

# Principles of Local, Regional and Micro-Vascular flaps in H&N Reconstruction

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# Reconstructive ladder

- Primary closure
- Heal by secondary intention
- Skin grafting
- Local flaps
- Regional flaps
- Free tissue transfer

# Reconstructive ladder

- Primary closure
- Heal by secondary intention
- Skin grafting
- **Local flaps**
- Regional flaps
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# Local Flaps

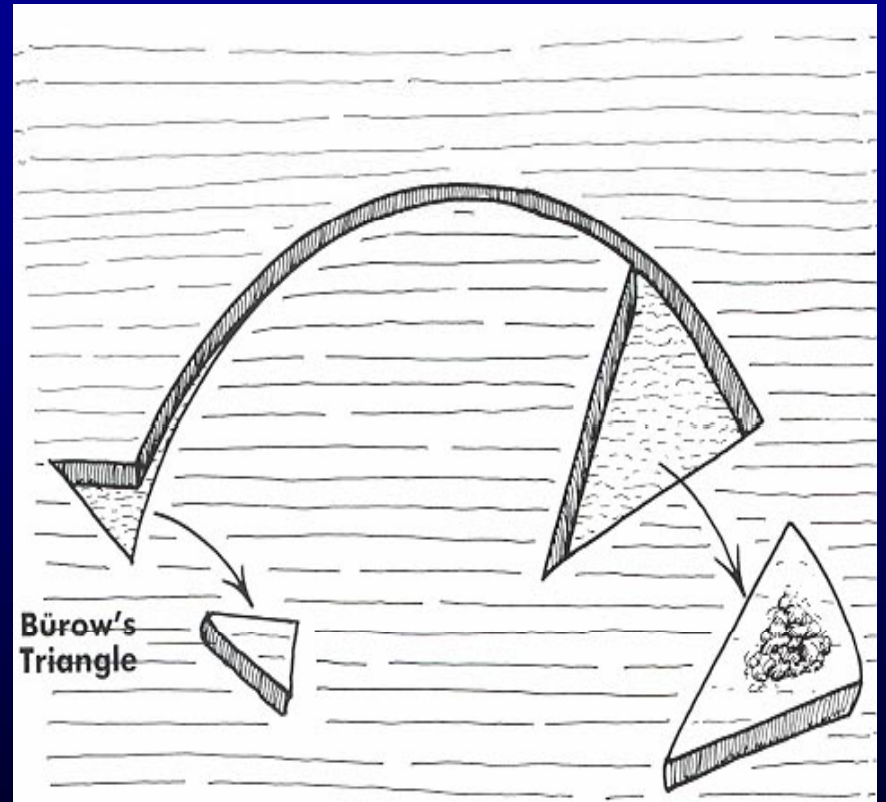
- **Advantages:**
  - Use of local tissue w/ better donor site match
  - One stage (usually)
  - Low donor site morbidity
- **Disadvantages:**
  - Random pattern blood supply w/ limited length
  - Distortion surrounding structures w/ donor site closure in some cases
  - Not enough bulk for deep defects

# Local Flaps

- Rotational
- Transposition
  - Rhomboid, Duformental, Bilobed
- Interpolated
- Advancement

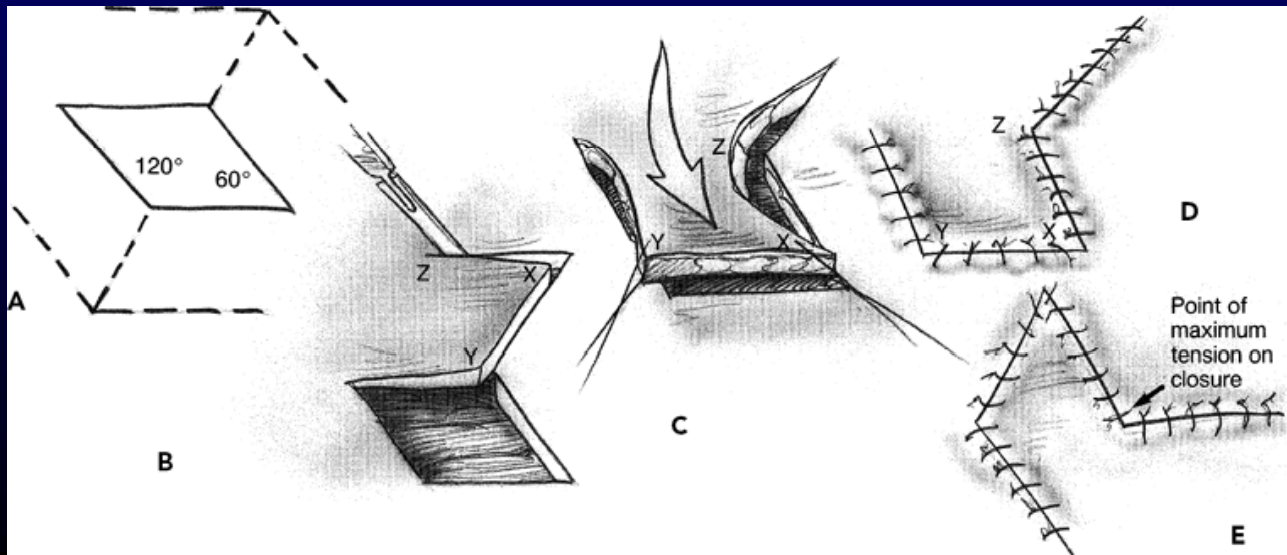
# Rotational

- Triangular Defect Adjacent to Flap
- Rotates in Arc about Pivot Point – curvilinear movement
- Flap Shortens as Rotated
- Burow's Triangle at Base of Flap
- Advantage – allows closure of large lesion by recruiting lax skin over a greater distance



# Transposition Rhomboid Flap

- Classic rhomboid flap is designed to fit a rhombic defect with two 60-degree and two 120-degree angles
- For each rhomboid defect, four possible flap orientations may be used for closure

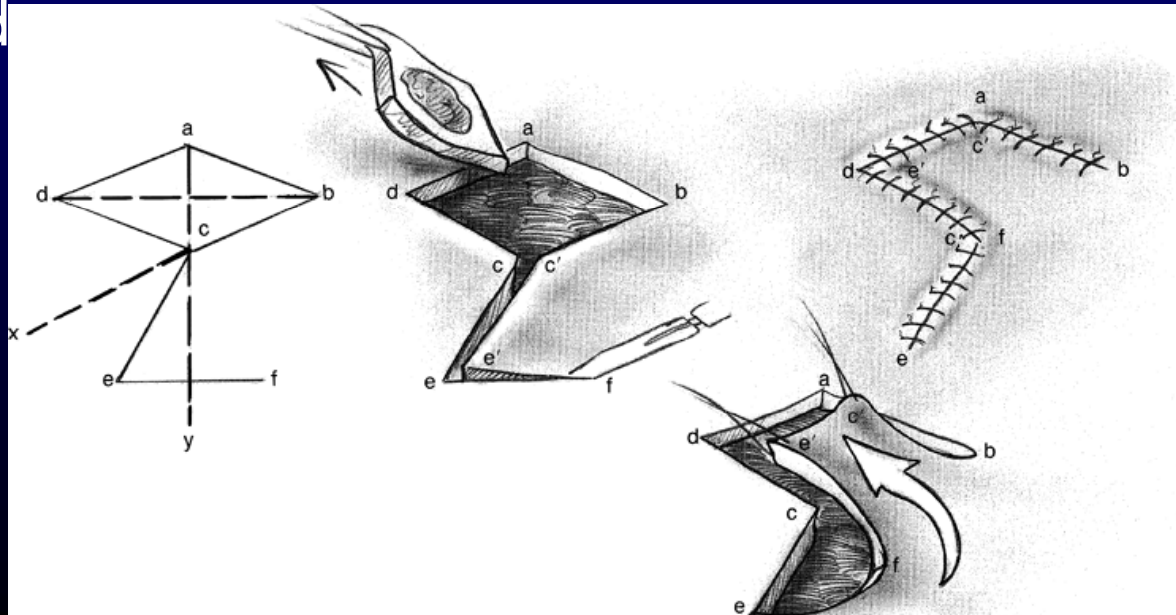


# Rhomboid Flap



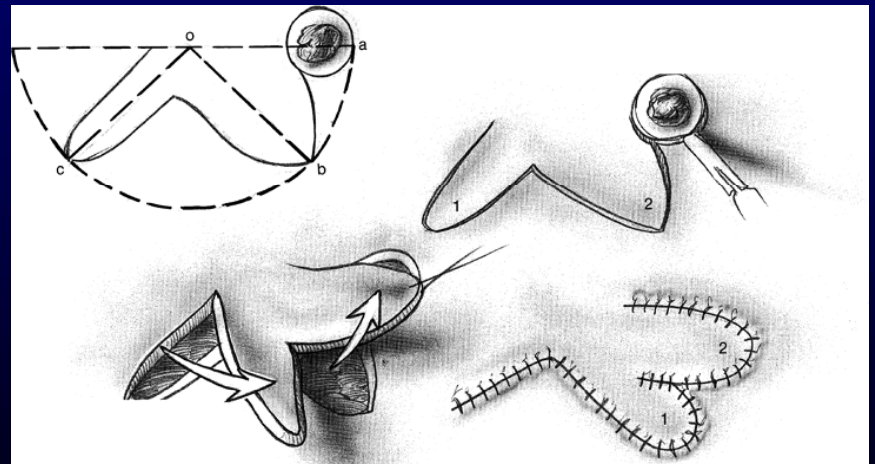
# Dufourmental Flap

- Variant of the rhomboid.
- For defects that don't correspond to 60, 120-degree dimensions.
- Imaginary lines extended from diameter and on side.
- Angle created by these two line then bisected by a line of same length as a side of defect.
- Back cut is then made parallel to long axis. Flap then rotated



# Bilobed flap

- Double rotation flap in tandem with a single pedicle.
  - Distributes tension over two flaps; each rotated about 90-deg.
- Work best for nose where tissue borrowed from para nasal area.



# Transposition Flaps

## Bilobed Flap

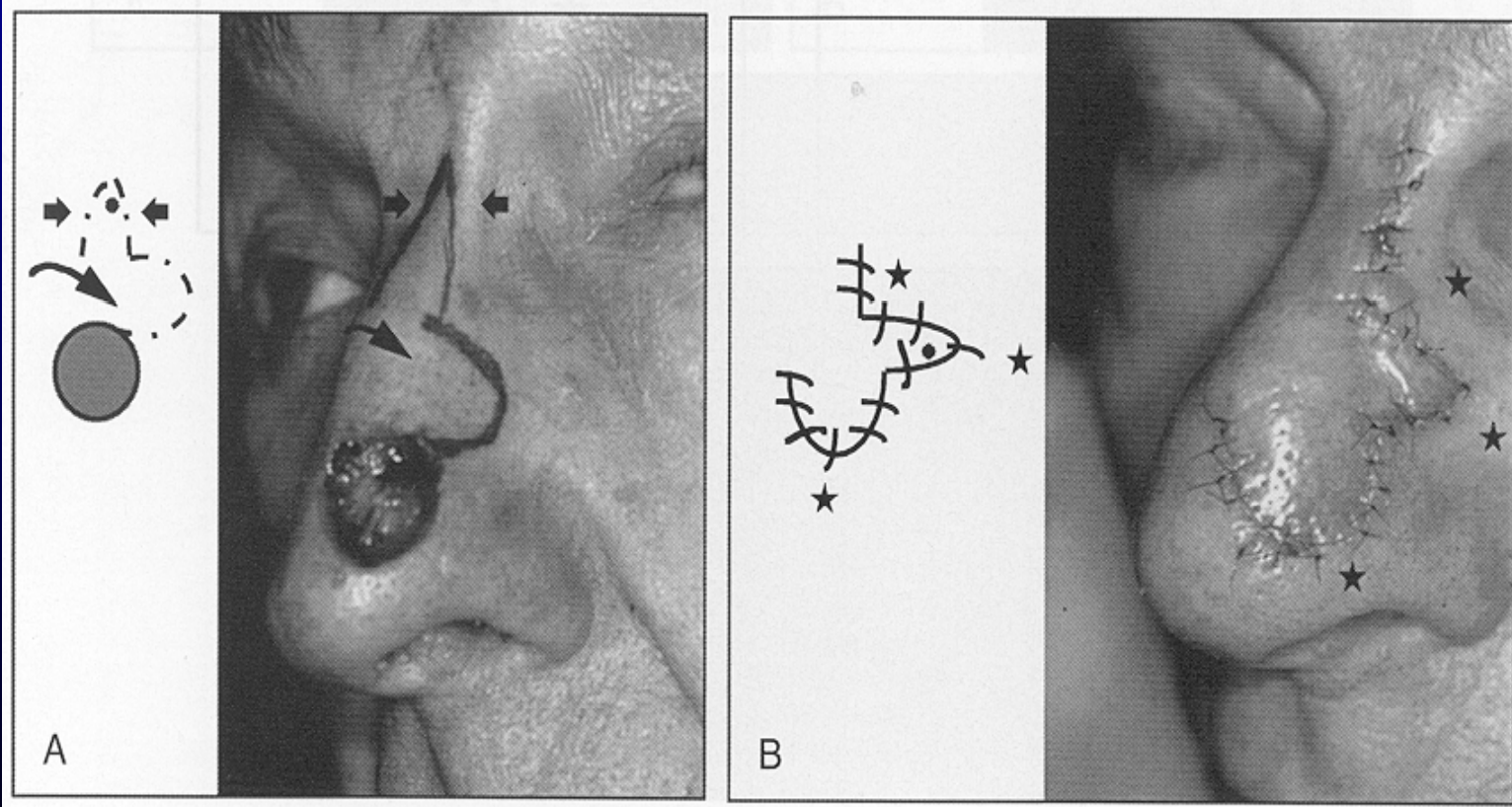


Figure 9. A and B, Bi-Lobe flap.

