

# **Fibula Osteocutaneous Free Flaps for Mandible Reconstruction**

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**Grand Rounds Presentation**

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# Introduction

-Transfer of tissue from donor site (leg) to recipient sites (multiple) for reconstruction

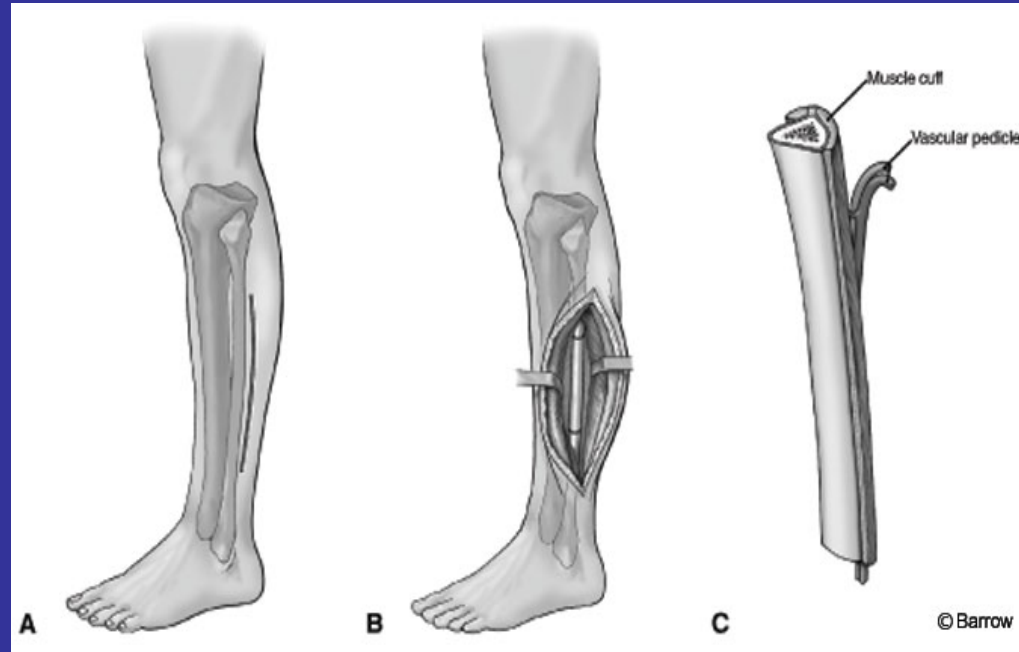
-Free Tissue Transfer:

- fibula bone
- vascular pedicle
- muscle, soft tissue, skin

-Microvascular procedure-cut from its blood supply and anastomosed with new one

-Reconstruction (mandible) may require

- osteotomies- for shaping
- plating- for fixation



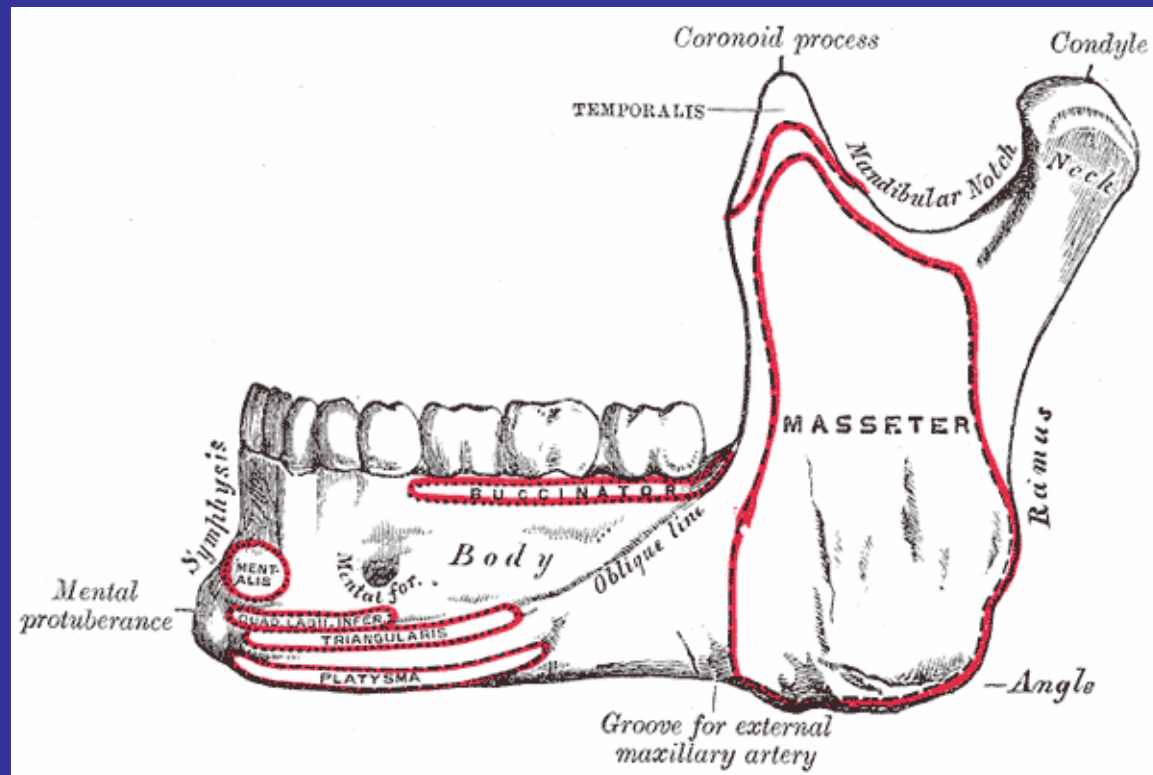
Galler RM, Sontagg HK. Bone Graft Harvest. *Barrow Quarterly*. 2003;19(4): [www.thebarrow.org/.../Vol\\_19\\_No\\_4\\_2003/158516](http://www.thebarrow.org/.../Vol_19_No_4_2003/158516).

