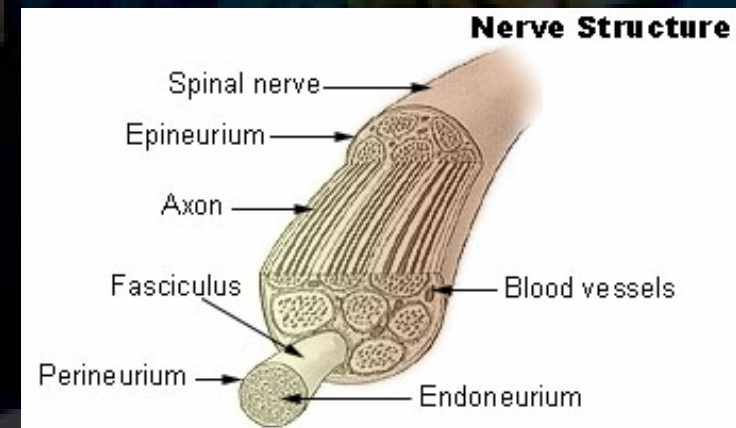
Techniques

- End to End repair
 - Arteries 1 mm
 - between 5 & 8 stitches
 - veins 1mm
 - between 7 & 10
 - clamps are released
- End to Side repair
 - Oval-shaped hole is cut on recipient vessel



Nerve Repair

- Process of connecting two cut ends of nerve
 - Neurorrhaphy / Nerve anastomosis
- Peripheral nerves
 - Bunches of nerve fibers called fascicles
 - Enclosed by perineurium
 - Epineurium is the outer layer
- Nerve repair
 - Suturing of epineurium only
 - Perineurium only
 - Through both layers



Pre-op Preparation

- Investigations
 - Blood: CBP, L/RFT, Clotting profile...
 - T&S / X-match
 - X-rays, CXR
 - ECG
 - Doppler /Arteriogram
- Advice
 - No smoking
 - No drinking, coffee, cola...



Pre-op preparation

- Donor Site

- No blood taking or IV access
- Prevent injury
- Marking of skin area by surgeon
- +/- prepare the donor site of skin graft

- Recipient Site

- debrides all necrotic or slough tissue.
- +/-Ensures wound swab for culture is -ve



Replantation



Replantation

- Surgical attachment
 - Revascularization of a body part that has been **completely** amputated



Revascularization

- Restoration of circulation to a devascularized but **not completely** amputated part





Preserve the amputated parts

- Placed in a bag after being wrapped in an sterile gauze dampened with NS
- Bag placed in container & submerged in ice NS bath to maintain a temp of 4°C
- Labeling
- Never by placed in a hypotonic or hypertonic solution



Preserve amputated parts



- ❖ Don't try to detach
- ❖ Don't stretch
- ❖ Moistened with NS
- ❖ Loosen dressing & crepe
- ❖ Cool with $\frac{1}{2}$ ice & $\frac{1}{2}$ H₂O in plastic bag
- ❖ Support with splint



Relevant history

- Mechanism of injury
 - Avulsion or crush
- Time of injury
 - Ischemic time
- Emergency treatment rendered, including care provided to amputated part



History

- Patient's age
- Hand dominance
- Occupation/ vocational demands & expectations
- Previous hand injuries or disability
- Other major injuries
- Medical/ psychiatric conditions that may preclude replantation



