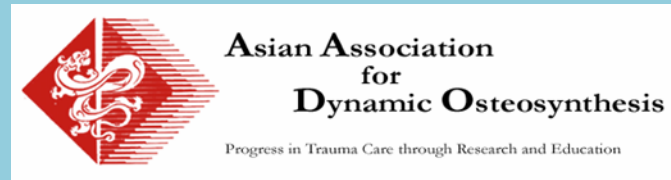


AADO Nurse Subcommittee
Wound Management Workshop
31 July 2011 Orthopaedic Learning Centre



The principle of Wound Coverage & Flap Surgery



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Wound coverage

Wound coverage is important

- To avoid infection
- To cover important structures
 - Nerve, vessels, tendon, bone, joint cartilage
- To avoid electrolytes and protein loss



Consequence of poor wound coverage

- Sepsis
- Extensive scarring
- Poor functional and cosmetic outcome

Management of severe limb injury

Primary goal : Initial healing and control sepsis

- Skeletal stability
- Adequate blood supply
- Soft tissue coverage

Secondary goal: functional reconstruction

- Nerve repair/ graft
- Muscle & tendon repair/ transfer
- Bone and joint reconstruction

Initial Assessment

- Physical exam
 - Circulation
 - Tissue involved
 - Depth and size of wound
 - Contamination
 - Tissue viability



Adverse factors affecting wound healing

- Infection
- Retained foreign bodies
- Retained devitalised tissue
- Poor circulation
- Radiation or chemotherapy
- Systemic factors: malnutrition, DM, PVD, smoking
- Wrong choice of treatment

Patient preparation

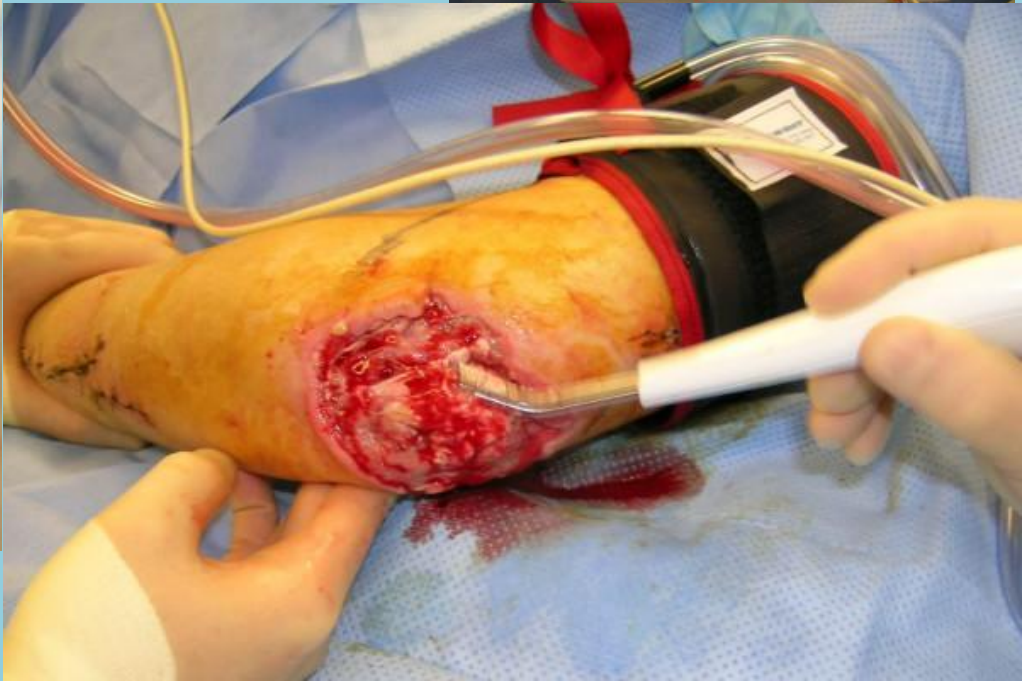
- Local
 - Adequate debridement and decontamination
 - Dressing care: keep wound clean, moist, viable tissue and barrier to infection
- Systemic
 - Nutrition support
 - Antibiotics
 - Pain control
 - Tetanus prophylaxis
 - Stress relief, psychosocial support

Acute management

- Adequate debridement
 - Aim to remove foreign bodies, contaminated tissue and devitalized tissue
 - Should be repeated every 24 hours till completely clean
 - Pulsatile Lavage



- Hydrosurgery System
Use of high-velocity water-jet for surgical debridement



Post-traumatic elbow wound

Method of Debridement

- Surgical
- Sharp
- Larval
- Enzymatic
- Autolytic
- Mechanical
- Chemical
- *For many wounds WBP will require the use of more than one debridement technique either within the initial phase of debridement or for maintenance debridement*