# History

-1975- Fibula free flap first performed by Taylor et al

-1989- First used in mandibular reconstruction Hidalgo

-2009- Most popular flap for reconstruction of the mandible- especially extensive deficits

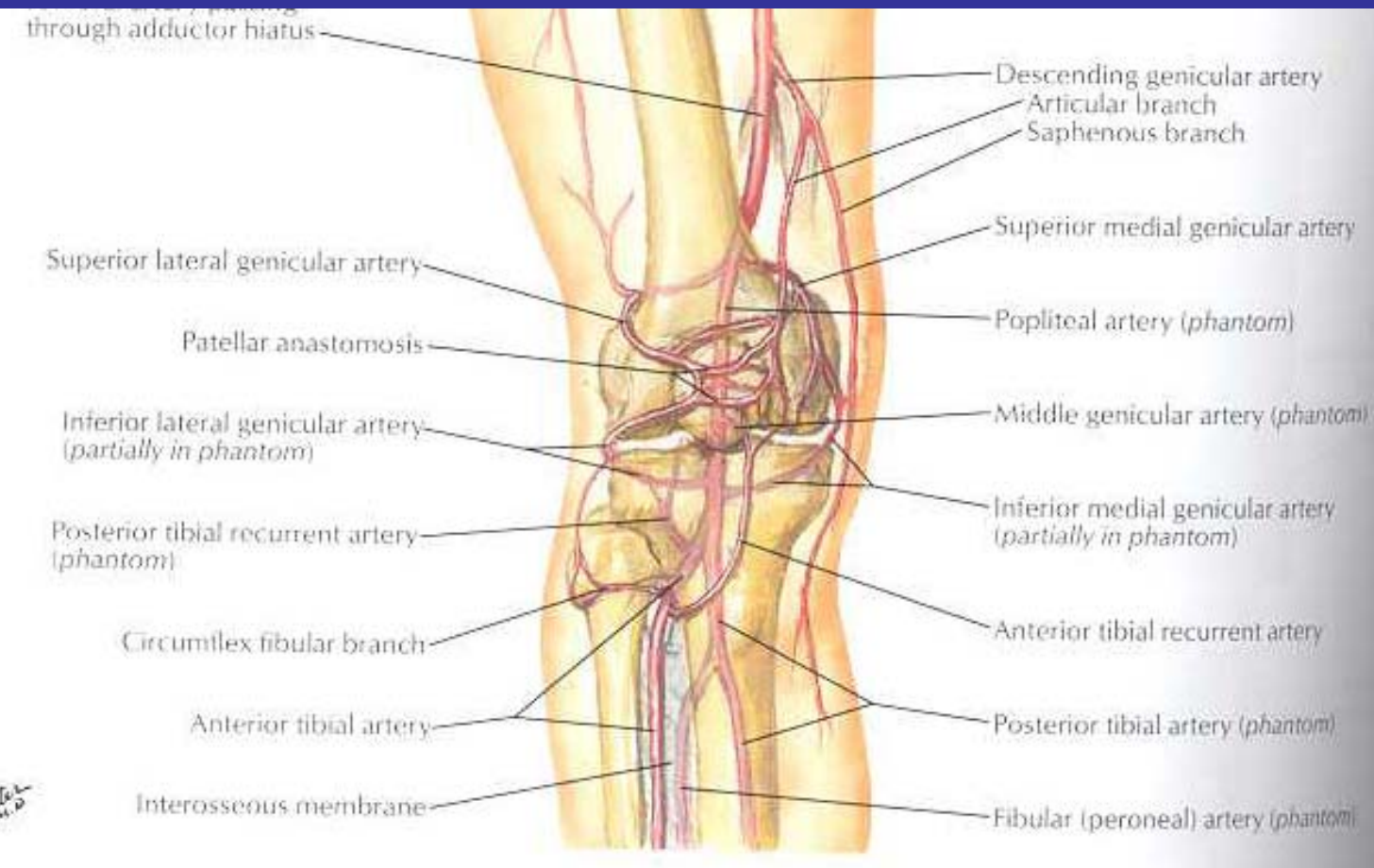


"Surgery of the Mandible and Treatment." *Living in the Net*. 2008. Web. 21 September 2009.  
<http://www.dxa.net/surgery-of-the-mandible-and-treatment/>

Gray's Anatomy of the Human Body 1918

# Relevant Anatomy

# Anterior View



-tibia

-fibula

-popliteal bifurcation

-AT

-PT

-peroneal artery-vascular pedicle-harvested with fibula

-venae comitantes

Netter FH. *Atlas of Human Anatomy*. 4th Edition. 2006; 517.