# Transposition Flaps

## Dorsal Nasal Flap (of Rieger)

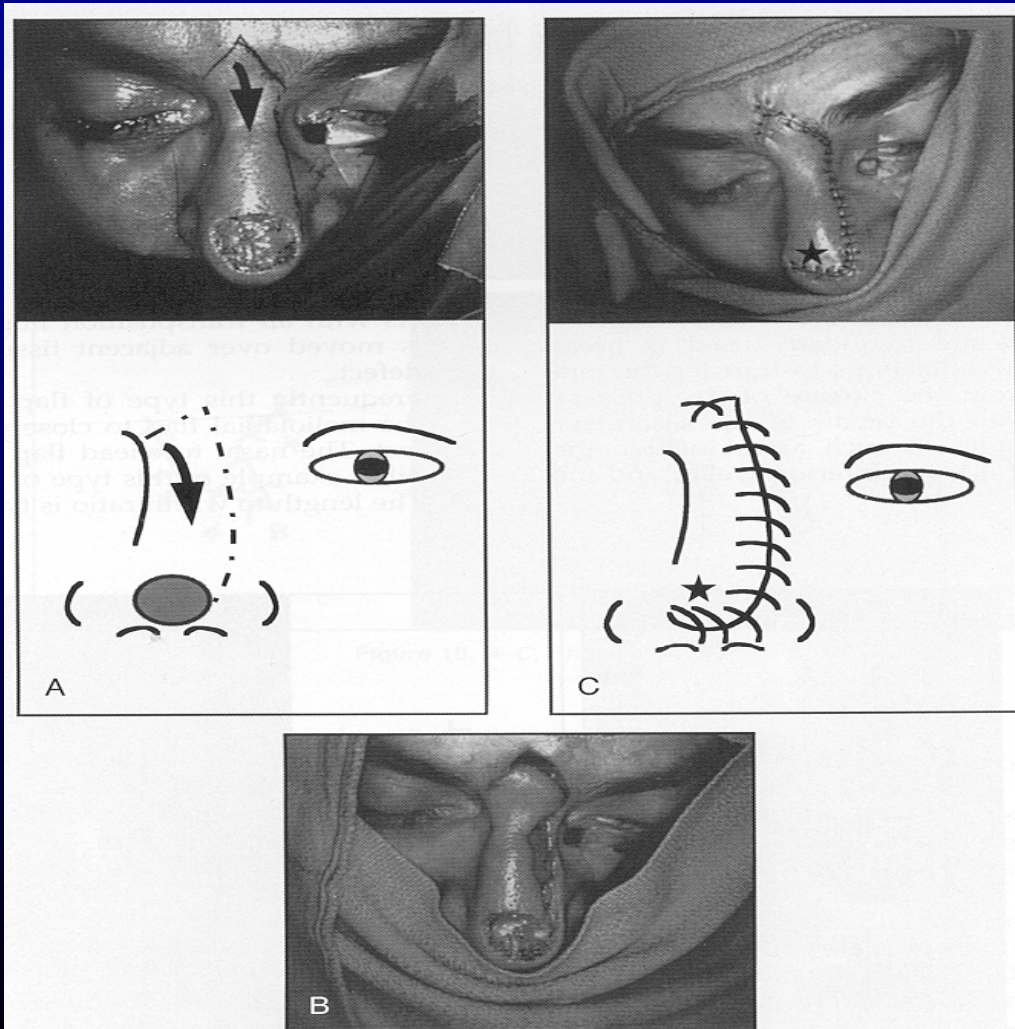
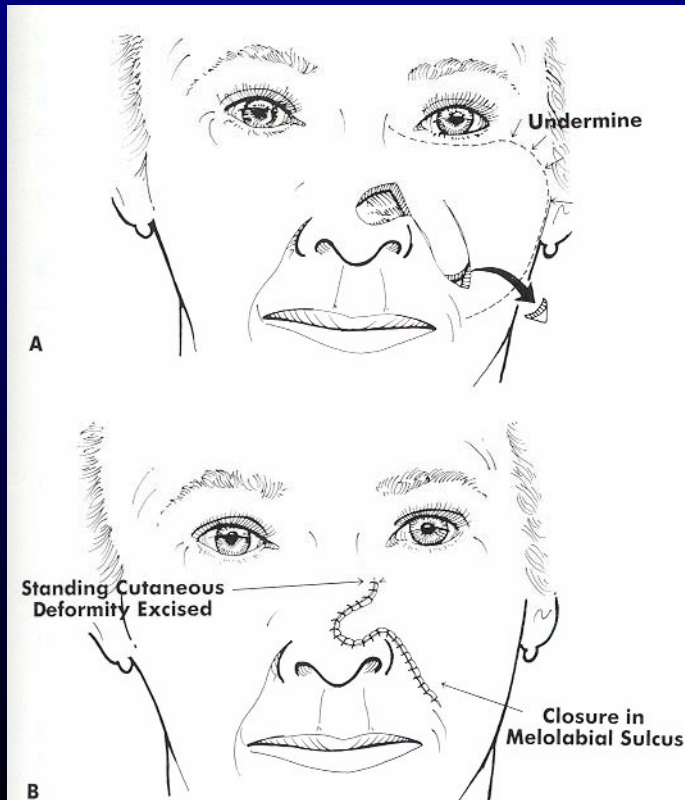


Figure 7. A-C: Dorsal nasal flap.

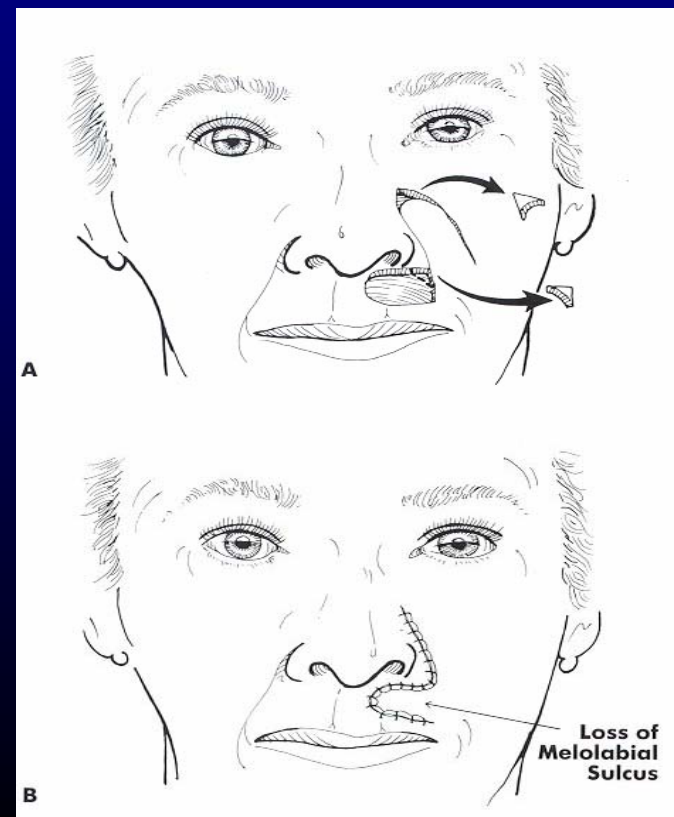
# Interpolated Flap

## MELOLABIAL FLAPS

### Superiorly Based



### Inferiorly Based



# Interpolated Flaps

## Paramedian Forehead Flap

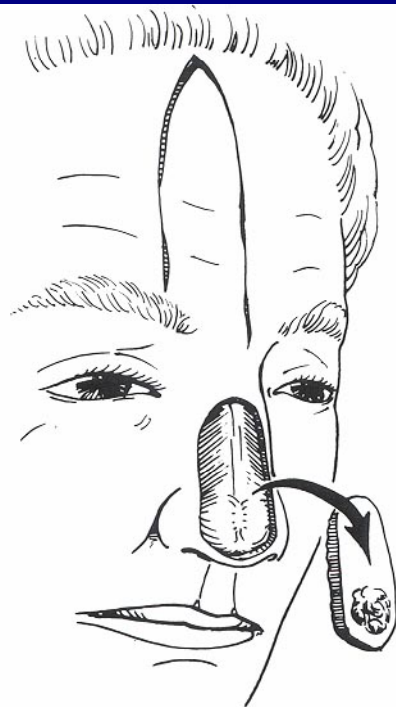


Fig. 13-4



Fig. 13-5

# Advancement Flaps

- Linear Movement
- Burow's Triangles at Base
- Length:Width Ratio 2:1
- Good for Forehead and Brow

# Advancement Flaps

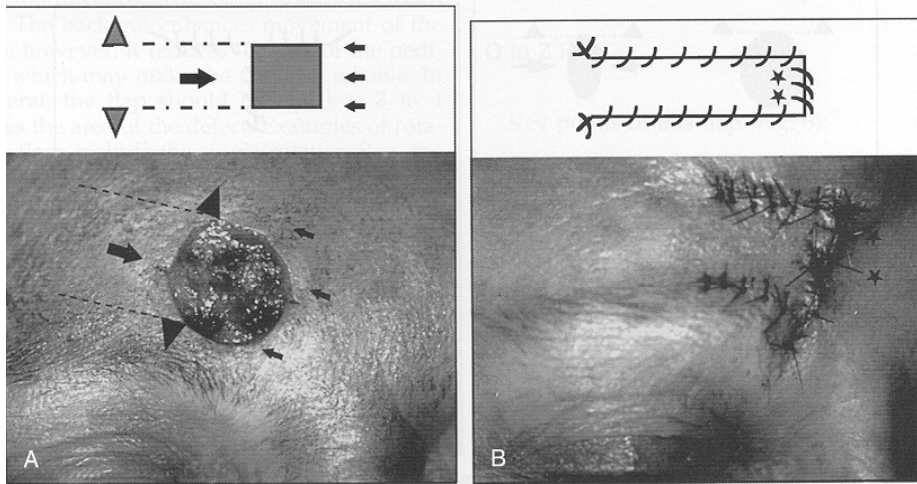


Figure 1. A and B, Single advancement flap.

## Single Advancement

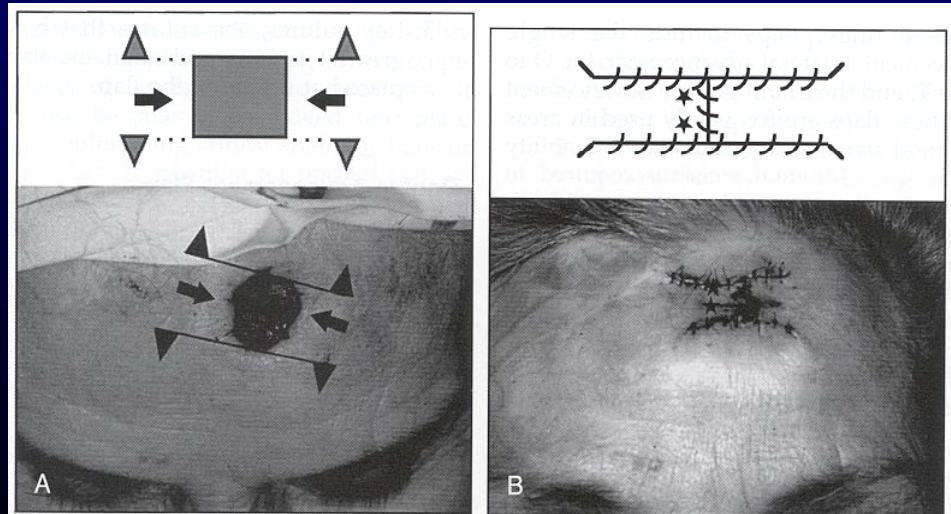


Figure 2. A and B, Double advancement flap.

# Advancement Flaps

## V – Y Advancement flap

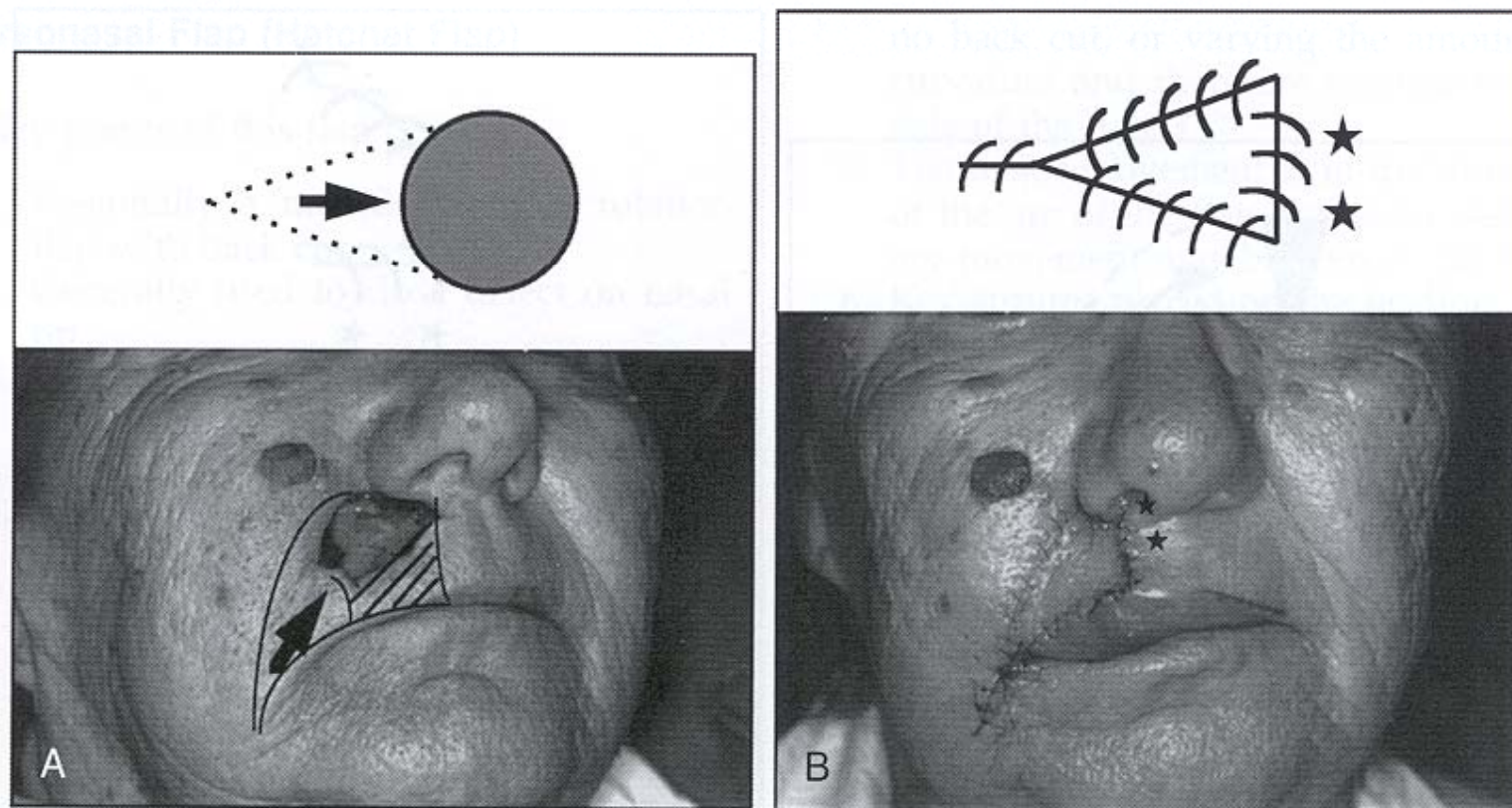


Figure 4. A and B, Island pedicle flap.