Dressing

- Debridement (non-viable tissue)

- Iruxol

- Promotion of healing

- Solcoseryl

- Actovergin

- Collagen

- Decontamination (infective agents)

- Seasorb silver, contain alginate to trap water

- Anticoat (silver only)

- Aquacel (Hydrofiber)

- External stimulation

- Hyphecan

Bacteriology

- All wounds are colonized by bacteria
- Presence of bacteria \neq infection
- Established infection does not preclude wound coverage surgery
 - Except certain bacteria
 - **Streptococcus : streptolysin, clear thin exudate**
 - **Pseudomonas : green colour exudate**

Bacteriology

- Rational use of antibiotics
- Nature of wounds
- Intelligent guess
- Avoid prolonged topical antibiotics
- Surgical debridement of dead and infected tissues

Anatomy

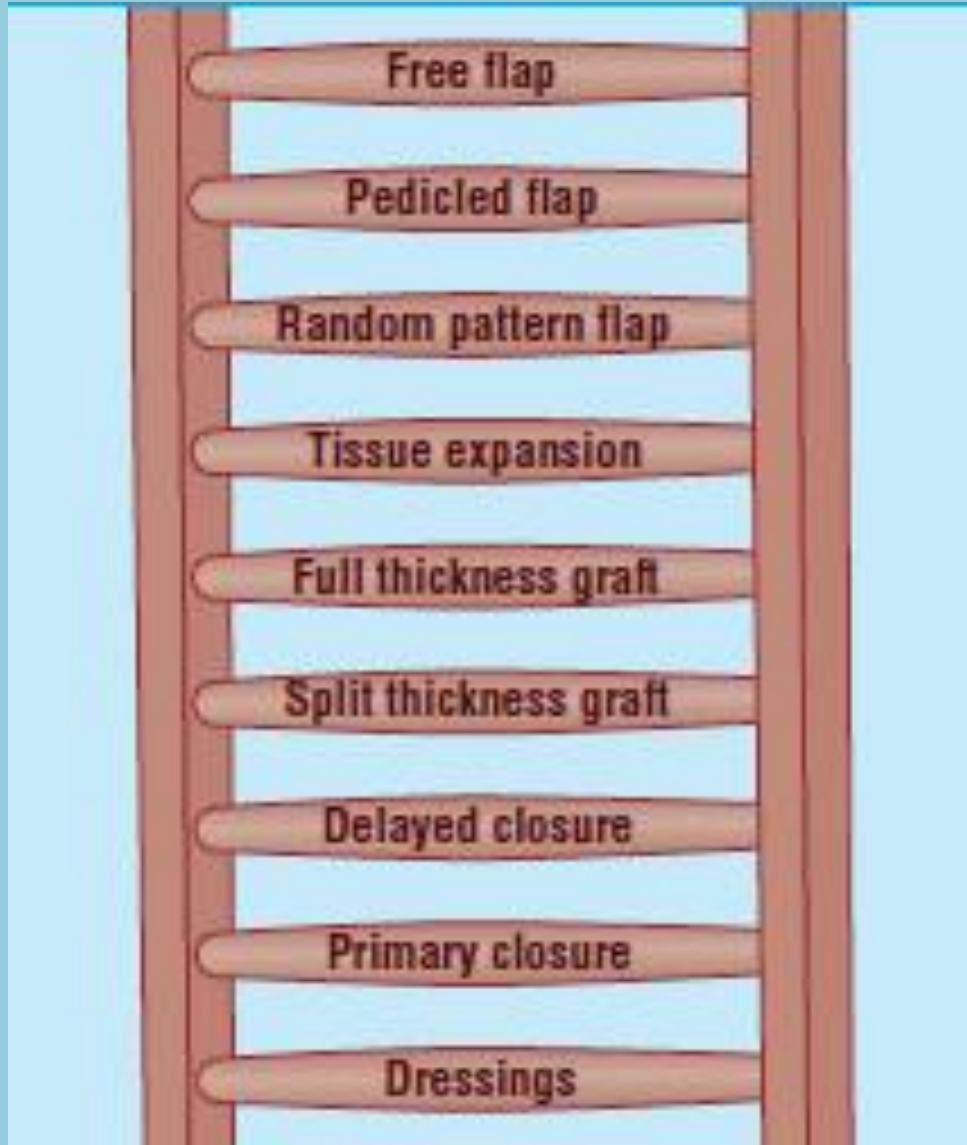
- What structures are missing
 - Loss of major peripheral nerves
- What needs to be replaced
 - Cavity filling
- What tissues available nearby
 - Vascular anatomy
- What tissues available distant
 - Free muscle transfer
- Overall vascular status of the limb