# Cross Section of Leg

-fibula- preferably harvested side- (surgeon preference)

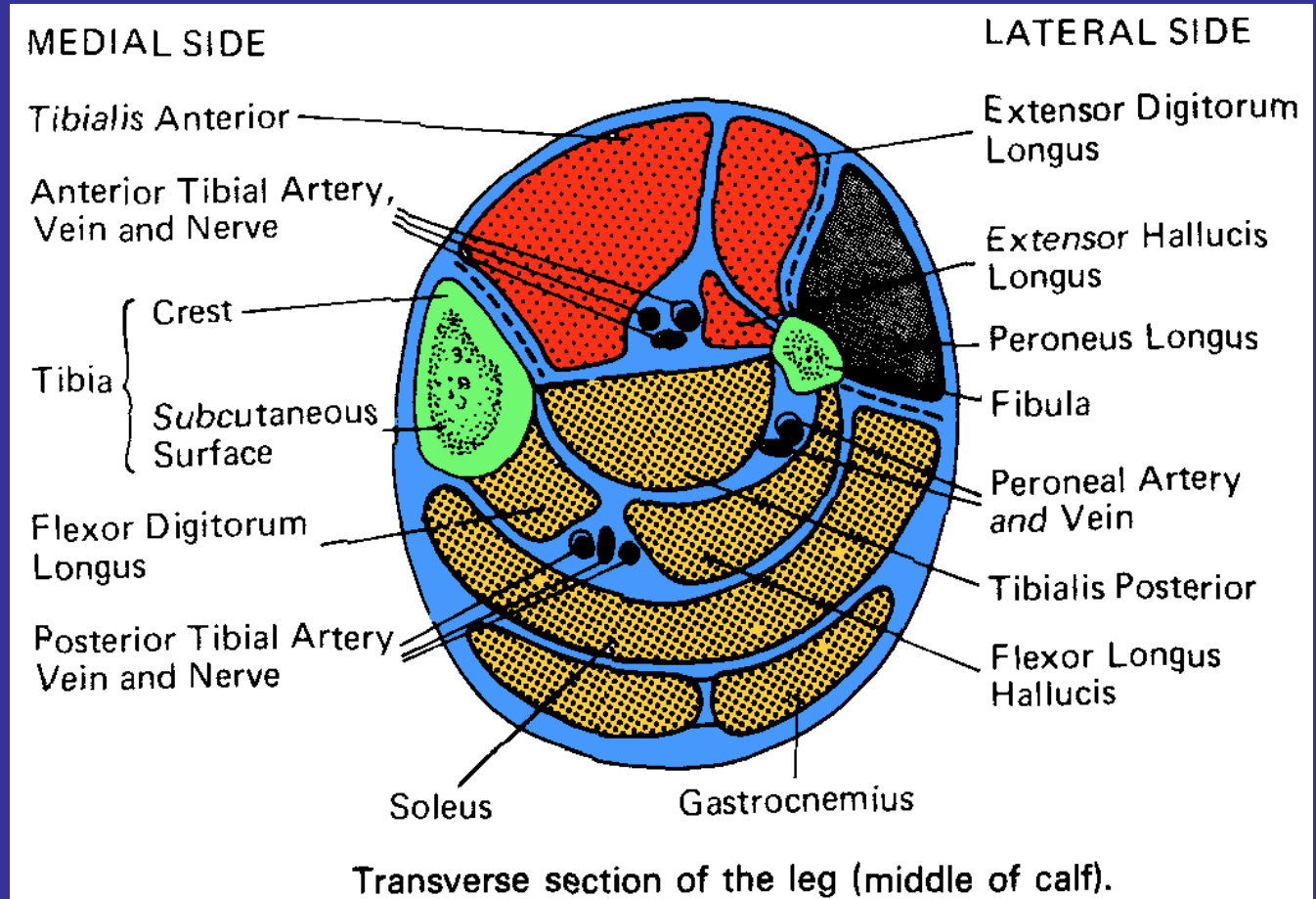
-ispilat, contra, always left (driving)