# Reconstructive ladder

- Primary closure
- Heal by secondary intention
- Skin grafting
- Local flaps
- **Regional flaps**
- Free tissue transfer

# REGIONAL FLAPS

- Advantages/Uses:

- Bulky
- Quick and easy to harvest
- Single stage
- Minimal donor site morbidity
- Required one surgical team
- Large Tongue Base/TG Defects
- Carotid Coverage

- Disadvantages:

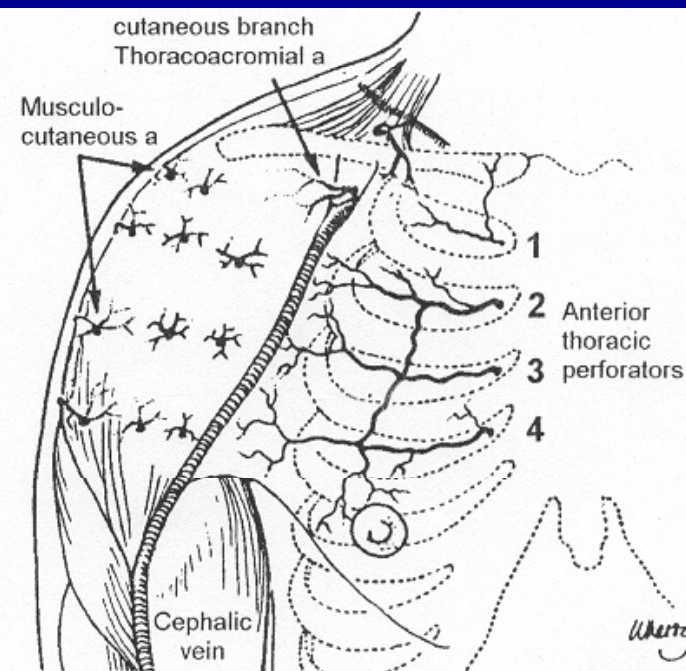
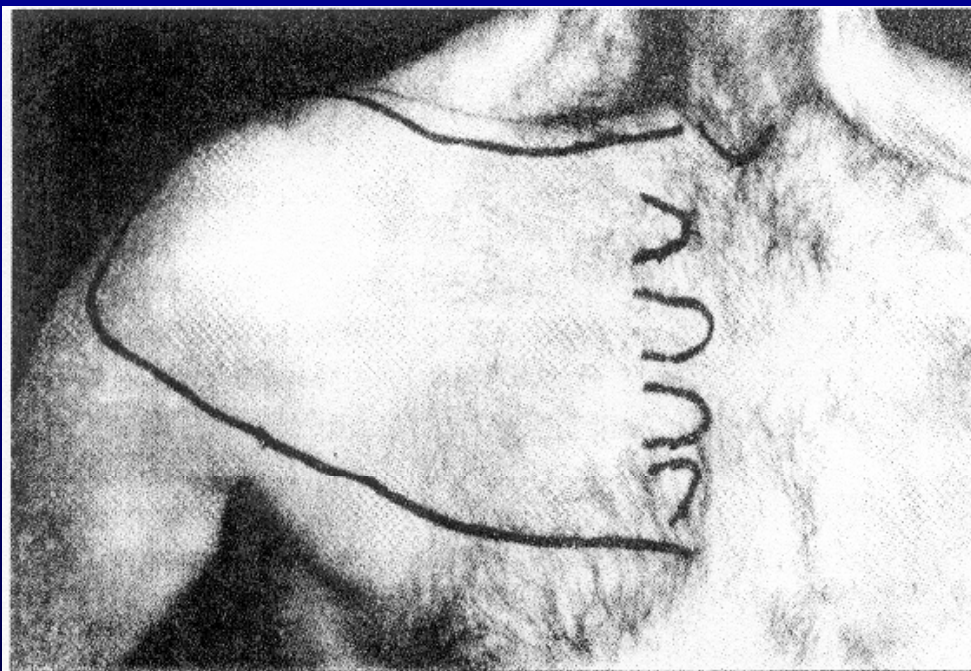
- Bulky
- Downward Pull of Flap
- Atrophy
- Arc of Rotation Limiting
- Distal Flap Necrosis

# REGIONAL FLAPS

- Deltopectoral flap
- Pectoralis major musculocutaneous flap (PMMF)
- Latissimus dorsi flap (LDMF)
- Sternocleidomastoid flap (SCMF)
- Trapezius flap
- Serratus anterior flap

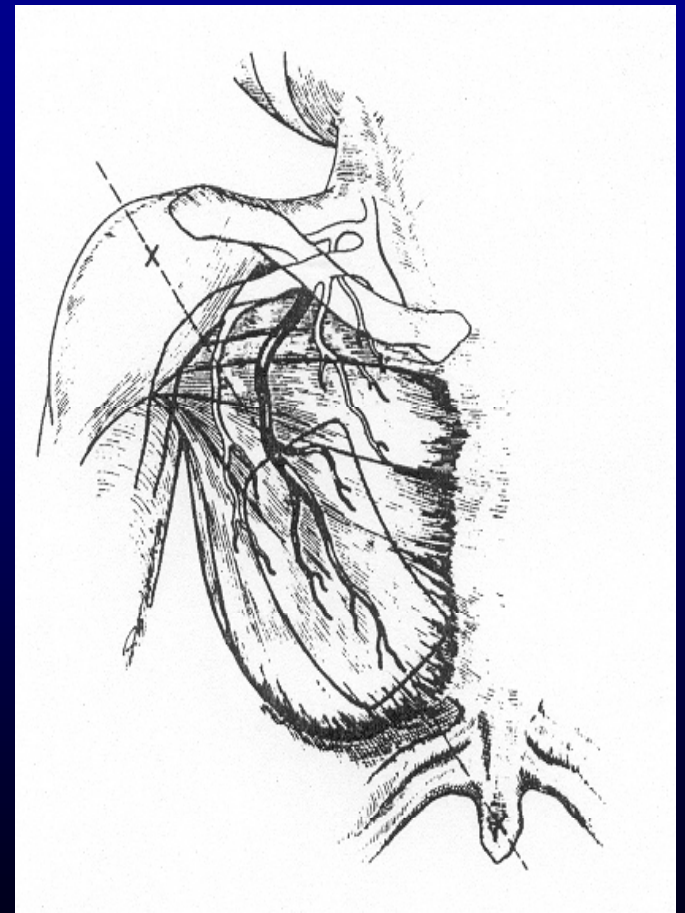
# Deltopectoral flap

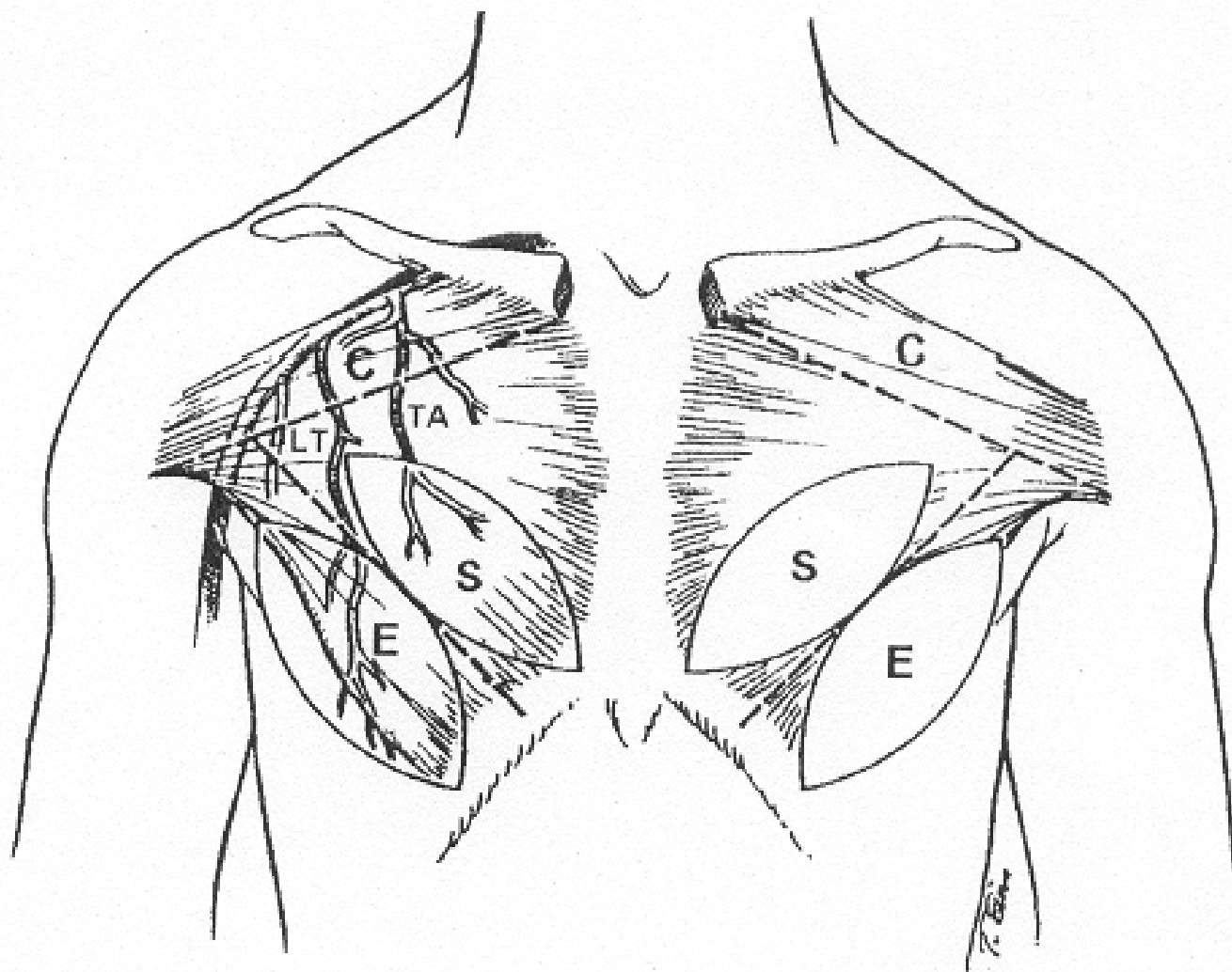
- Three main vascular contributions:
  - 1<sup>st</sup> four perforating branches of internal mammary artery
  - Thoracoacromial artery supplies upper midportion of deltopectoral flap
  - Perforating vessels from deltoid muscle



# Pectoralis major musculocutaneous flap (PMMF)

- Thoracoacromial  
major pedicle
- Secondary segmental  
parasternal  
perforators from  
internal mammary  
artery





# Latissimus dorsi flap (LDMF)

Thoracodorsal artery branches

- Advantages:

- Large size
- Wide excursion
- Donor site morbidity negligible

- Disadvantages:

- Positioning
- Intricate dissection
- Complexity of tunneling

# Sternocleidomastoid flap (SCMF)

- Moderately useful
- Partial flap loss in 50% of patients
- Most reliable when based on the occipital artery and retained skin bridge
- Arc of rotation determined by the course of the spinal accessory nerve within the muscle
- Improved vascularity with preservation of superior thyroid artery and vein
- Can include clavicle in the flap

# Trapezius flap

## –Three main vascular sources:

- » Transverse cervical artery (TCA)
- » Dorsal scapular artery (DSA)
- » Posterior intercostal arterial branches

# Serratus anterior flap

- Fasciocutaneous extension of serratus anterior muscle from 6<sup>th</sup> to 8<sup>th</sup> ribs
- Long pedicle 15-20 cm
- Rib can be included
- Latissimus dorsi flap can be included in same pedicle
  - Can cover large soft tissue defects

# Reconstructive ladder

- Primary closure
- Heal by secondary intention
- Skin grafting
- Local flaps
- Regional flaps
- **Free tissue transfer**

# Free tissue transfer

- High success rates
- Superior aesthetic and functional results
- Allows for reconstruction of defects that could not be repaired in other ways
- Advantages
  - Vascular pedicle anastomosed to most appropriate recipient
  - Ease of flap inseting and orientation
  - Closure of massive defects feasible
  - Provide epithelium, subcutaneous tissue, muscle, nerve, and bone
  - Option of restoration of sensation
    - Sensory nerve harvest
- 95% flap survival
- Complication rate approximately 20%
  - Salivary fistula 12%

# Free tissue transfer

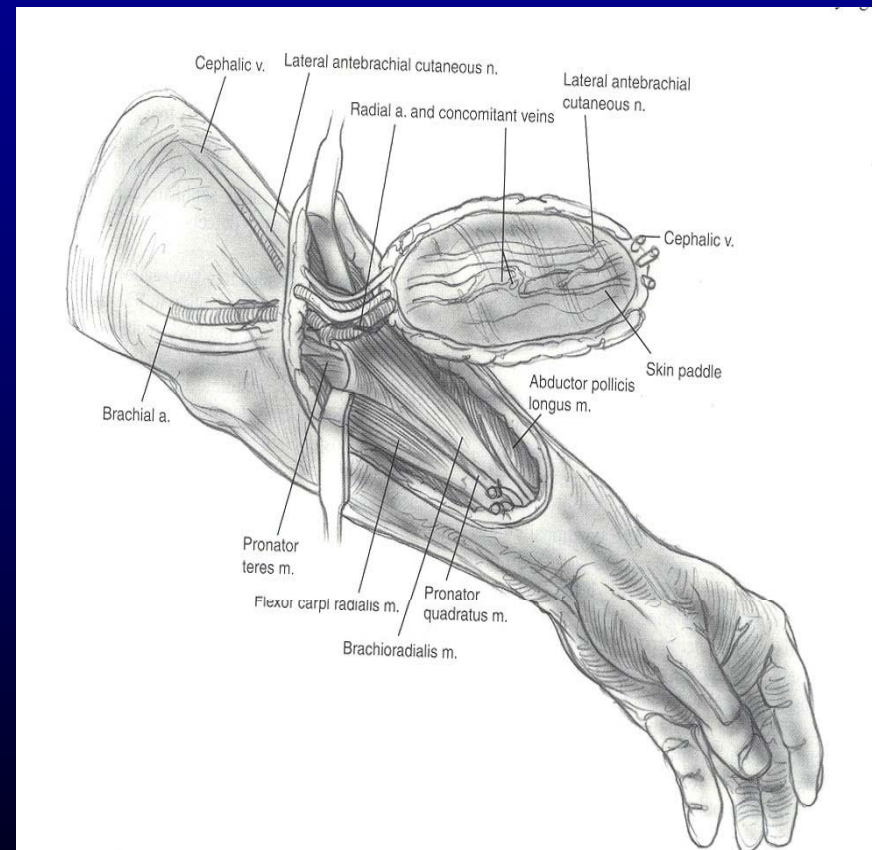
- Fascial and Fasciocutaneous Flaps
- Muscle and Musculocutaneous Flaps
- Composite Free Flaps
- Visceral Flaps

# Fascial and Fasciocutaneous Flaps

- 1. Radial forearm
- 2. Antro Lateral thigh
- 3. Lateral arm
- 4. Temporoparietal fascial

# Radial Forearm Free Flap

- “work horse of the head and neck surgeon”
- Arterial source
  - Radial artery
- Venous Source
  - Paired vena comitantes and/or cephalic vein