Anatomy

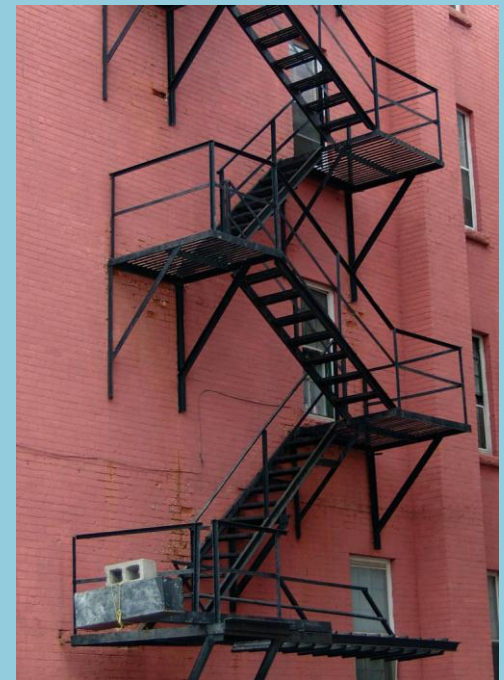


Methods of wound coverage ...

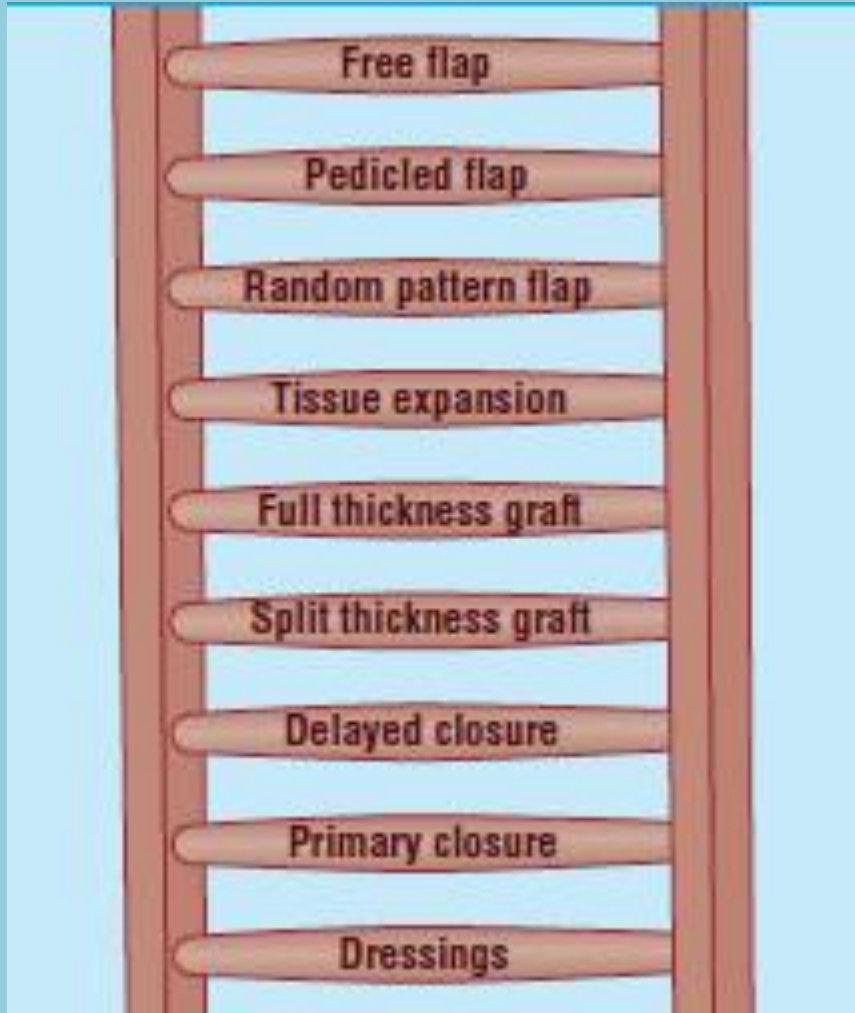
Reconstruction Ladder



- The more complicated the wound, the higher the ladder you need to climb



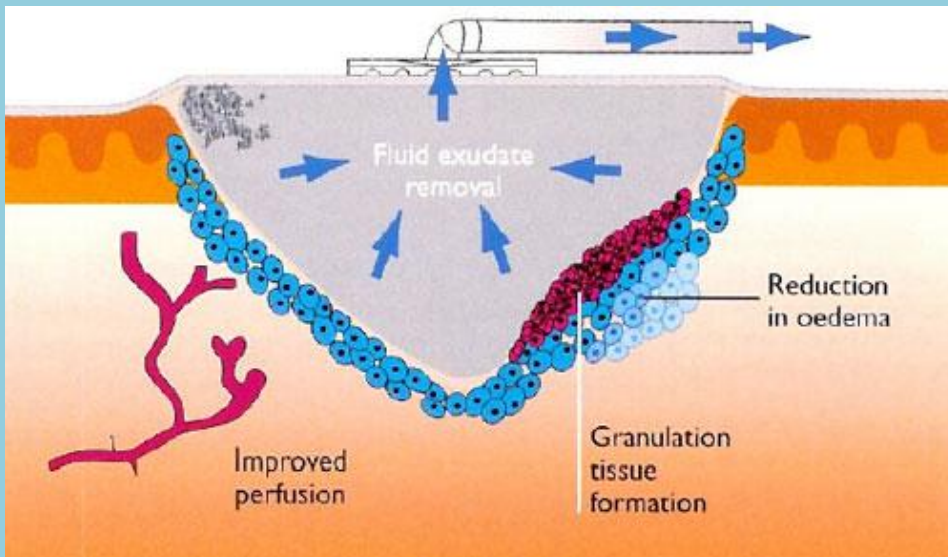
Reconstruction Ladder