-peroneal artery-  
-cutaneous  
perforators

-soleus or flexor  
hallicus longus

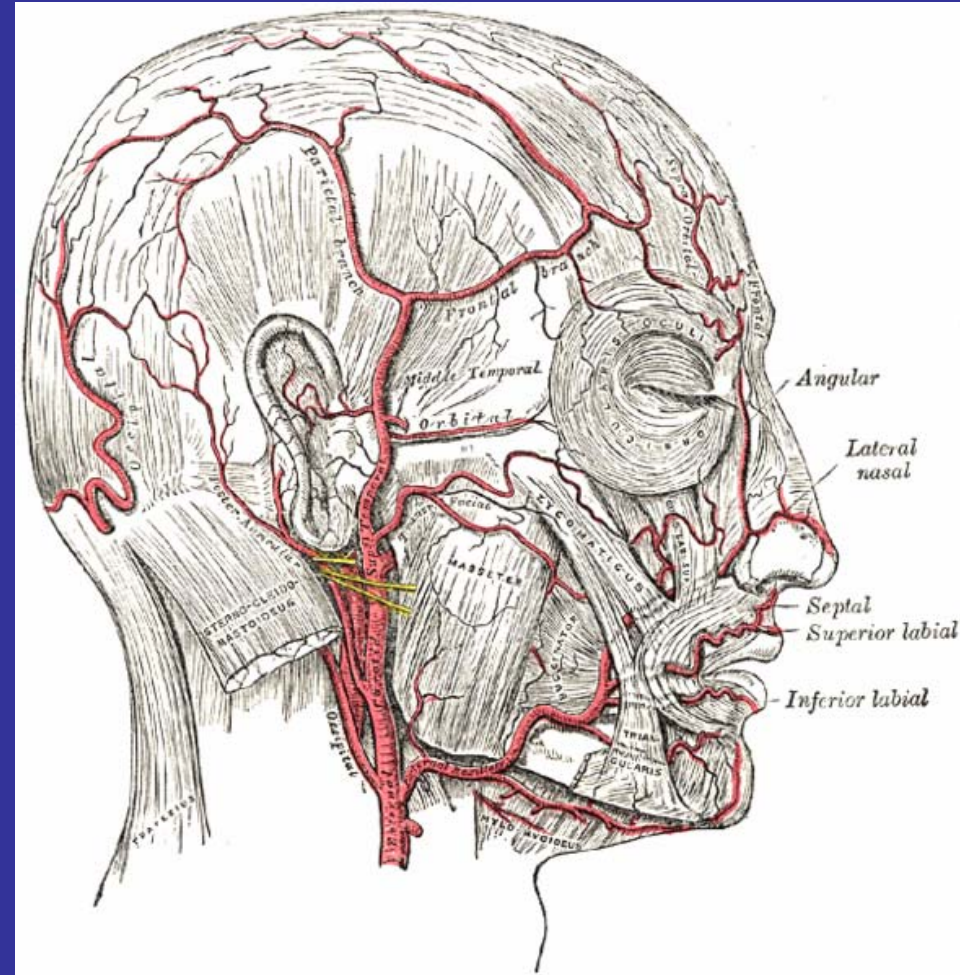
-skin/soft tissue

-pedicle-dissected  
distal to prox



# Anastomosis

- anastomosis site variable:
  - location of defect
  - available blood supply
  - health of surrounding vessels
- facial artery or external carotid
- nearby veins
- end to end preferred (rather than end to side)
  - facial- end to end
  - external carotid- end to side



# Indications

-Mandibular Defects result in abnormal:

- mastication
- speech
- cosmesis

-Mandibular Defects caused by:

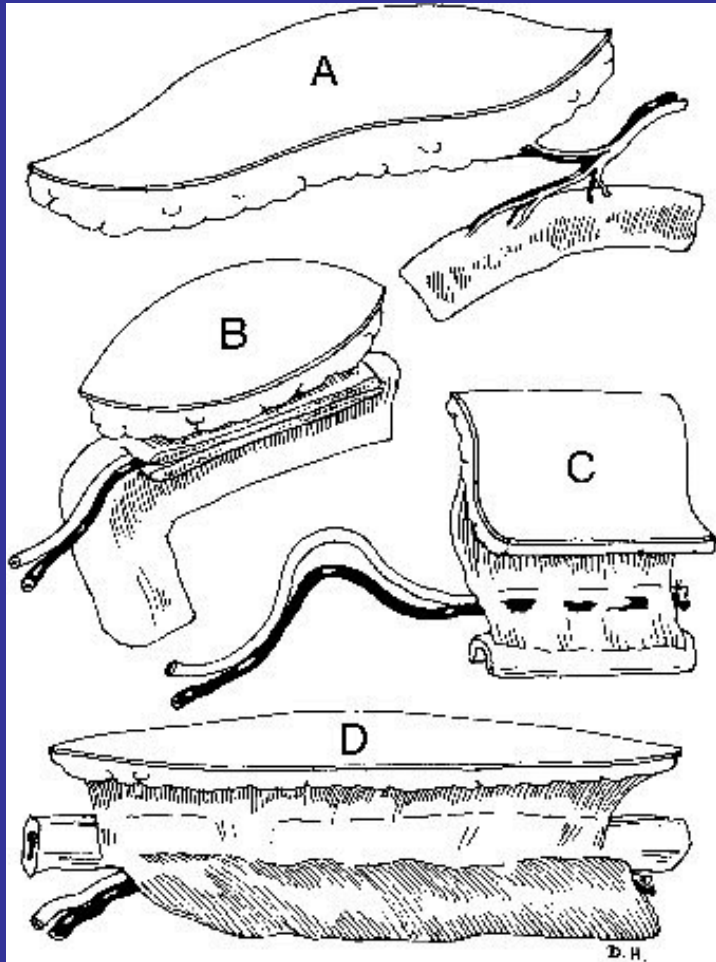
- traumatic injury
- inflammatory disease (osteomyelitis or osteoradionecrosis)
- neoplasm (both malignant or benign)
- congenital abnormalities