# Radial Forearm Free Flap

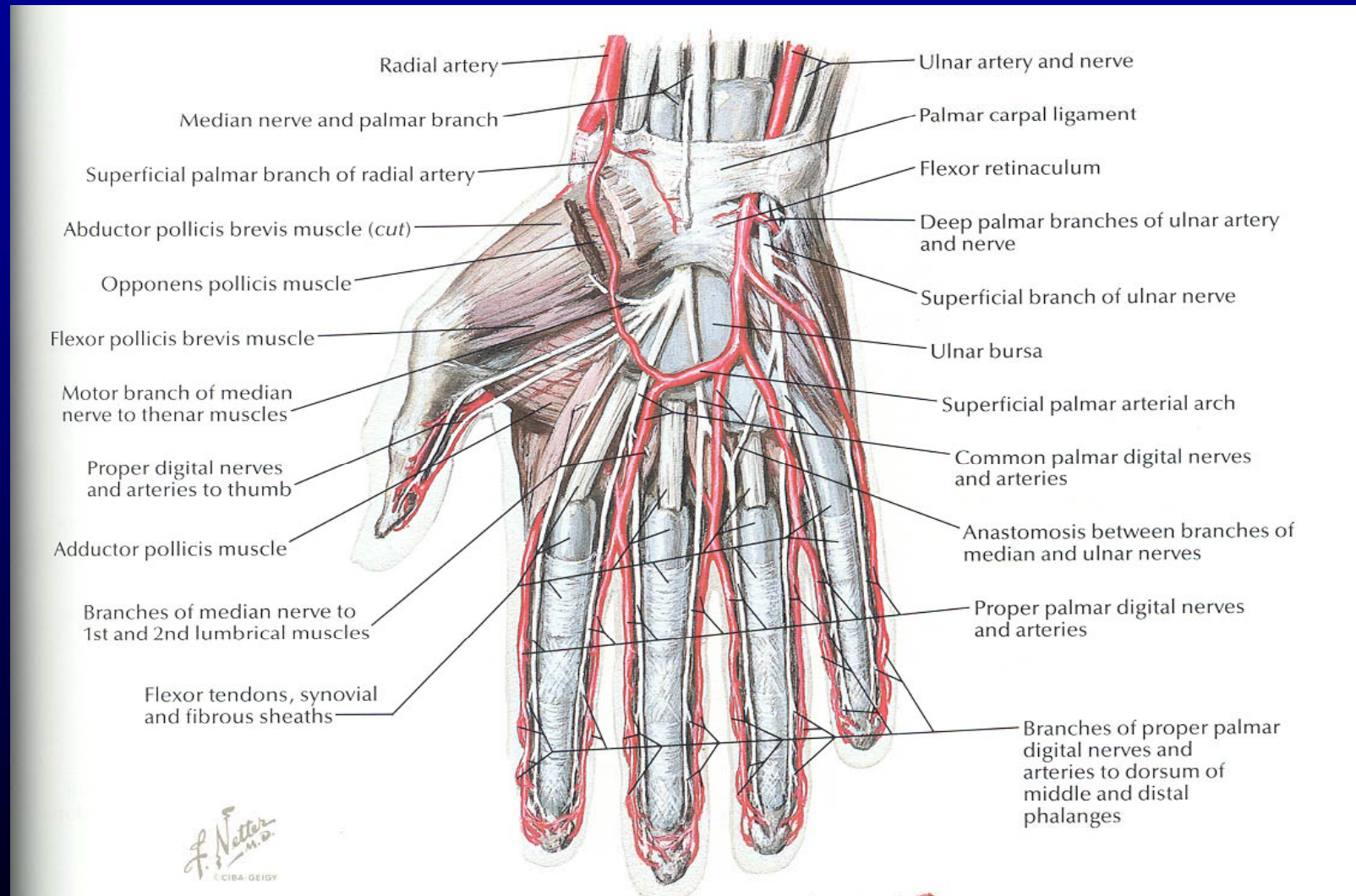
- **Advantages:**

- Thin, pliable skin with long, large pedicle
- Easy positioning
- Potential for sensate flap
- Potential for unusual shapes
- Potential for vascularized bone
- Ease of preoperative evaluation

- **Disadvantages:**

- Loss of hand
- Poorly aesthetic donor site
- Requires skin graft
- Potential for pathologic fractures
- Loss of hand function

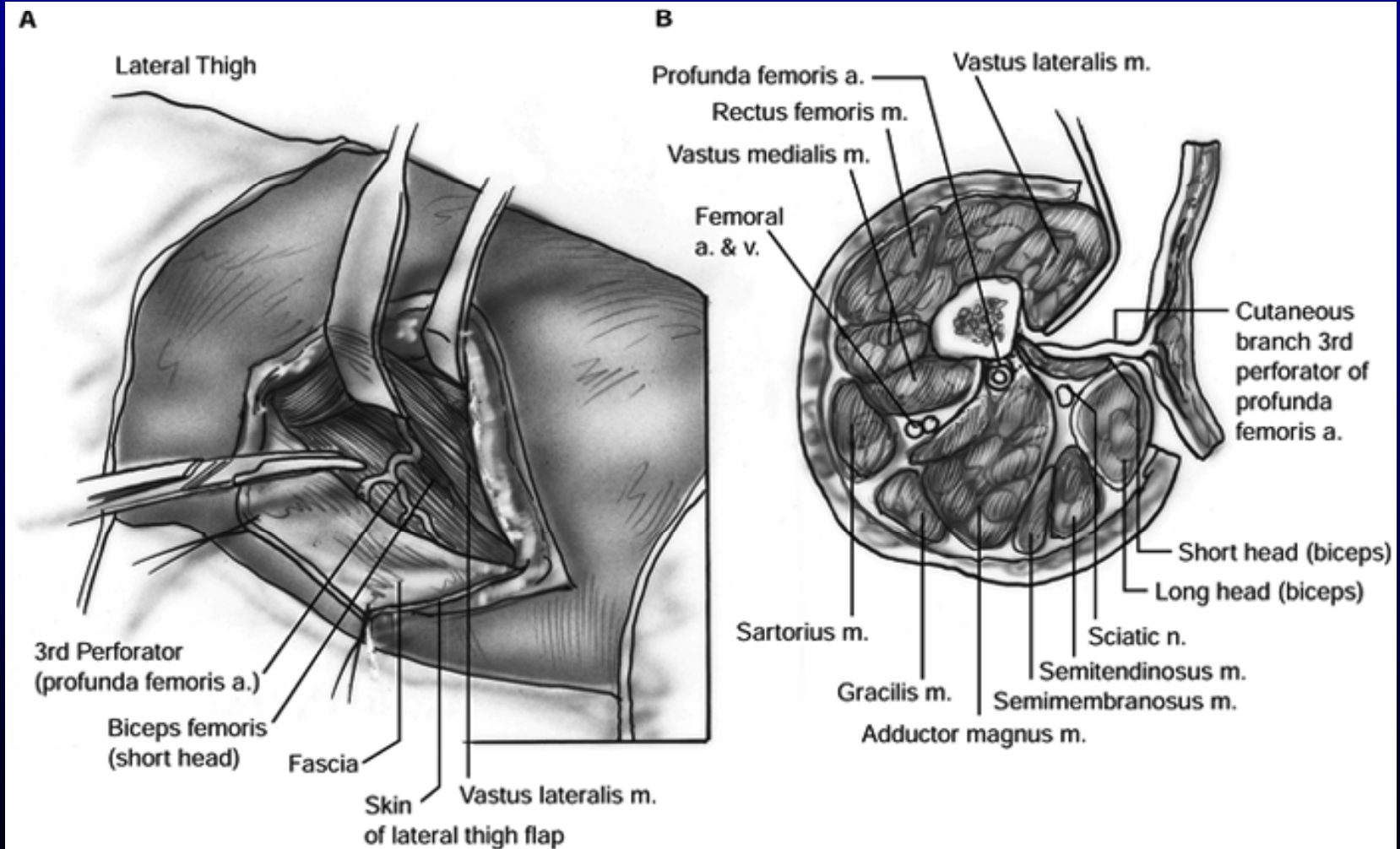
# Superficial palmar arch, Allen's test



# Anterolateral Thigh Flap

- Thick flap based on the 3<sup>rd</sup> perforator of the profunda femoris system
- Potential for large flaps (25 X 14cm)
- Reinnervation via lateral femoral cut. nerve

# Anterolateral Thigh Flap

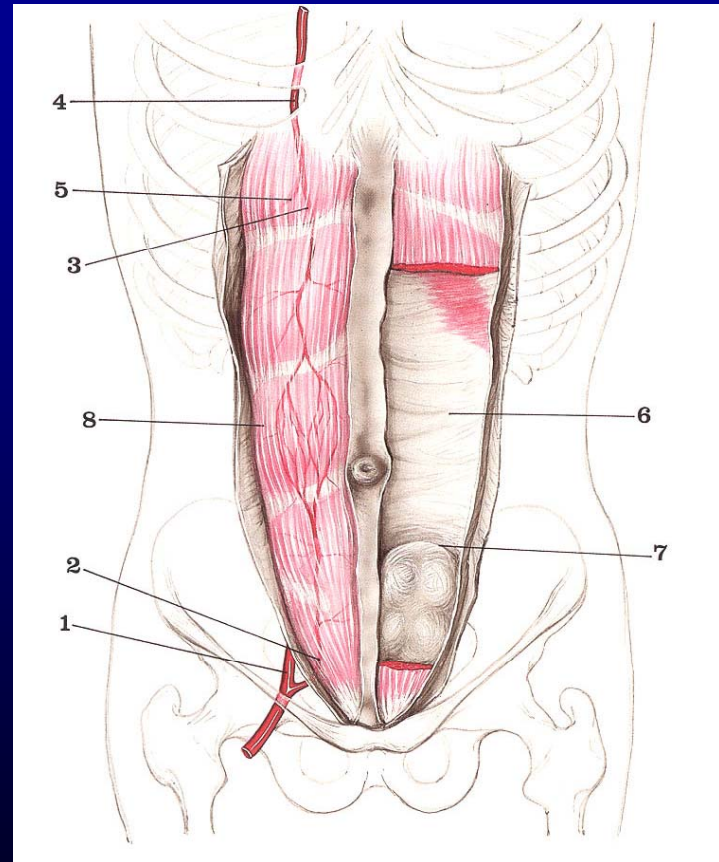


# Muscle and Musculocutaneous Flaps

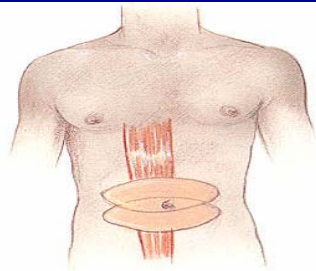
- 1. Rectus Abdominis
- 2. Latissimus Dorsi
- 3. Gracilis Flap

# Rectus Abdominus Free Flap

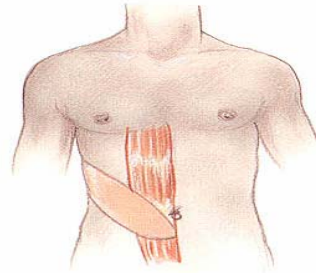
- Arterial supply based on deep inferior epigastric artery
- Venous supply from vena comitantes joining external iliac vein



A.



B.

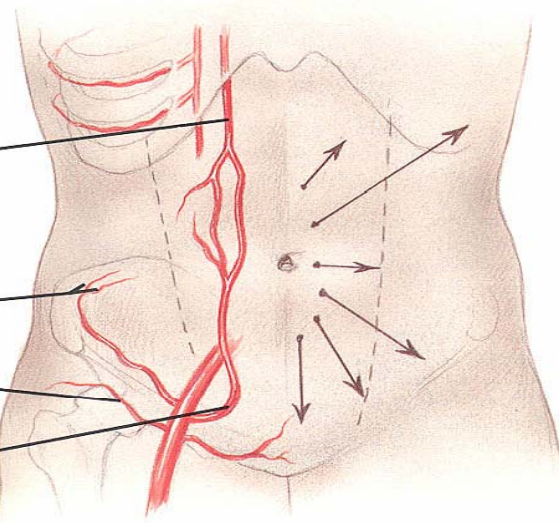


Deep superior  
epigastric a.

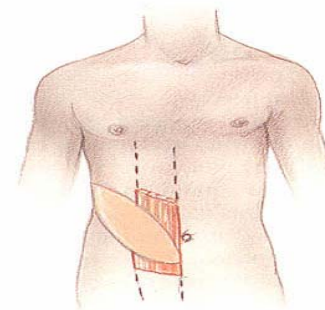
DCIA  
(perforators)

SCIA

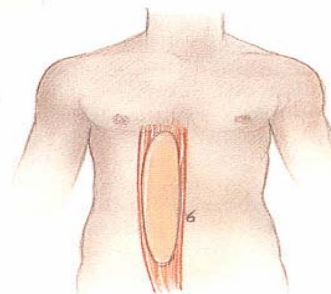
Deep inferior  
epigastric a.



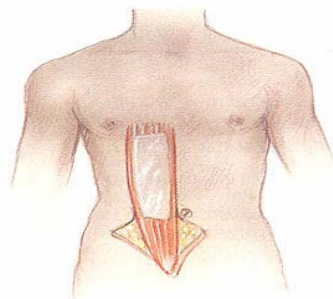
C.



D.



E.



# Rectus Abdominus Free Flap

- **Advantages:**

- Easy positioning and harvest
- Constant anatomy
- Long (8-10 cm) and large caliber vessel (avg 3.4 mm)
- Donor site closed primarily
- Large flap obtained
- Anterior rectus sheath durable

- **Disadvantages:**

- Often bulky
- No sensation potential
- Potential for hernia formation if dissection below arcuate line