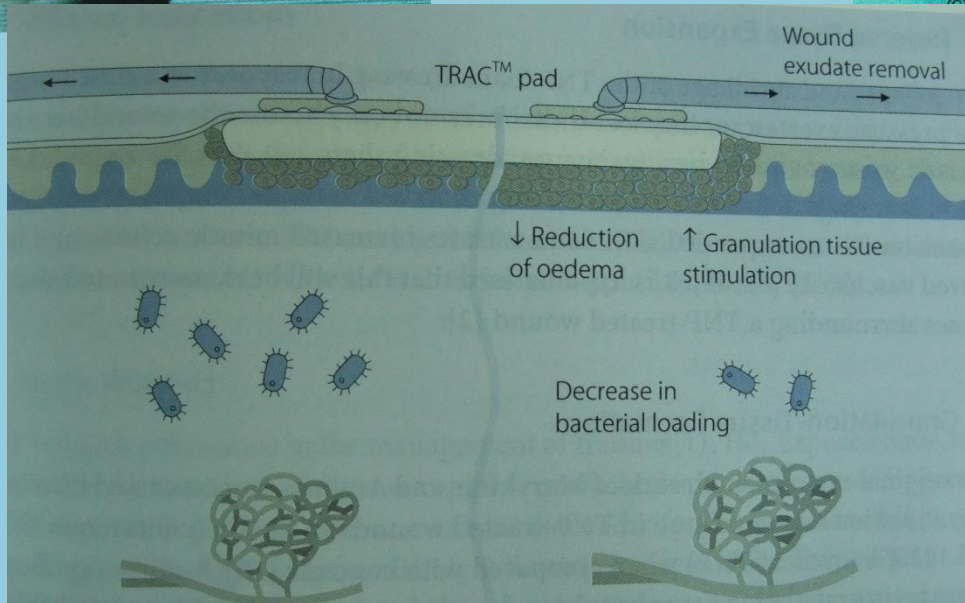
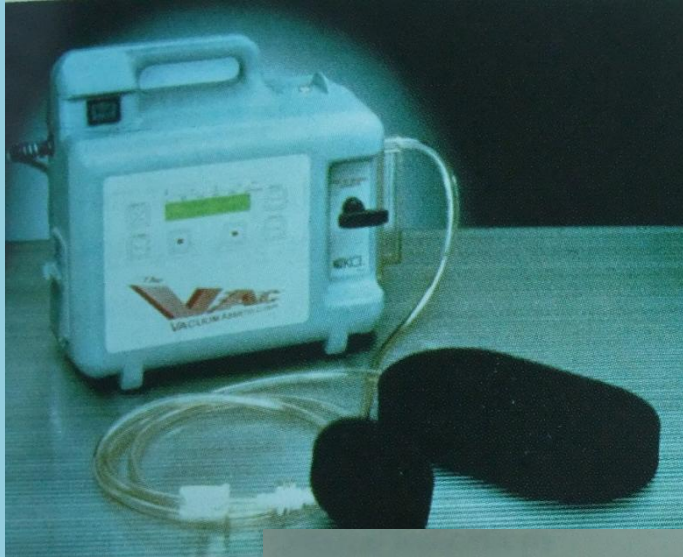
- Select the simplest method that fulfill wound requirement

Dressing

- VAC – dressing
 - After adequate debridement
 - Continue vacuum therapy
 - Removal of exudate
 - Induce granulation tissue



Topical Negative Pressure (VAC)