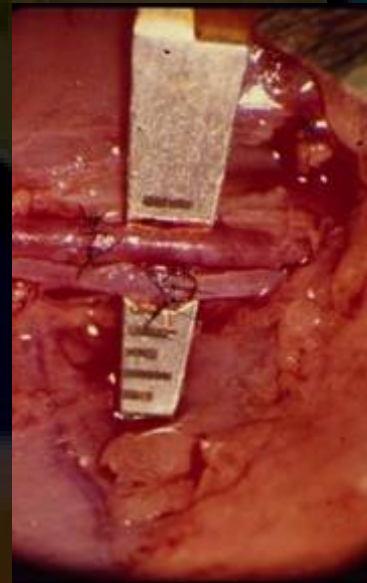
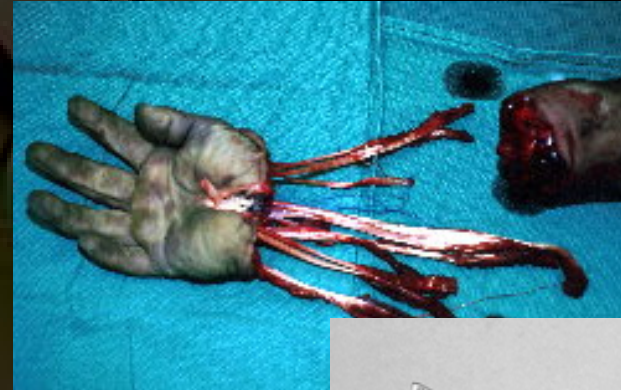
Relevant physical examination

- Location (level) of amputation
- Single or multiple injury levels in the extremity
- Single or multiple amputated parts
- Condition of amputated part (sign or crush or avulsion)
- Condition of the amputation stump



Sequence for replantation

- Wound debridement
- Identification of arteries, veins, nerves & tendons
- Bone stabilization
- Extensor tendon repair
- Flexor tendon repair
- Vascular anastomosis
- Nerve repair
- Skin closure



Methods for bony stabilization

- K wire or intraosseous wires
 - can be placed rapidly & easily
- Lag screw fixation or miniplate & screws
- Plate fixation
 - major limb replantation



Post-op Care

- Complete bed rest
- Keep warm
 - ⊗ warm Room ($\sim 26^{\circ}\text{C}$)
 - ⊗ ? lamp treatment
- Bed cradle
- Support operated limb → Avoid torsion of pedicle



Post-op Care

- Elevation
 - Heart level
 - Above heart level
 - One pillow
- Vital Signs
 - BP/P
 - Body Temp.
 - I/O



Post-op Care

- IVF
 - Hydration
- Foley's catheter
 - measure output
- NPO
- Pain control
 - (No Puncture on affected site)
- Medication
 - Dextran 40
 - Aspirin
 - Persantin
 - Analgesic
 - Antibiotics



Monitoring

- Colour
- Capillary Refill
- Tissue Turgor
- Temperature
- Doppler
- SpO₂
- Pin Prick



Monitoring

- Colour

- Normal → Pink
- Arterial fail → Pale
- Venous fail → Cyanotic

- Capillary Refill

- Normal → 1-2 sec
- Arterial fail → Slow
- Venous fail → Fast



Monitoring

- Tissue Turgor

- Normal → Full
- Arterial fail → Hollow, "Prune like"
- Venous fail → Tense, Distended+ Blisters



Monitoring

- Temperature
 - Normal: 30-37°C
 - Replanted or flap: +/- 2-3°C
 - ? By touch
 - By Thermo Scan
 - Arterial / venous thrombosis
 - fall below 30°C, differential 2.5°C
 - Arterial thrombosis/ Venous thrombosis:
 - rapid fall 3°C/ slowly fall 1-2°C



Monitoring

- Doppler
 - Vascular Doppler
 - Implantable Doppler Probe
 - Laser Doppler Flow meter
- SpO₂
 - Normal: ~ >90%
 - Vascular compromise
 - Sudden fall
 - Not ↑ on 100% O₂ given



Monitoring: Pin

Prick

- **By Surgeon**
 - 25 gauge needle
 - No.11 blade
- Heparin
 - promote bleeding
- Normal: **Bright red** blood
- Slow to start bleeding
- Bleeds a short
- Arterial Occlusion: Serum
 - No bleeding
- Venous Occlusion:
 - Bleeds brisk
 - Bleeds a long time



Pressure on flap



Thank you