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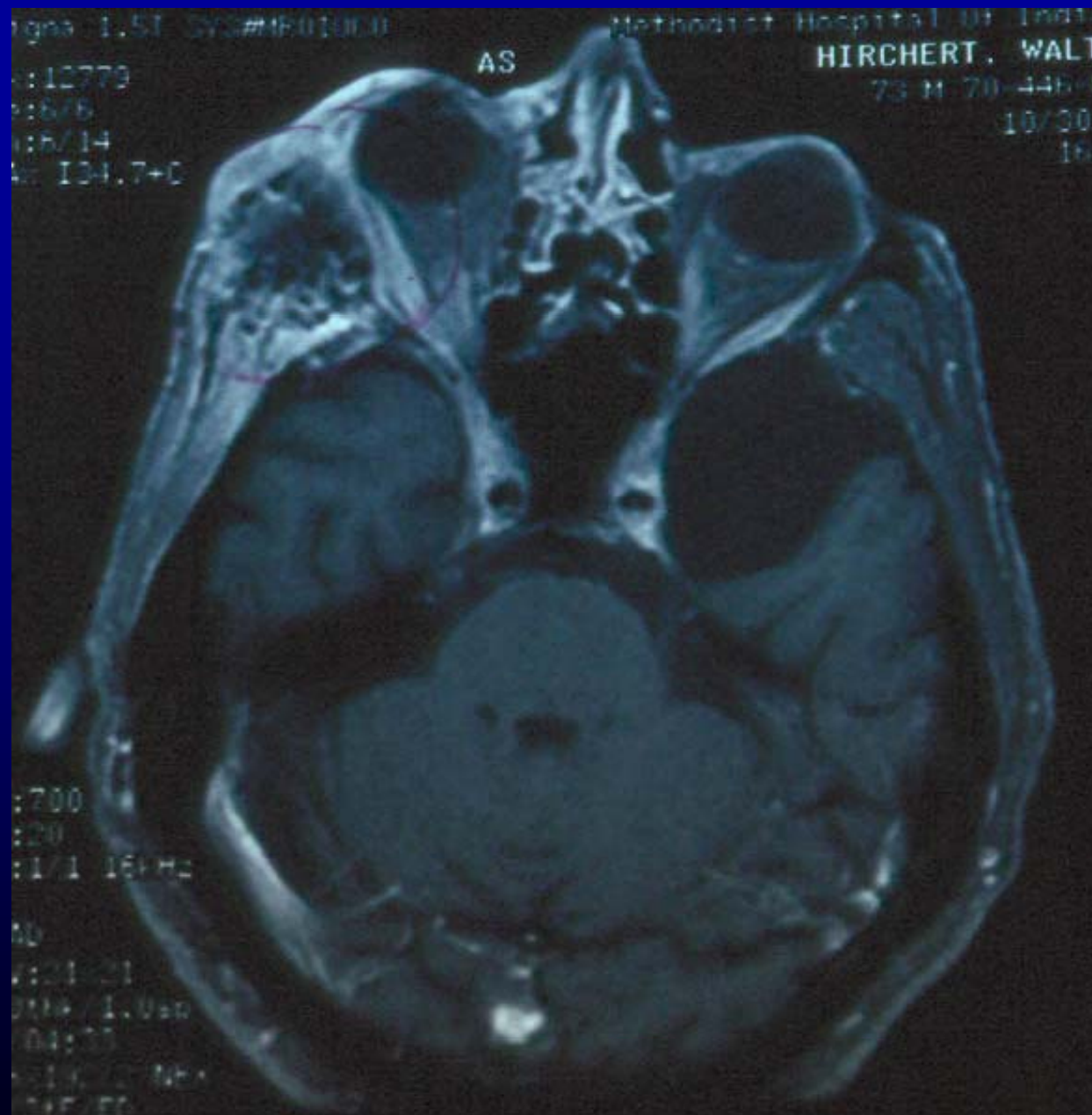
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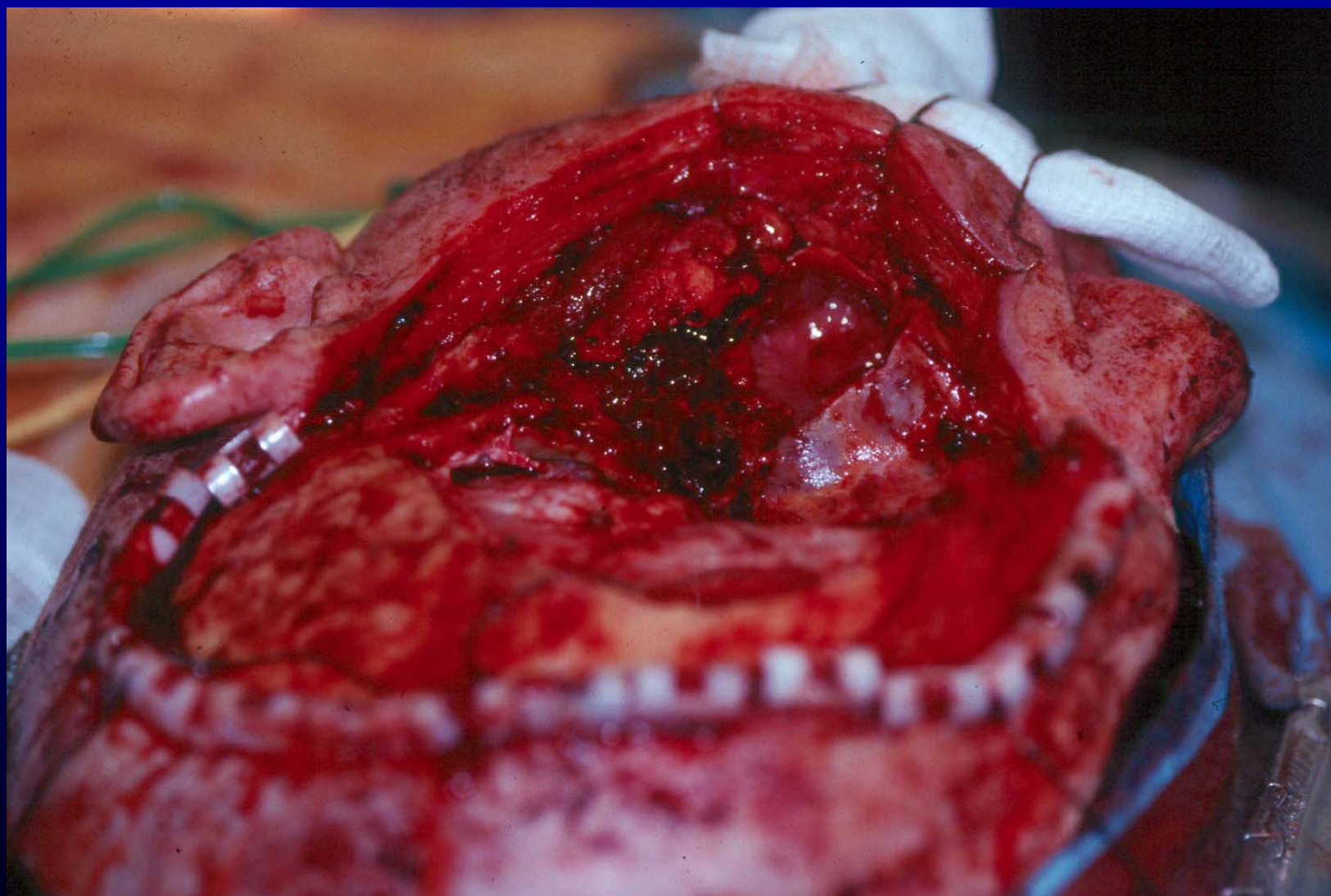
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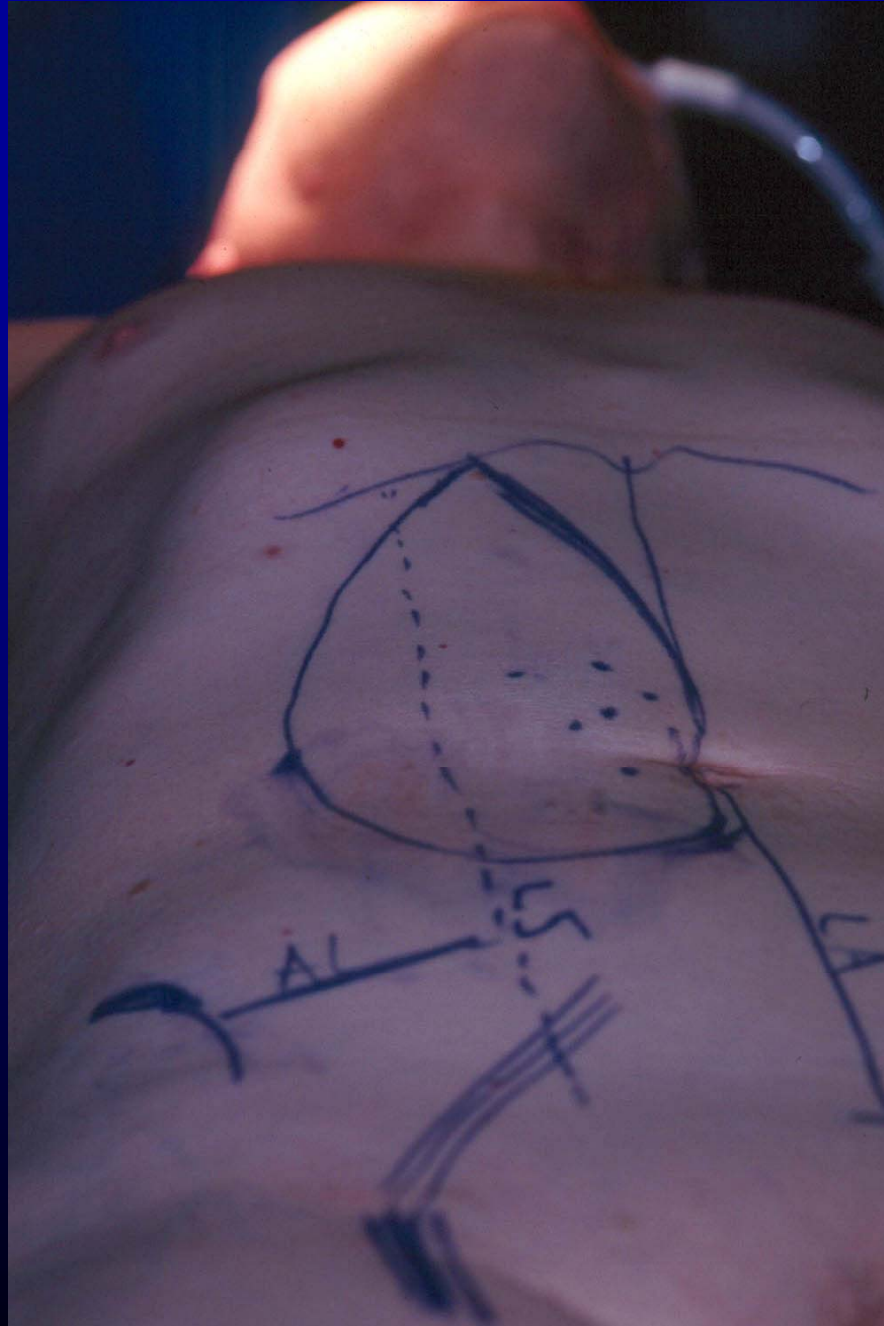
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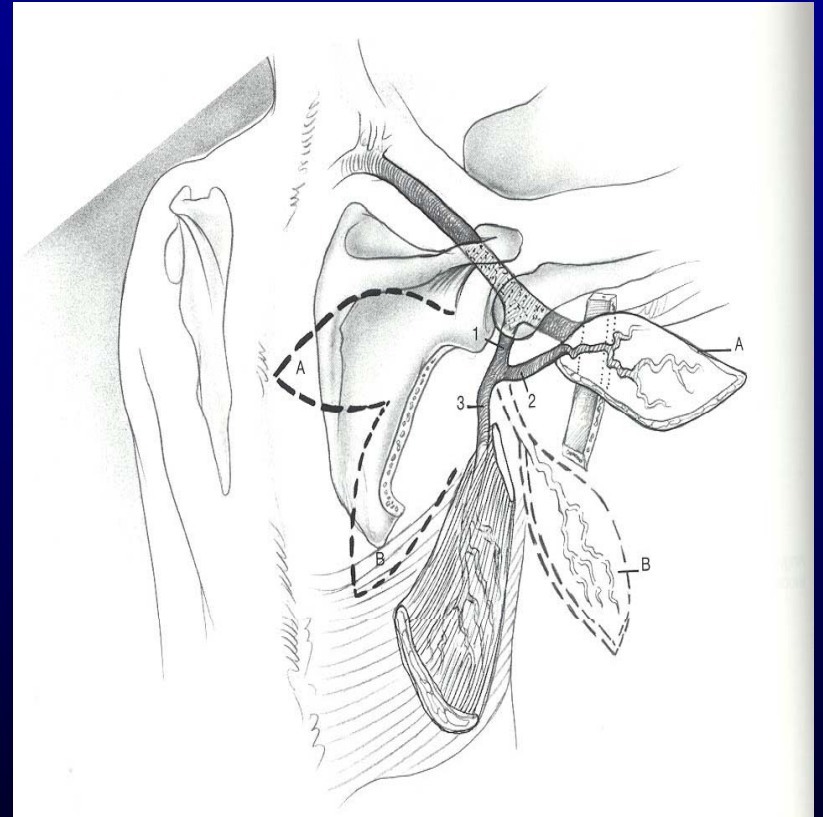