-Large deficits (requiring more than 10cm of bone)

-goals

- reconstruct functional jaw -muscle attachments
- possible implant insertion
  - osseointegrated vs. conventional
- understandable speech

# Advantages



A: scapula B: iliac crest C: radius D: fibula

-allows for transfer of bone, soft tissue and skin in a one-stage procedure using only one donor site

-fibula flap allows the most bone (up to 25-30cm) vs. 10-15 for the other bone flaps

-blood supply to fibula is both intraosseous and segmental, therefore, osteotomies can be made

-fibula allows for a skin paddle up to 25cm in length and 5cm in width

# Advantages

-two teams can work simultaneously with patient in supine position (donor site far away from head)

-implants- possible in with the fibula flap because (potential for conventional denture or osseointegrated implant)

-the diaphysis is always thicker than 5cm

-bone is bicortical

-implant can be monitored post-operatively with doppler (peroneal artery remains large as it parallels the fibula)



# Limitations

- smaller length of pedicle-harder to do the anastomosis
  - max of 5 cm of pedicle when the whole fibula is taken
  - (others gives you 10cm)
- other (parascapular and lateral brachialis) flaps not as impacted by atherosclerosis. Iliac crest is (supplied by superficial iliac circumflex)
- long scar on the lateral leg- others less conspicuous (scapula, iliac crest)
- remodeling of the bone requires multiple osteotomies
  - Joel Ferri et. al 1997: 6/29 had more than 2 osteotomies- in 5 of those there was no radiologic evidence of bone fusion 3 months after surgery. And in one of those, the last bone segment was lost completely secondary to resorption. -this disrupts the centromedullary fibular pedicle
  - greater than 2 osteotomies risks losing the distal parts of the flap (other free flaps can be remodeled with less vascular risk)
- limited amount of small tissue available to transfer for deficits near mandible-
  - different flaps may be needed
  - particularly important for cosmesis

# Pre-operative Work-up

- Preoperative imaging of popliteal vessel trifurcation to evaluate
  - atherosclerosis (SCC of mandible, smoking, and PVD)
    - flap survival
    - donor site complications because of dependent collaterals
  - congenital anatomic anomalies
    - rule out that the peroneal artery contributes to the circulation of the foot (dorsalis pedis)
- controversy over workup :
  - Angiography- gold standard- ionizing radiation  
invasive
  - CT angio- also accurate- radiation
  - MRA- less radiation- less expensive, non-invasive  
availability
  - Doppler- map cutaneous perforators-
    - Operator dependent
- physical exam alone?
  - all anomalous circulation may not be  
detectable