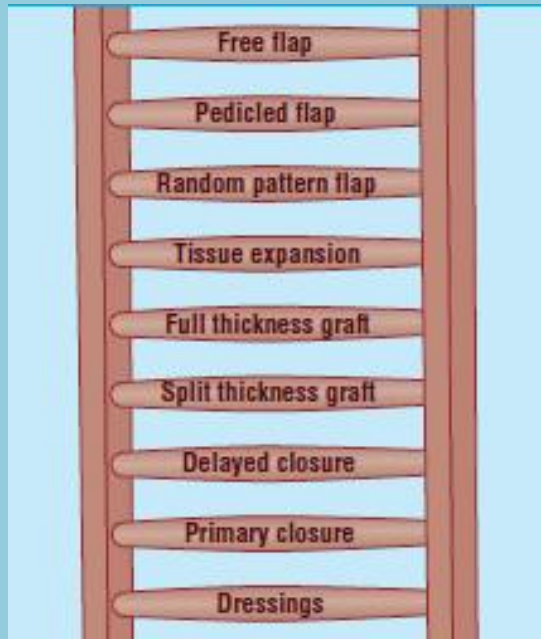


VAC regime

- Negative pressure
 - Most wound: 125mmHg
 - Skin grafts: 50-120 mmHg
- Cycle
 - Constant for 48 hours then intermittent (5 mins on and 2 mins off)
- Dressing changes
 - Most wound : 48 hours, then every 4-5 days
 - Infected: less than 48 hours
 - Clean wound: 4-5 days

Primary closure

- In minimally contaminated wound
- After adequate debridement

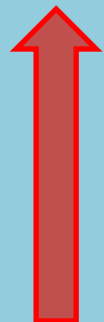
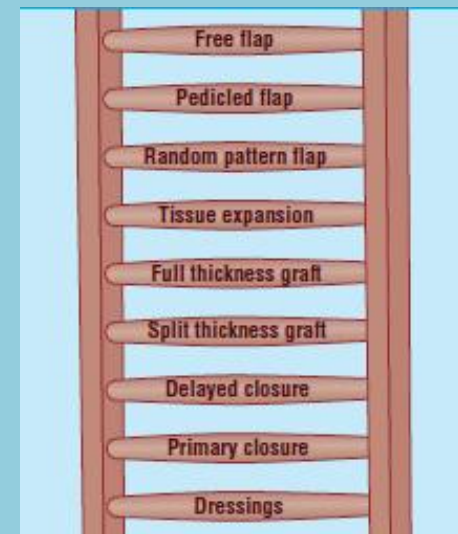


Delayed primary closure

- Repeated debridement of contaminated wound
- Delayed closure of wound if clean
- Wound should be under no tension



Skin graft - STSG



SSG preparation



Tie over

Donar site

- Keep dressing intact x 2-3 weeks unless infection is suspected

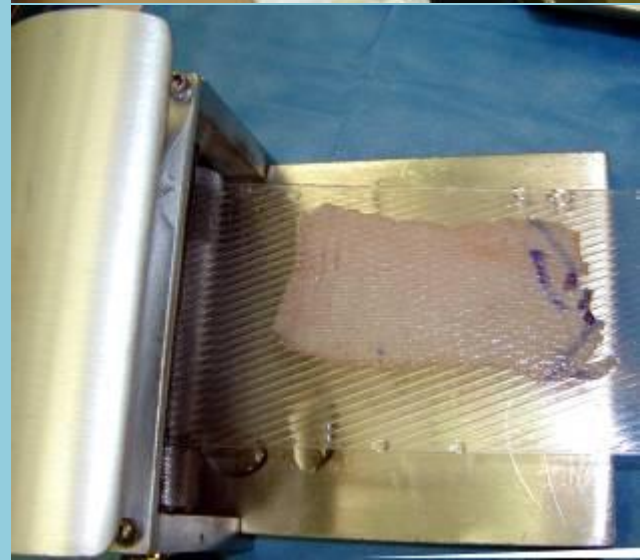
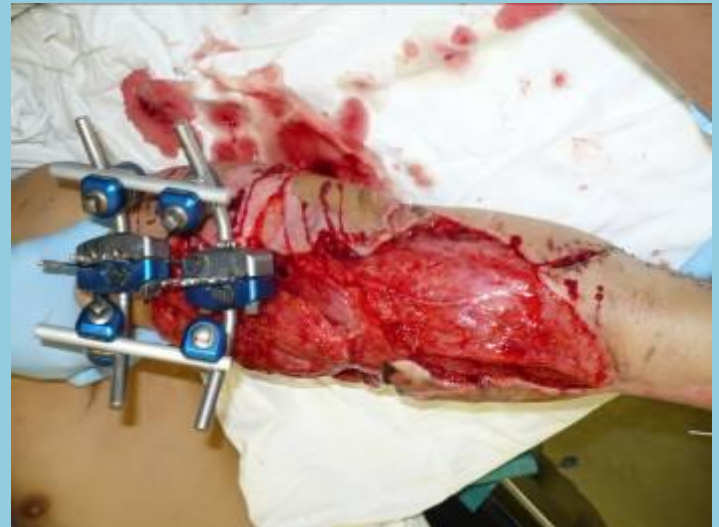