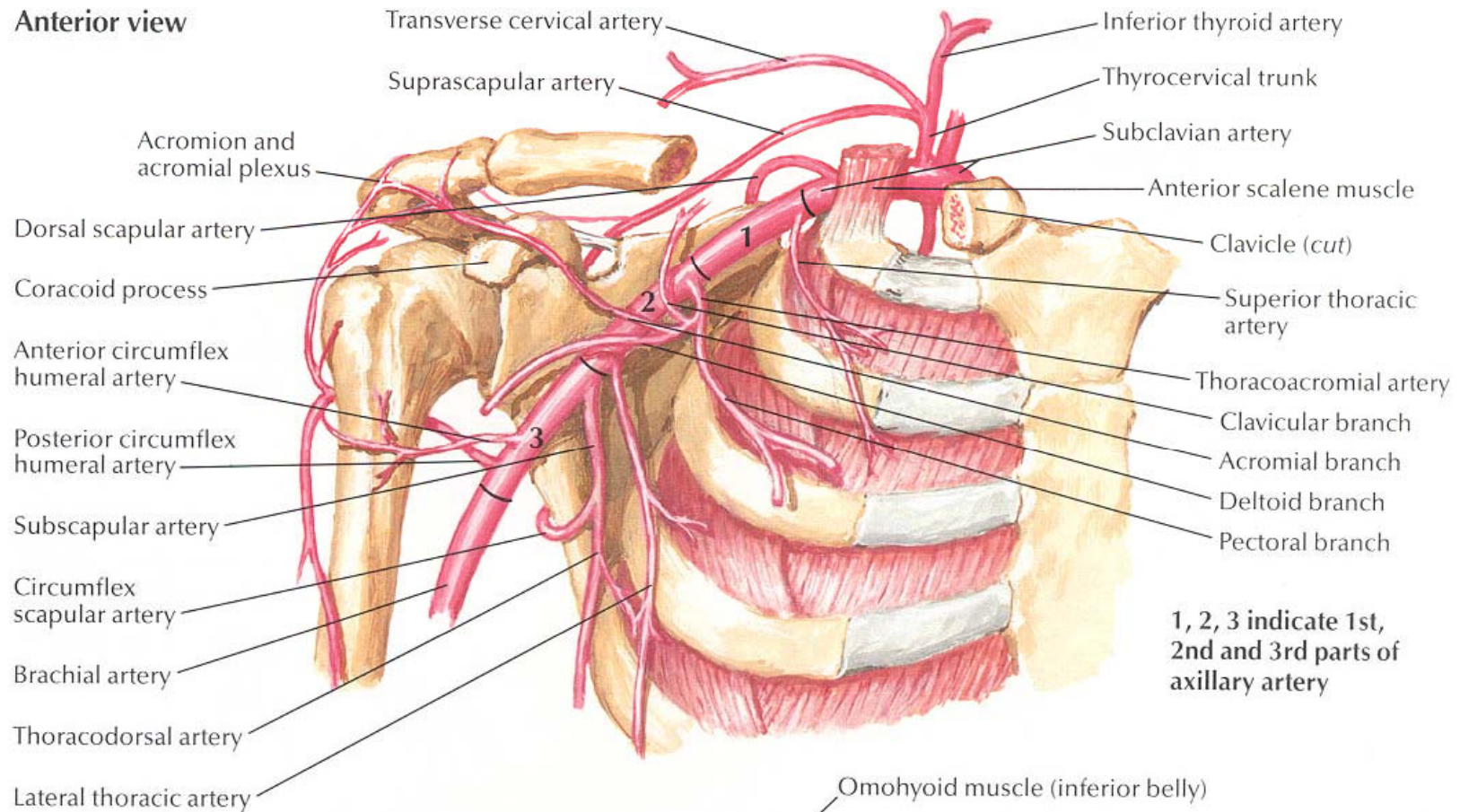


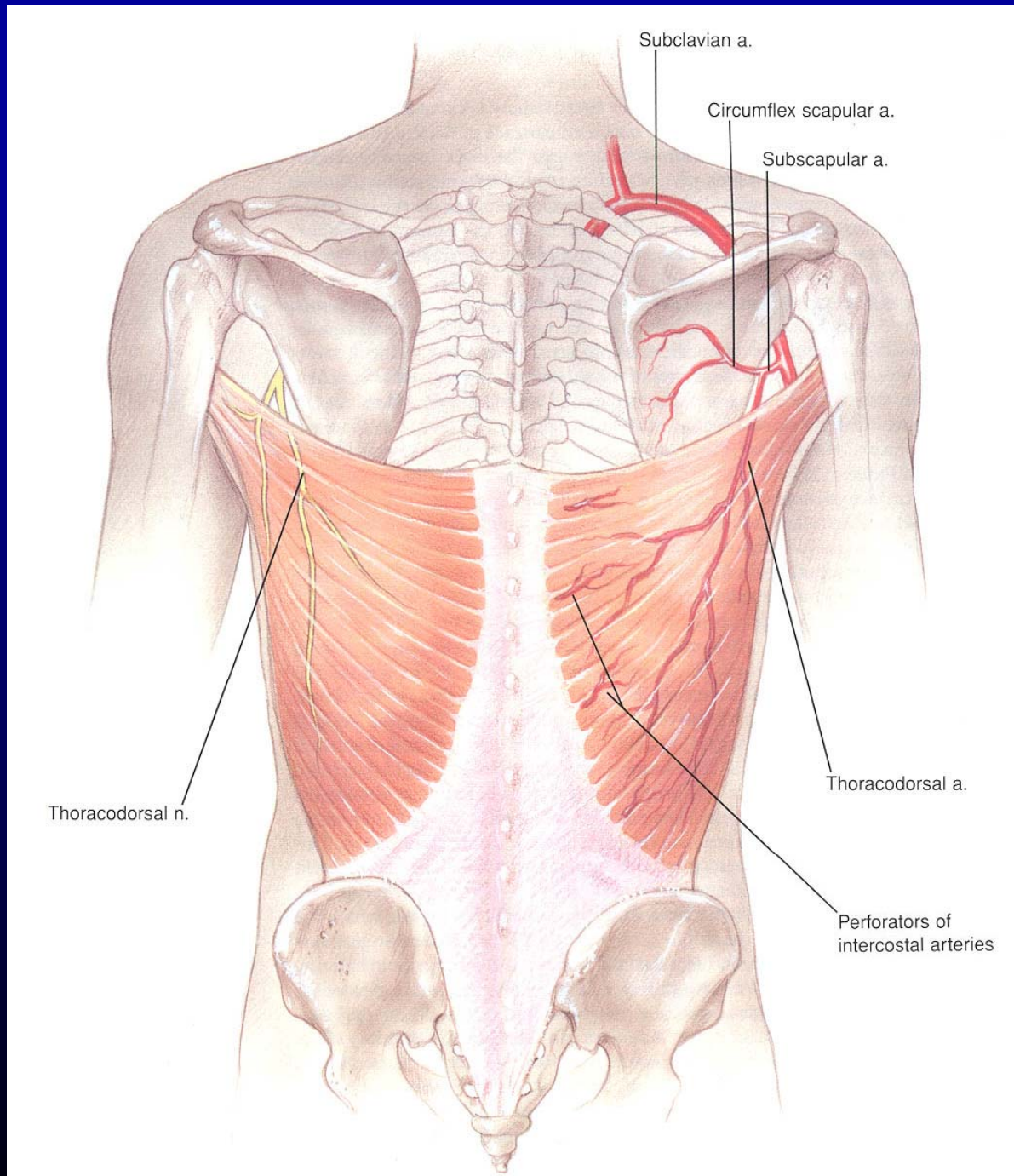
# Latissimus Dorsi Free Flap

- Arterial supply based on thoracodorsal artery
- Venous drainage from thoracodorsal vein
- Motor nerve innervation potential with thoracodorsal nerve



## Anterior view





# Latissimus Dorsi Free Flap

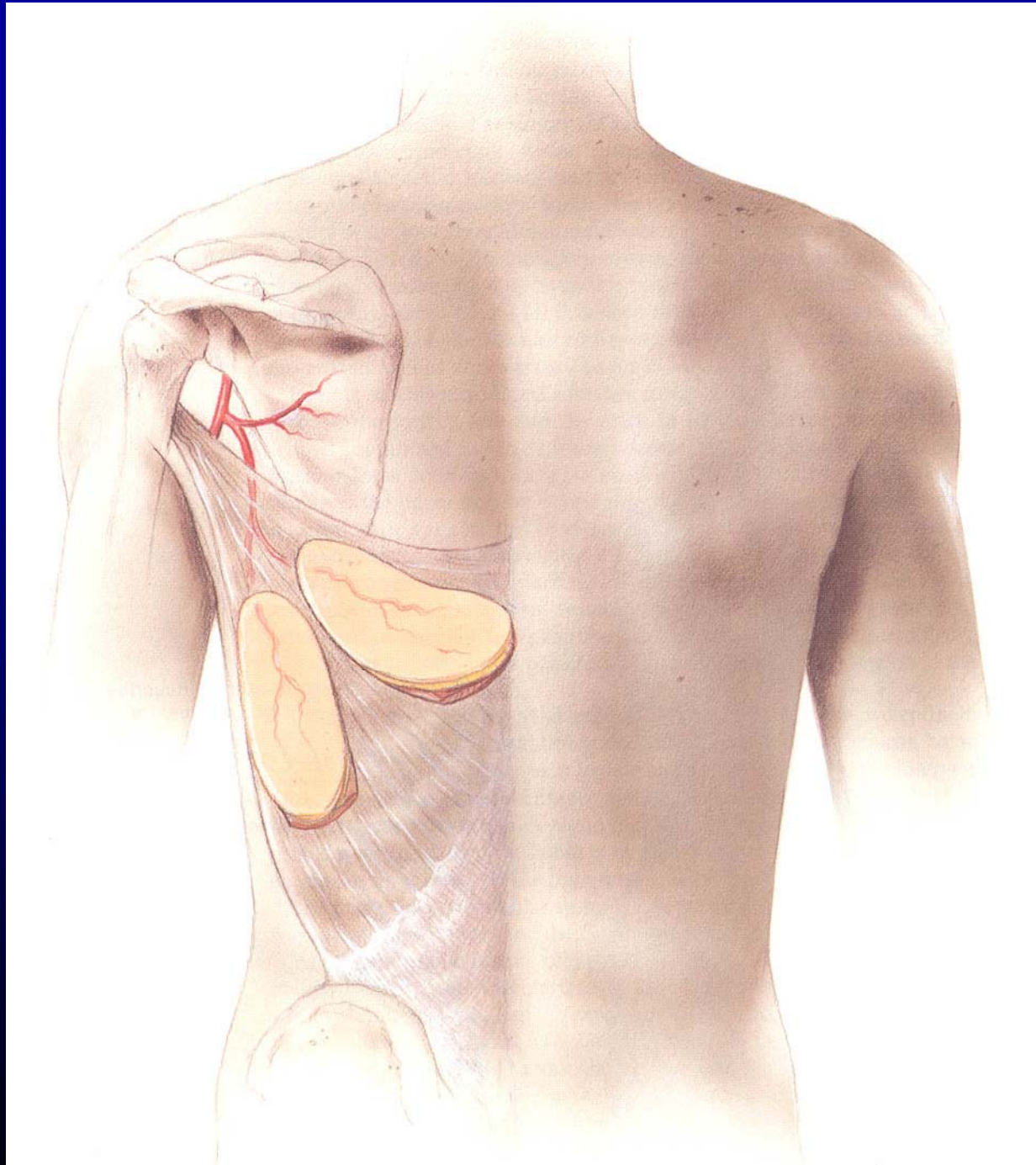
- **Advantages:**

- Large flap with long pedicle ( artery 2-3 mm, vein 3-5 mm, length: 7-10 cm)
- 2<sup>nd</sup> largest skin paddle
- Possibility for “axillary megaflap”
- Multiple skin paddles
- Low donor site morbidity
- Possibility of muscle reinnervation via thoracodorsal nerve

- **Disadvantages:**

- Difficult positioning and two team harvest
  - 30-45% LD
- Postoperative seroma formation
- Bulky flap
  - Unable to tube





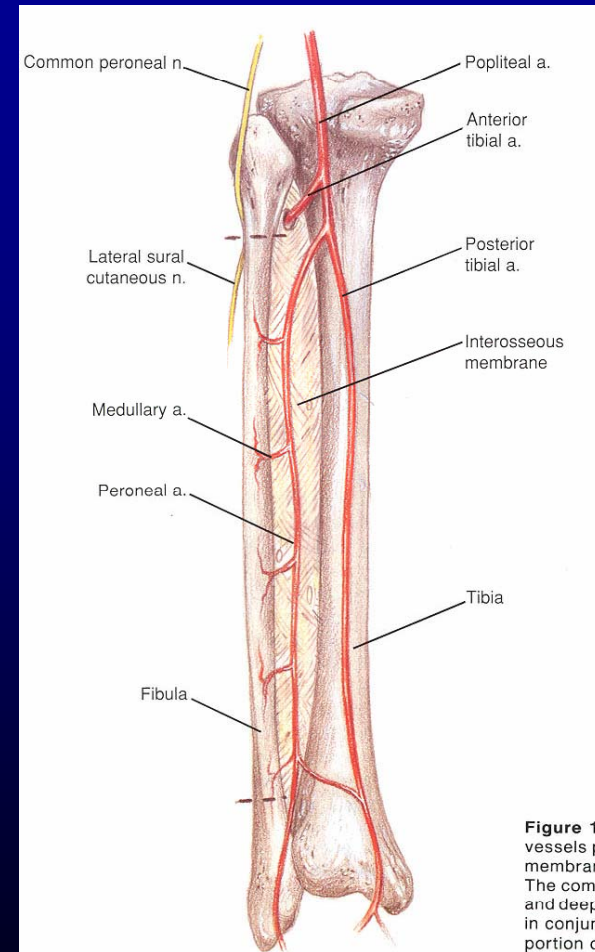


# Composite Free Flaps

- 1. Fibular osteocutaneous flap
- 2. Osteocutaneous iliac crest flap
- 3. Osteomusculocutaneous iliac crest flap
- 4. Fasciocutaneous scapular and parascapular flap
- 5. Osteofasciocutaneous scapular and parascapular flap

# Fibular Free Flap

- Arterial supply – peroneal artery
- Venous supply – vena comitantes



# Fibular Free Flap

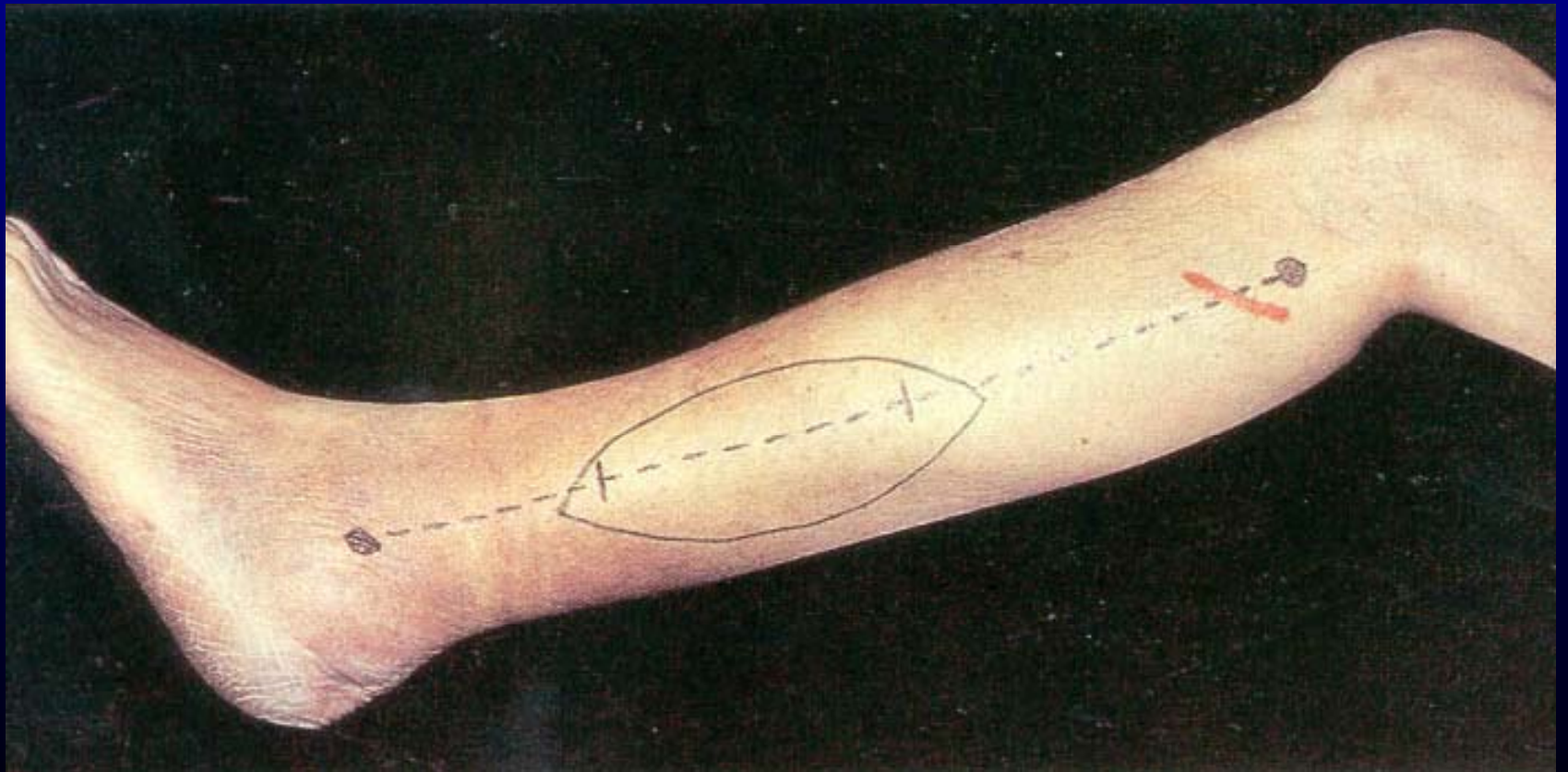
- **Advantages:**

- Longest and strongest bone stock (25 cm of bone)
- Pedicle 12 cm
- Can be a sensate flap
  - Lateral sural n.
- Low donor site morbidity
- Easy positioning
- Excellent periosteal blood supply (contouring)
- Support osseointegrated implants