# Contra-indications

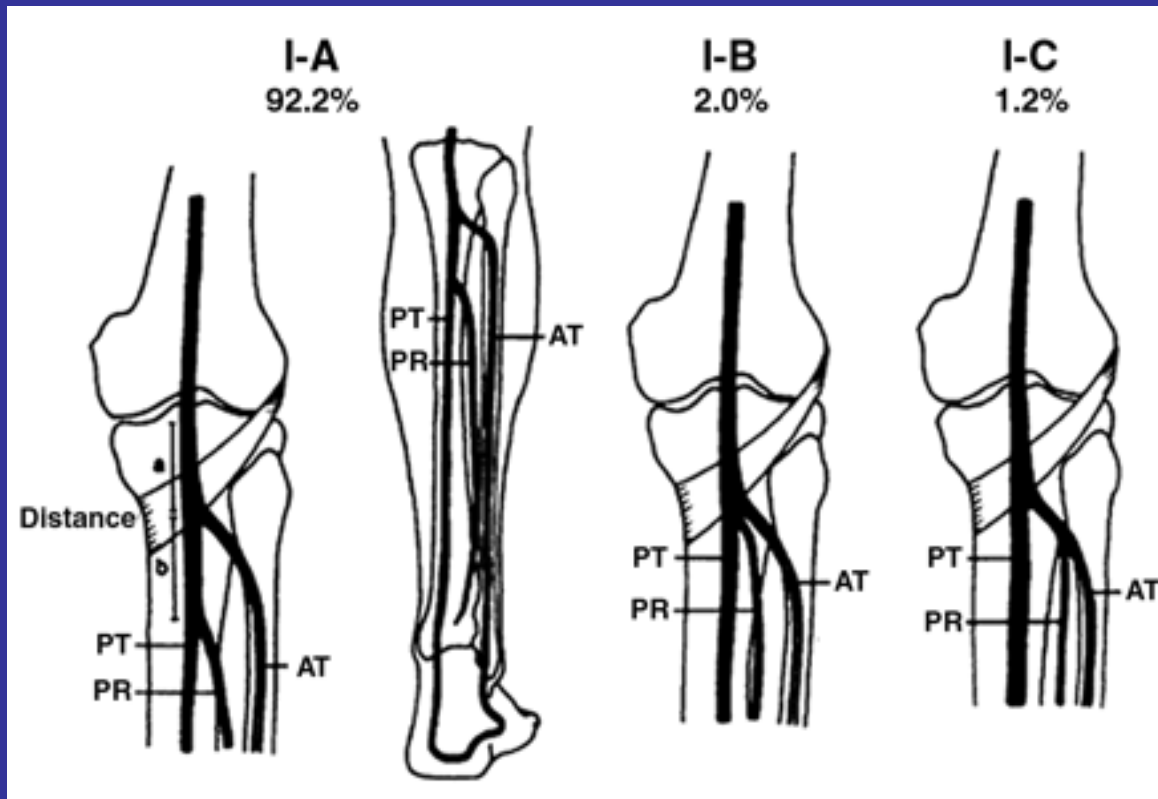
1. History of peripheral vascular disease-
2. Unfavorable Preoperative Doppler/Angiography studies
3. Anomalous lower extremity vasculature  
    blood supply to the foot derived from a perforating artery of the peroneal artery (which forms the dorsalis pedis)
4. Need for independent position of the skin paddle relative to the bone
5. Venous insufficiency (donor site morbidity)