- Failed by poorly vascularized bed, infection, shearing
- Bulky dressing, “Tie over dressing”, VAC, plaster immobilization
- For SSG : inspect after D5, FTSG : D7
- Skin contracture, hyperpigmentation

SSG



Repeated debridement + skin grafting



7 months ...

- Active elbow control regained



STSG



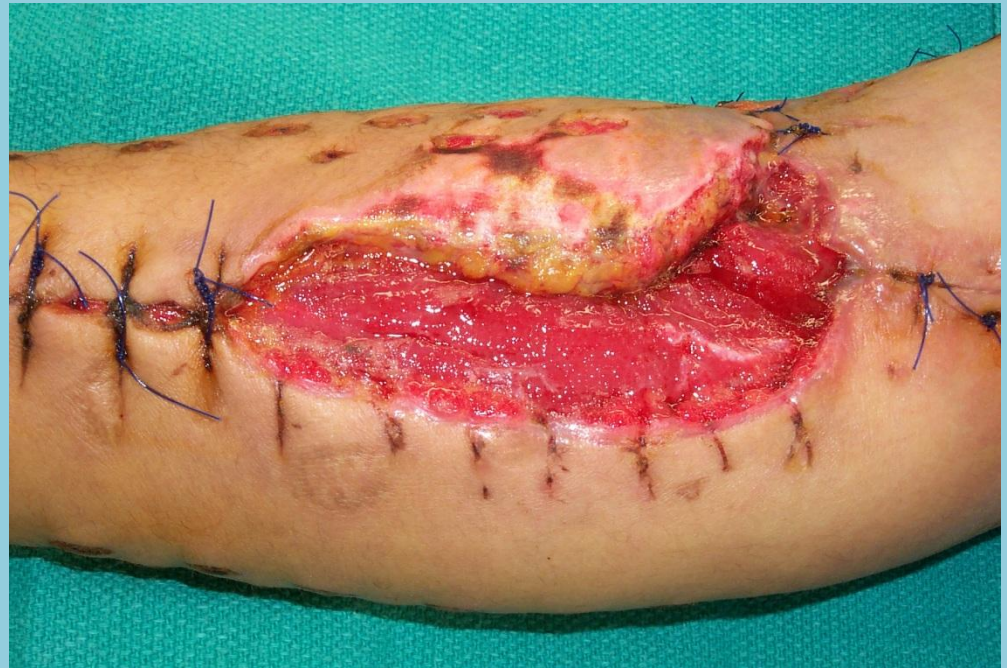
Skin graft – FTSG



- Full thickness (include dermis) and splitted thickness
- Survive on vascularized bed by “imbibition”