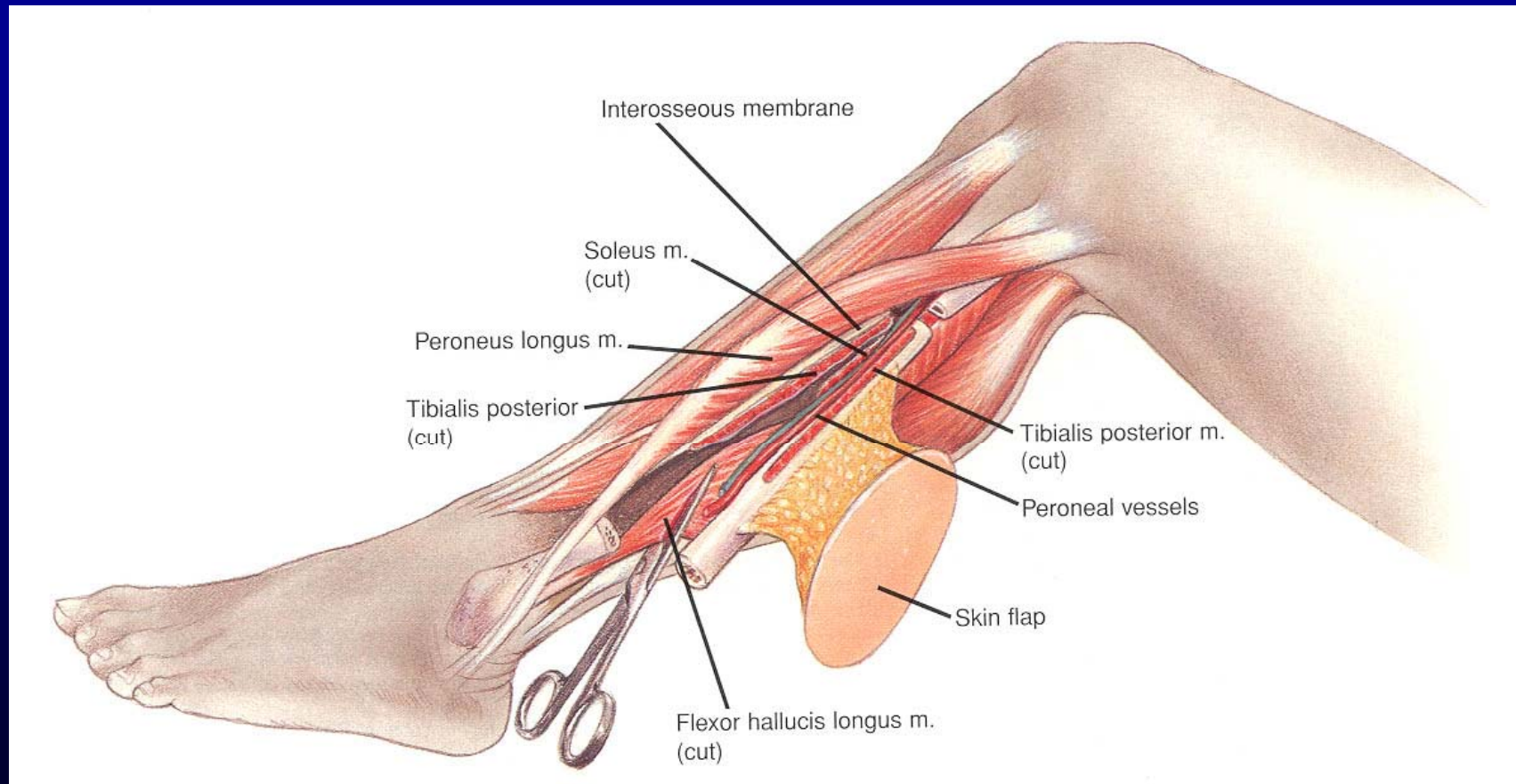
- **Disadvantages:**

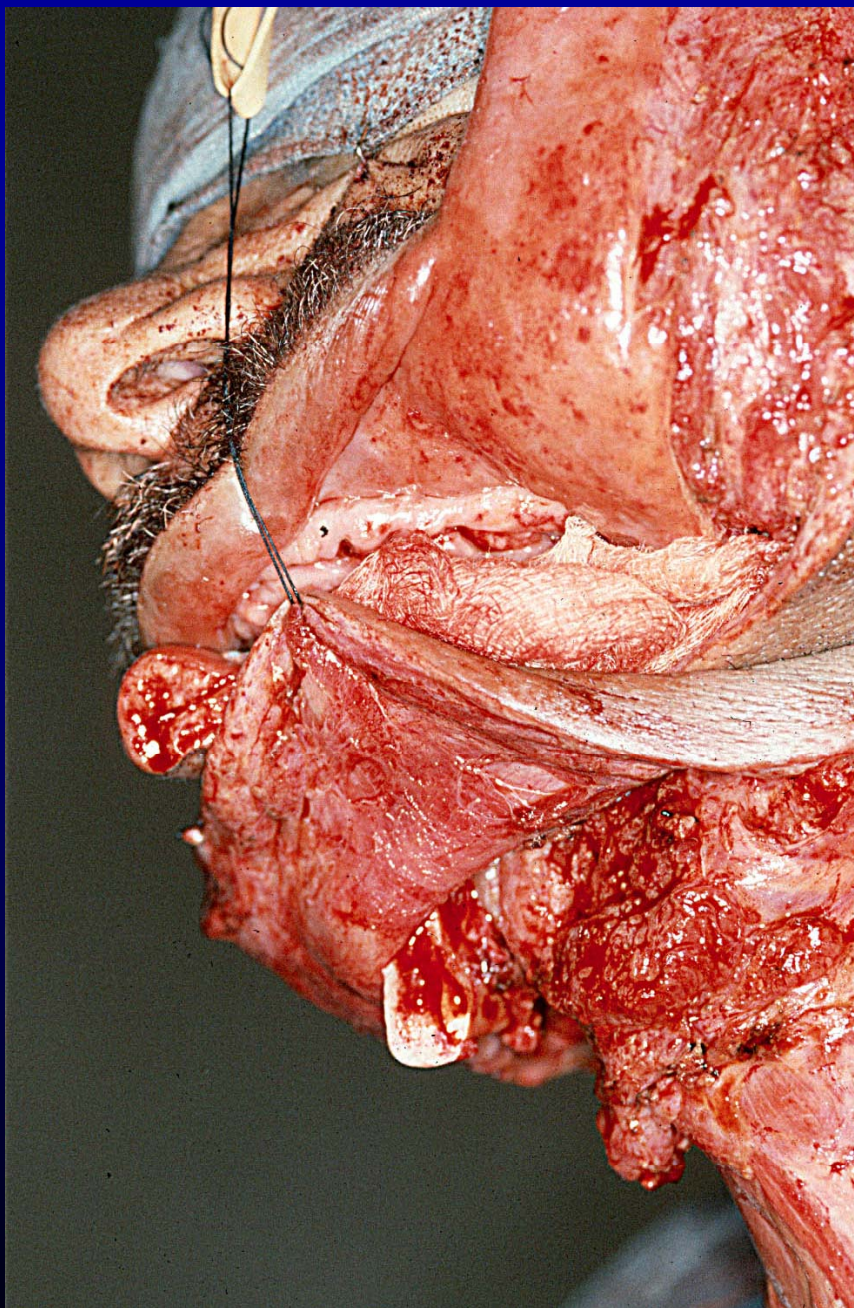
- High incidence of peripheral vascular disease
- Small cutaneous paddle
- Decreased ankle strength and toe flexion
- Small risk chronic ankle pain
- Requires invasive study for preop. evaluation

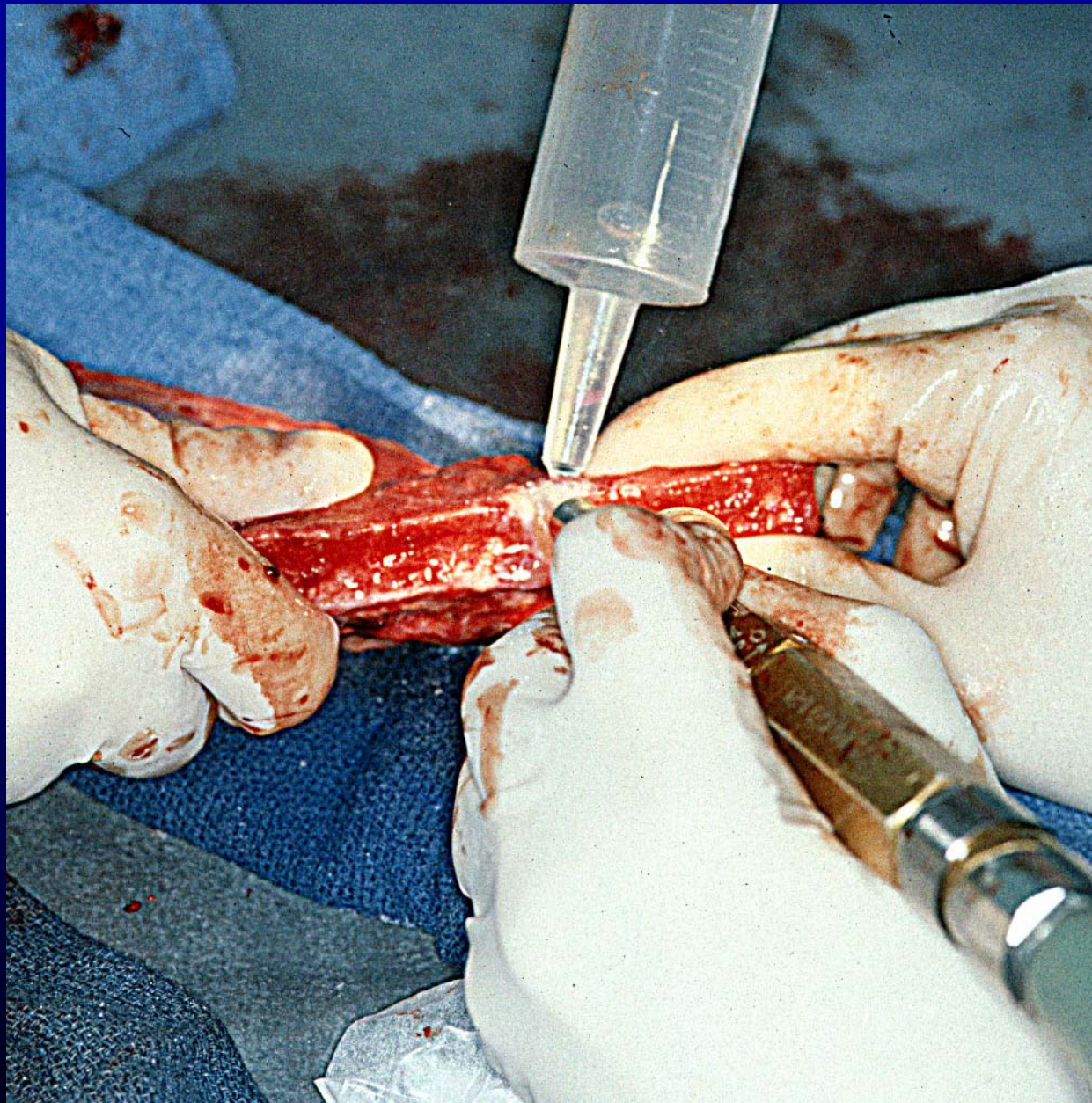
- Fibula is outlined
- Skin paddle centered over junction of middle and distal third to encompass dominant septoperforators

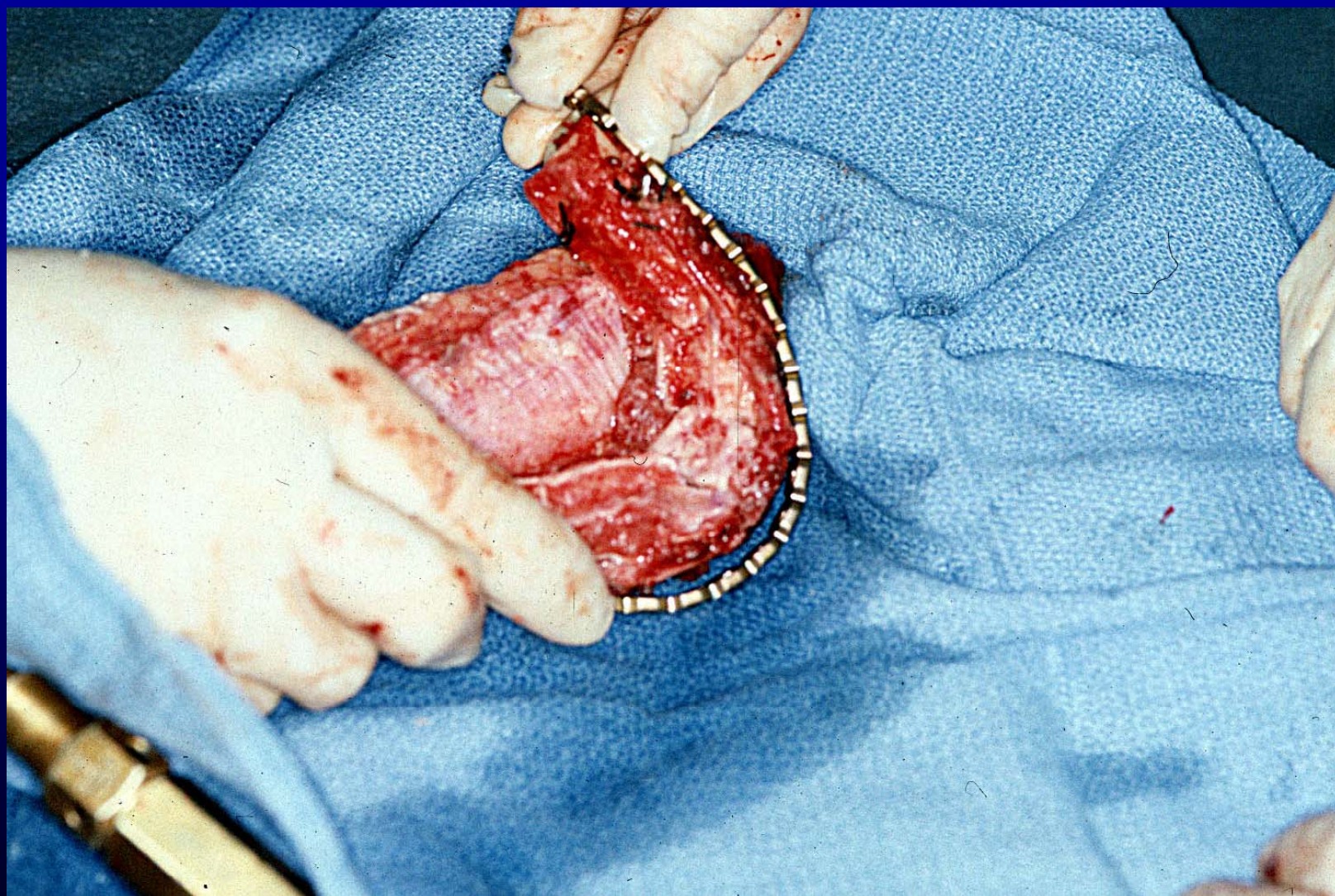


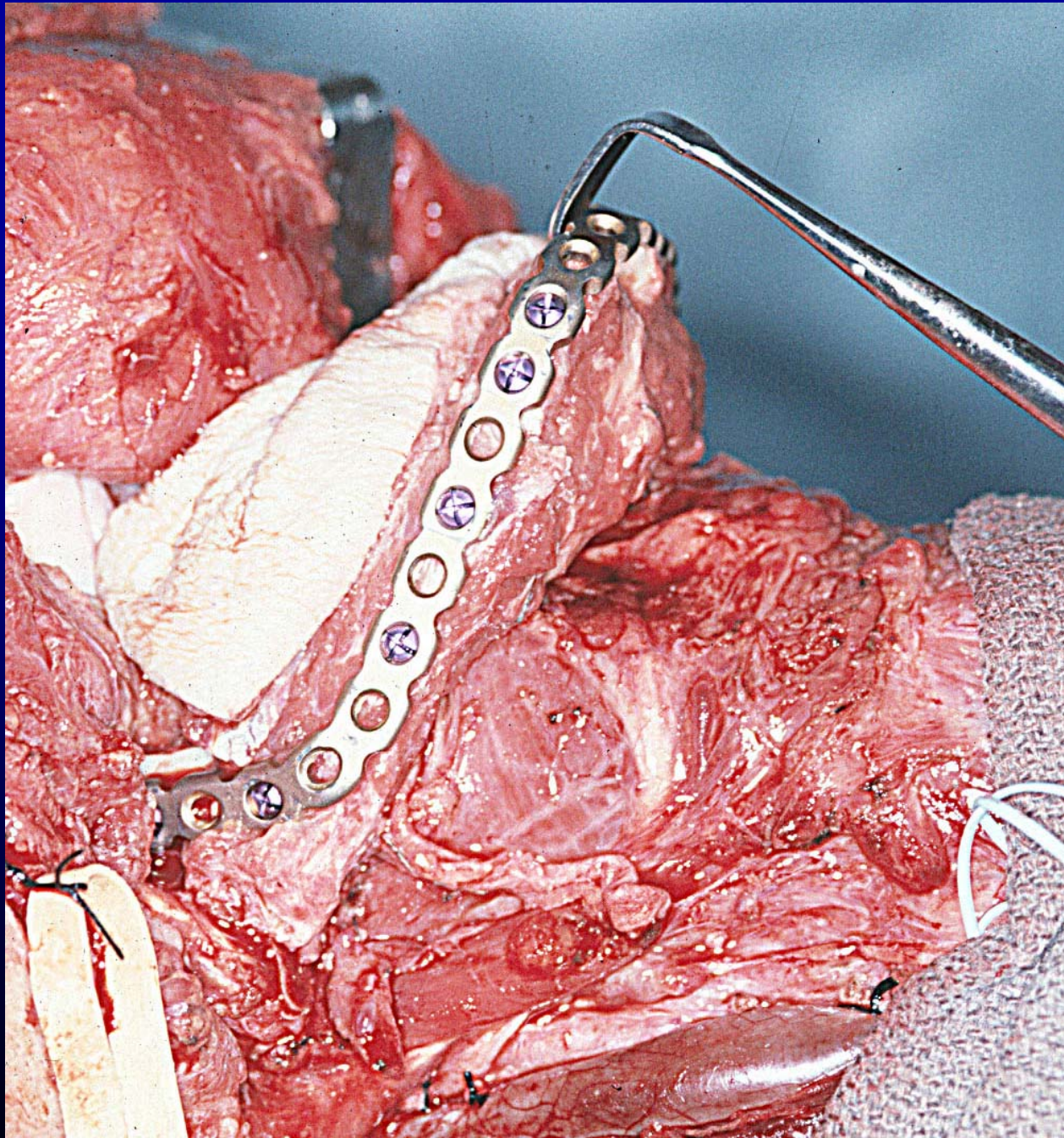
- Leave 6 cm of proximal and distal fibula