# Pre-op workup: Anatomic Variations. Popliteal Branching Classification

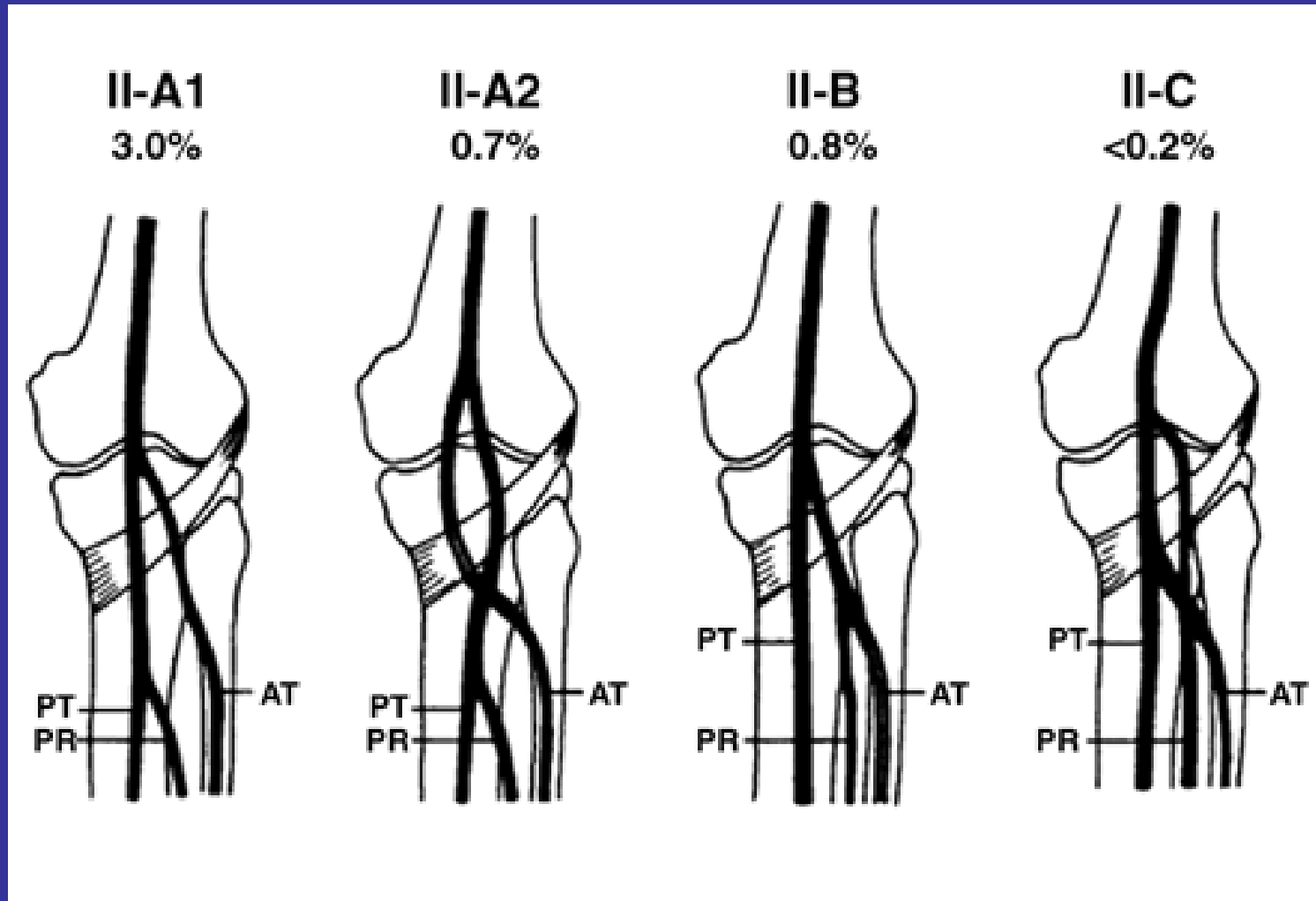
-IA: Usual pattern

-IB: trifurcation without tibioperoneal trunk

-IC: AT and PR arise from common trunk

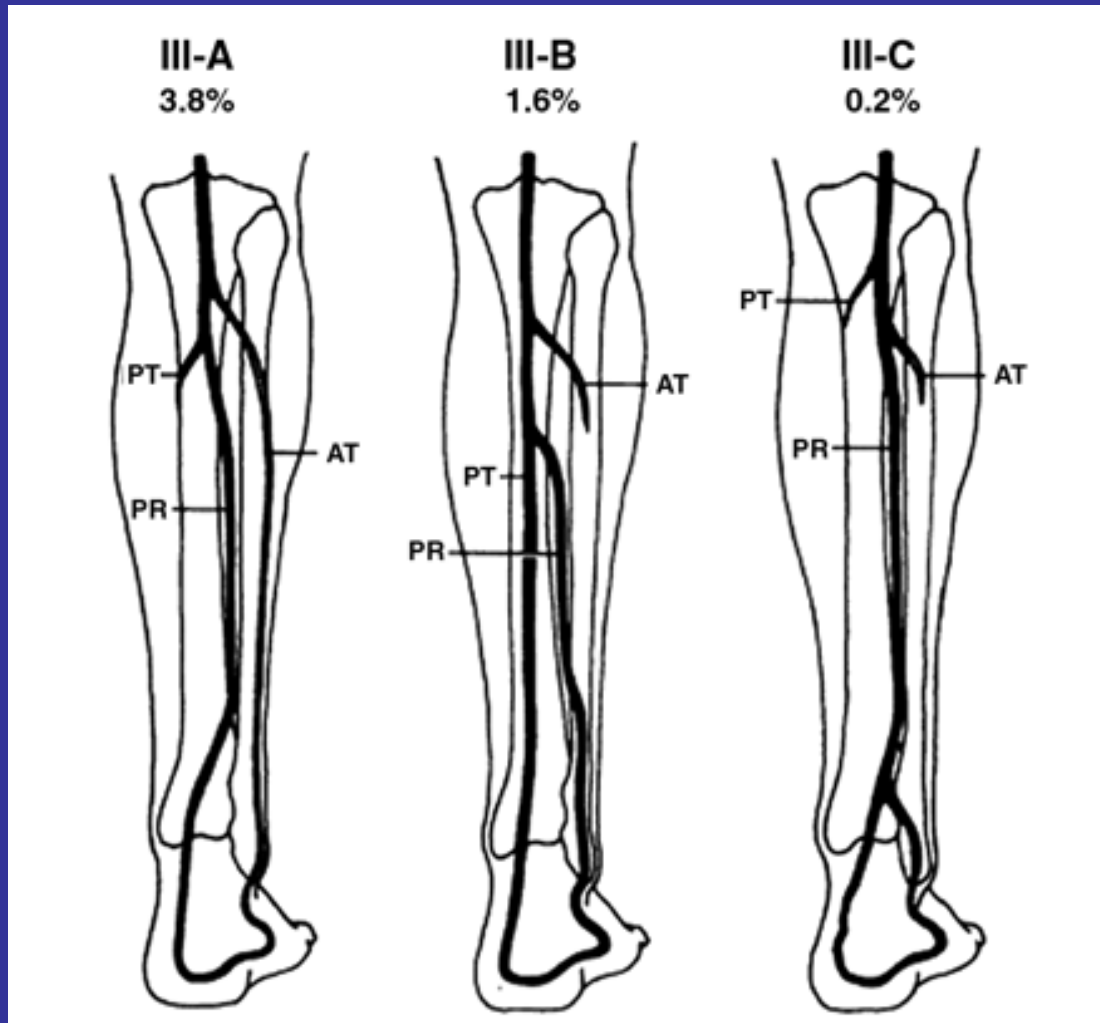


# Preop workup. Popliteal Branching



- *Ann Surg* 1989; 210:776-781 [12]

# Anatomic Variations



**IIIC- Arteria  
peronia magna**

*Ann Surg* 1989; 210:776-781 [12]