Preparation for recipient site

- Free of infection
- Healthy granulation tissue
- Good vascularity

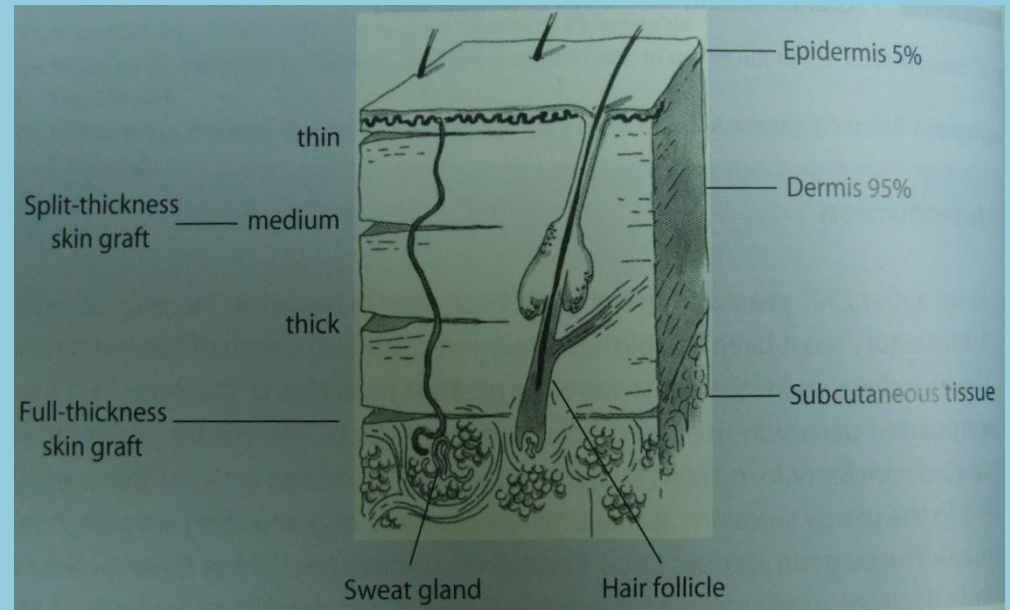


SSG vs FTSG

- SSG
 - Depends on the vascularity of recipient bed
 - Scars usually bad
 - Good for large areas
 - Donor sites can be used repeatedly
- FTSG
 - Limited supply
 - Good skin like quality
 - Different mechanism of recipient site incorporation
 - Can be used on bare tendon or bone

STSG

- Advantages
 - May be meshed
 - Large area
 - Easier revascularization
- Disadvantages
 - Poor cosmesis
 - Limited durability
 - Contracts over time



FTSG

- Advantages
 - No wound contracture
 - Increased sensibility
 - Increased durability
 - Better cosmesis
 - Primary closure of donor site
- Disadvantages
 - Longer time to revascularize
 - Cannot mesh
 - Recipient site must have rich vasculature

Tissue Expansion

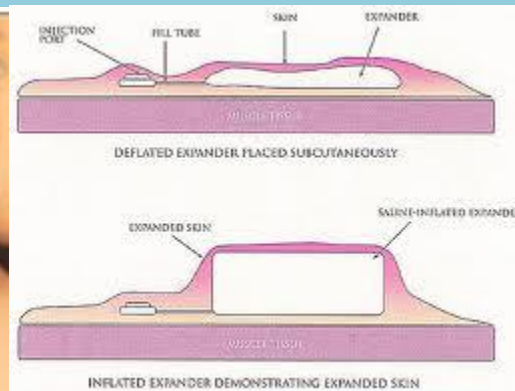
a procedure that enables the body to "grow" extra skin for use in reconstructing almost any part of the body.

- Advantage

- expansion offers a near-perfect match of color, texture, and hair-bearing qualities
- the skin remains connected to the donor area's blood and nerve supply, there is a smaller risk that it will die
- scars are often less apparent



Tissue Expansion



Tissue Expansion

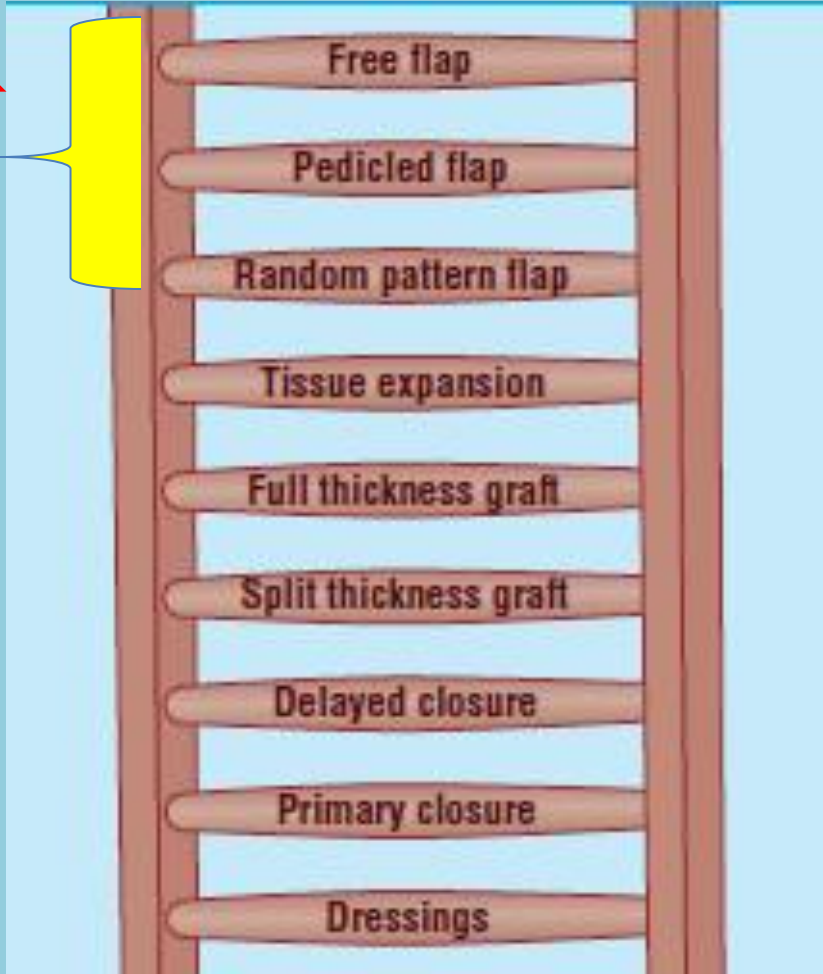


Final result of tissue expansion



Repeated debridement, VAC dressing, revision suturing, AFO protect equinus deformity, nutrition, infection prevention....lots of nursing input !!!