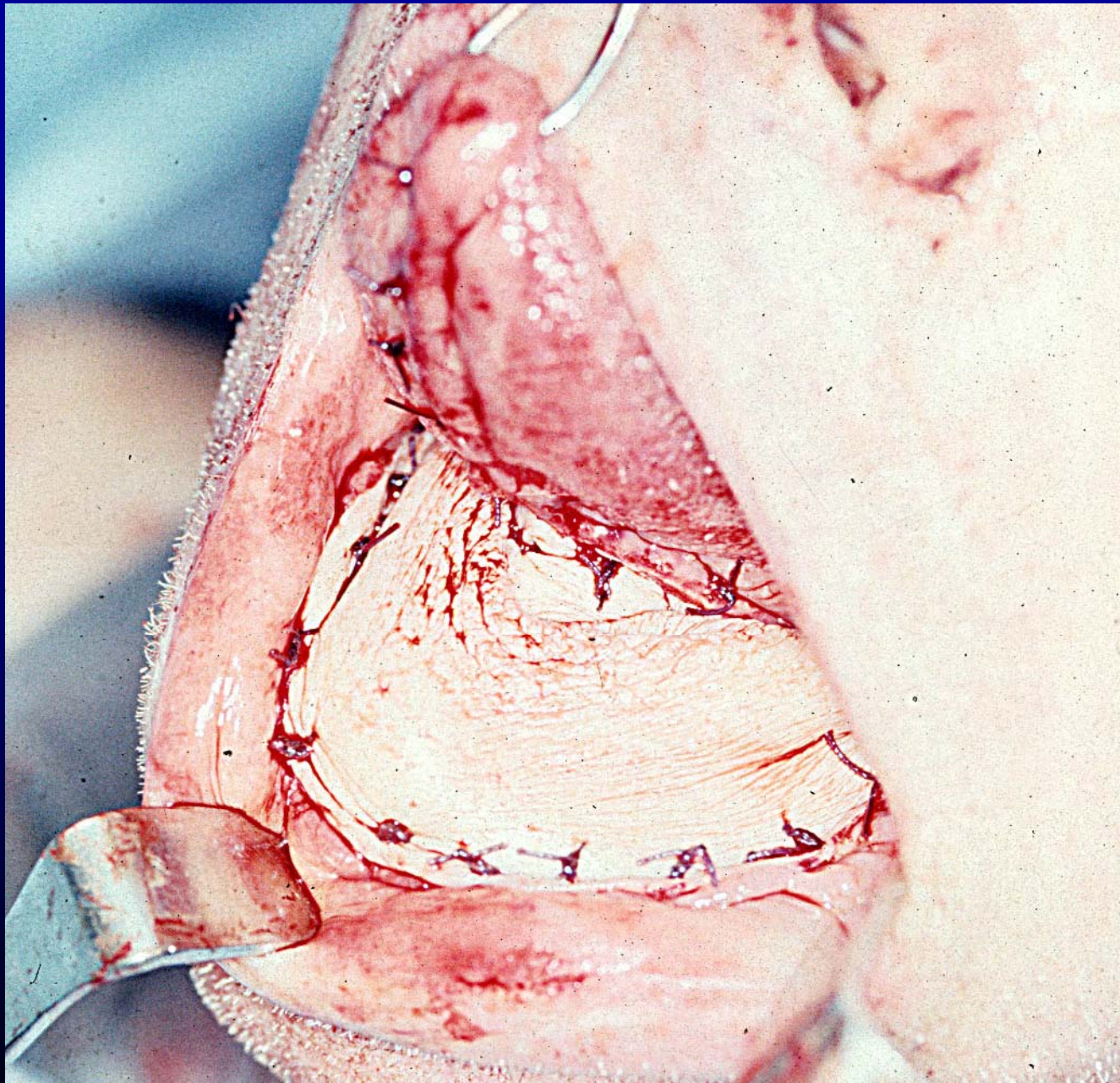






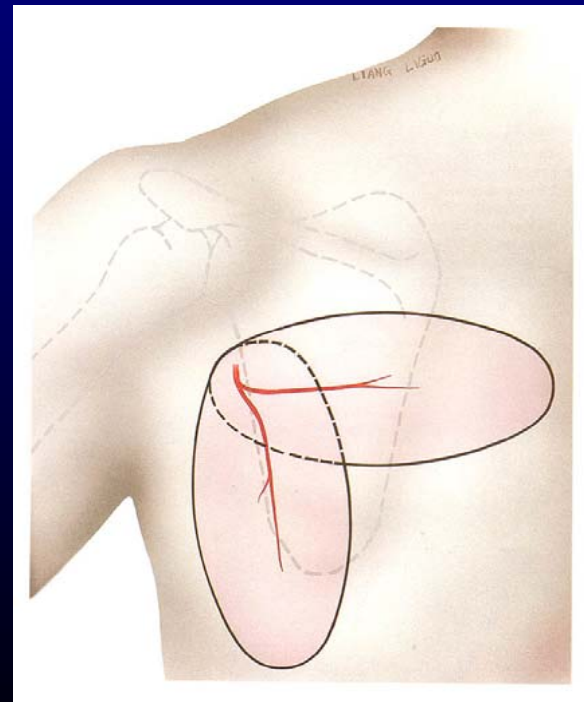
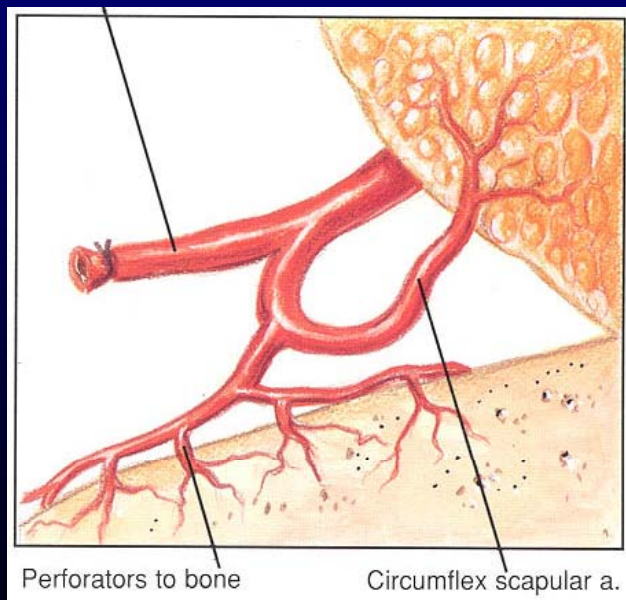






# Scapular/Parascapular Free Flap

- Arterial supply
  - Circumflex scapular
- Venous Supply
  - Vena comitantes



# Scapular/Parascapular Free Flap

- **Advantages:**

- Large skin paddle
- Easy to harvest
- Low donor site morbidity (closes primarily)
- Availability for bone

- **Disadvantages:**

- Thick skin
- Difficult positioning

# Visceral Flaps

- 1. Jejunum
- 2. Omentum
- 3. Gastroomentum

# Functional Objectives

- Restore sensation
- Maintain oral continence
- Facilitate swallowing
- Prevent aspiration
- Preserve speech
- Protect vital structures
- Achieve primary wound healing
- Obtain cosmesis

# Planning and Technique

- **Patient Factors:**

- Age
- Malnutrition
- Diabetes Mellitus
- Hypertension
- Peripheral Vascular Disease
- Hyperlipidemia
- **Smoking**
- Immunosuppression
- XRT

# Planning and Technique

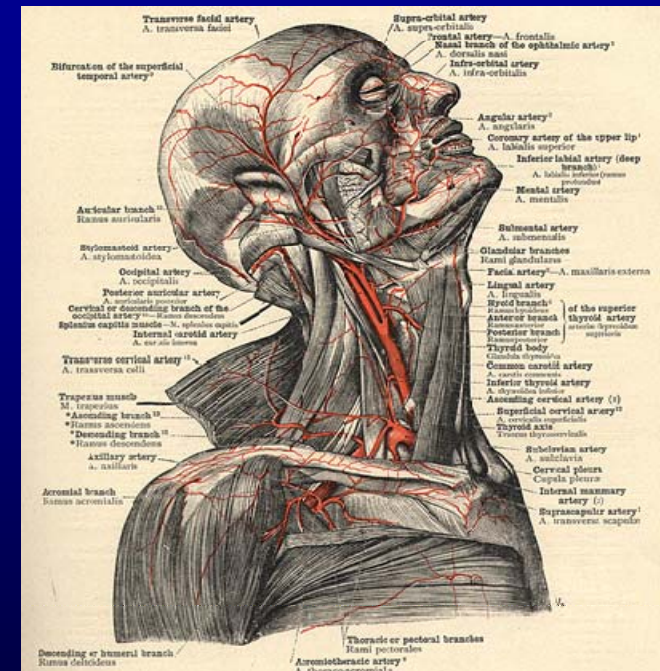
- **Surgical Factors:**
  - Rough handling
  - Damage to axial vessels
  - Tension

# Characteristics of “ideal” free flaps for H & N reconstruction

- Length and caliber of vessels adequate
- Innervation with sensory or motor nerves feasible
- Functional recovery of resected structure(s) facilitated
- Cosmetic potential excellent
- Donor site morbidity minimal

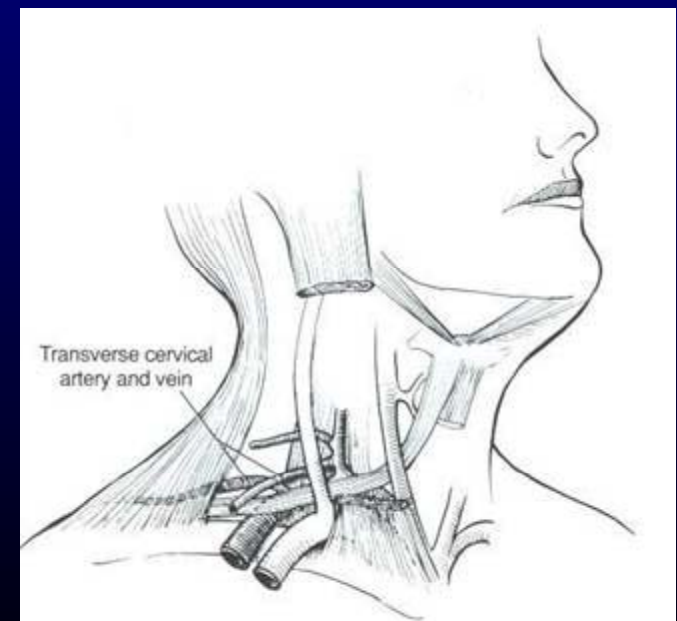
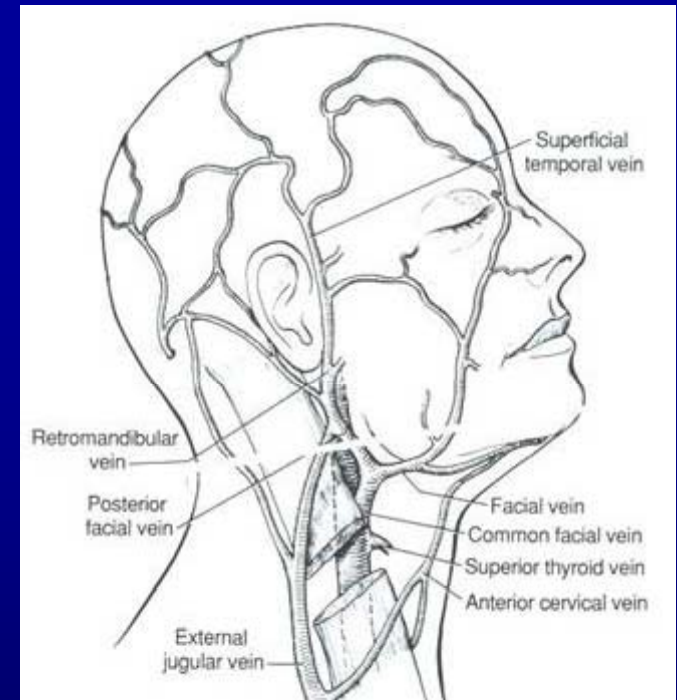
# Recipient vessels

- Arteries
  - Superficial temporal system—scalp and upper face
  - Facial artery—midface and cervical region (atherosclerosis common)
  - Superior thyroid or lingual artery—lower cervical region
  - Other: thyrocervical trunk, external carotid, common carotid



# Recipient vessels

- Veins
  - External jugular
  - Branches of internal jugular (common facial)
  - Internal jugular
  - Retrograde (superficial temporal, thyroid)
  - Transverse cervical, occipital (very small)



# Potential Problems

- Donor Site:
  - Hemorrhage
  - Wound breakdown
  - Nerve damage
  - Scarring
  - Functional deficits
  - Cosmetic deformities

# Potential Problems

- **Recipient Site:**

- Immediate

- Early

- Late

# Immediate Complications

- Anastomotic leak
- Anastomotic failure
- Flap compression

# Anastomotic failure

- 93-95% success rate expected
- Venous thrombosis: Arterial thrombosis 4:1, arteriovenous loop, tobacco use significant factors
- Venous occlusion, Delayed reconstruction, Hematoma significant factors in breast free tissue recon.
- Age, prior irradiation, DM (well-controlled), method of anastomosis, timing, vein graft, and specific arteries/veins not felt to contribute to failure rate

# Early Complications

- Anastomotic occlusion
- Vascular thrombosis
- Flap edema
- Secondary hemorrhage
- Infection

# Late Complications

- Infection
- Dehiscence
- Fistula
- Poor cosmesis
- Loss of function

# Viability = Perfusion

- Problems outside the vessel wall
- Problems with the vessel wall
- Problems within the vessel wall

# External to Vessel Wall

- mechanical compression from neighboring anatomic structures:
  - Tight skin flaps
  - Edema
  - Hematoma

# Intrinsic to Vessel Wall

- Disruption of endothelium
  - Release of thromboplastin and formation of thrombus
- Vessel wall spasm
  - Restricts blood flow

# Treatment for anastomotic failure

- Revision of anastomoses
- Exploration of wound
- Streptokinase, ASA, Heparin
- Wound care