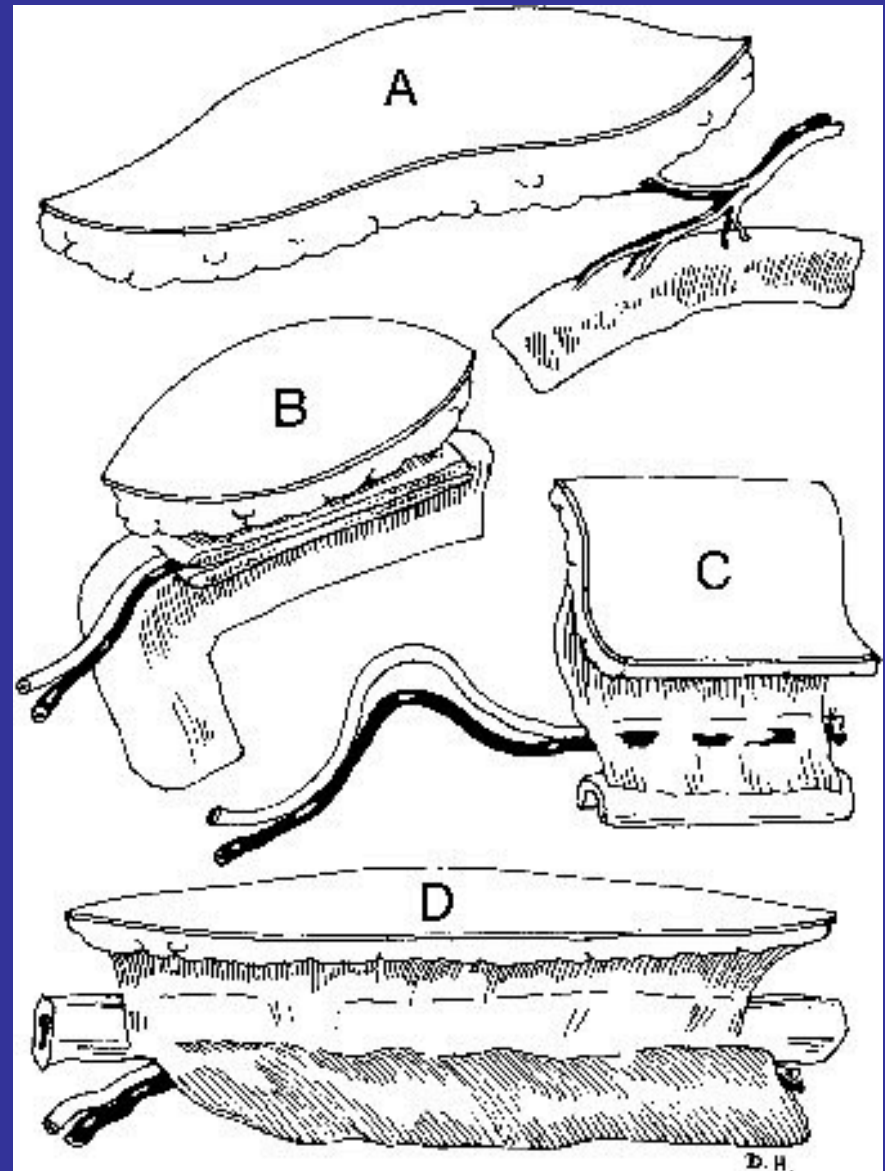
# Donor Site Morbidity

- usually very low
- complications usually resolve over time
- Ankle Instability: leaving the distal fibula (4cm-10cm) minimizes risk -usually unnecessary to fuse tibia to remaining fibula
- leg weakness
- temporary foot drop
- residual pain
- edema
- may require skin graft

# Morbidity of donor site of other flaps

Iliac Crest: secondary herniations

Parascapular: can result in limited arm abduction



# Outcomes

- Hidalgo 10yr fu review in 2002
- 82 consecutive patients reviewed long term outcomes
- from 1987-1990- followed 10 year outcomes
- 34 still alive -20 participated
- Methods
  - aesthetic outcomes judged by observers
  - questionnaires
  - Xrays- for bone resorption
- mean follow up time was 11 years
- 15 total patients received radiation (2 pre-op, 13 post op)

# Outcome Results

## -aesthetics

- excellent in 55%
- good 20%
- fair 15%
- poor 10%

## -diet:

- 70% reported regular diet
- 30% soft diet

## -speech

- 85% had easily intelligible
- 15% intelligible with effort (partial or hemiglossectomies)

## -bone resorption

- mandible midbody- 92% bone height remained
- midramus 93% bone height retained
- symphysis- 92% bone remained

## -donor site

- no long term disability
  - 3 patients described intermittent leg weakness
  - only one patient was limited by physical activity (jogging) by it
- one patient reported running a marathon

# Conclusion

- Fibula Free Flap is a free tissue transfer procedure using microvascular techniques
- Useful in mandible reconstruction- especially for large bony defects
- Pre-operative work-up requires evaluating lower leg vasculature
- Relatively low donor site morbidity
- Relatively good long-term outcomes

**The End**

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