Flap Reconstruction

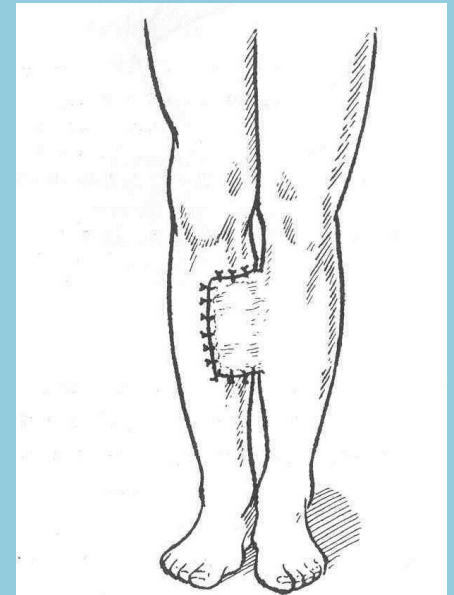
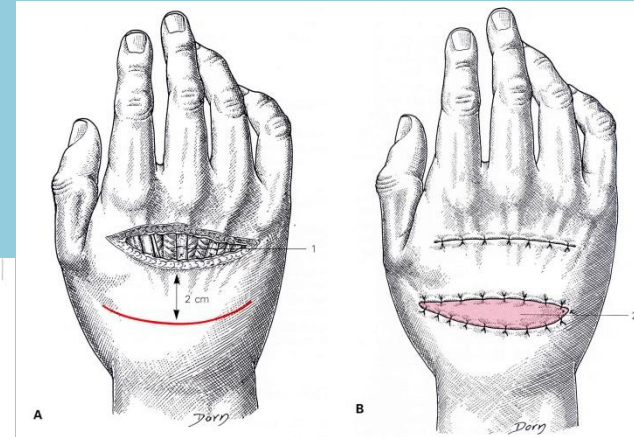
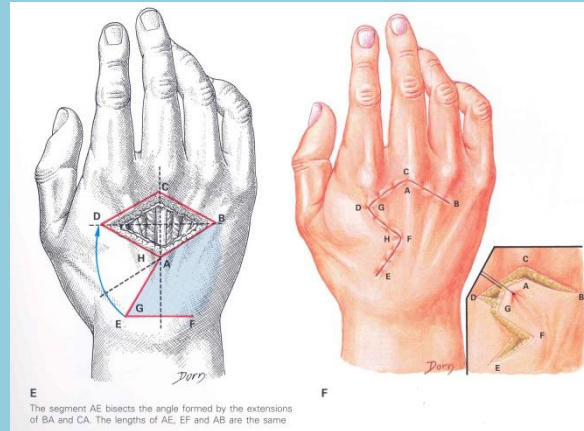


Indications for Flap Coverage

- Skin graft cannot be used
 - Exposed cartilage, tendon (without paratenon), bone, open joints, metal implants
- Flap coverage is preferable
 - flexor joint surfaces → avoid contracture
 - durability required

Classification of Flaps

- Local
 - Advancement
 - Rotation
- Distant
 - Pedicled
 - Tubed
 - Free



Classification Flaps

- According to blood supply

- Random

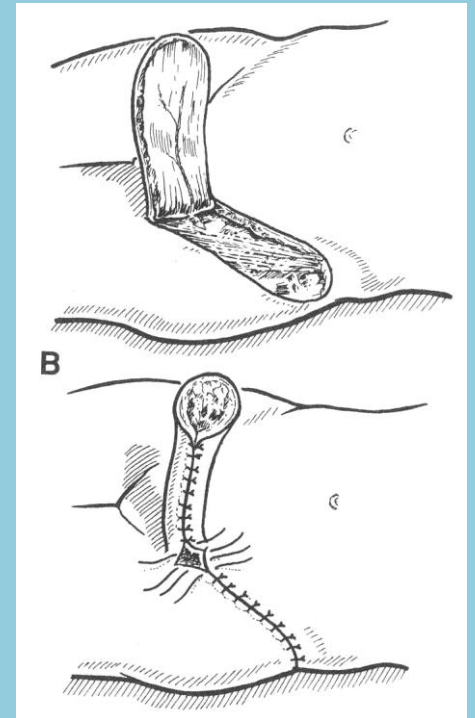
- 1:1 ratio



- Axial

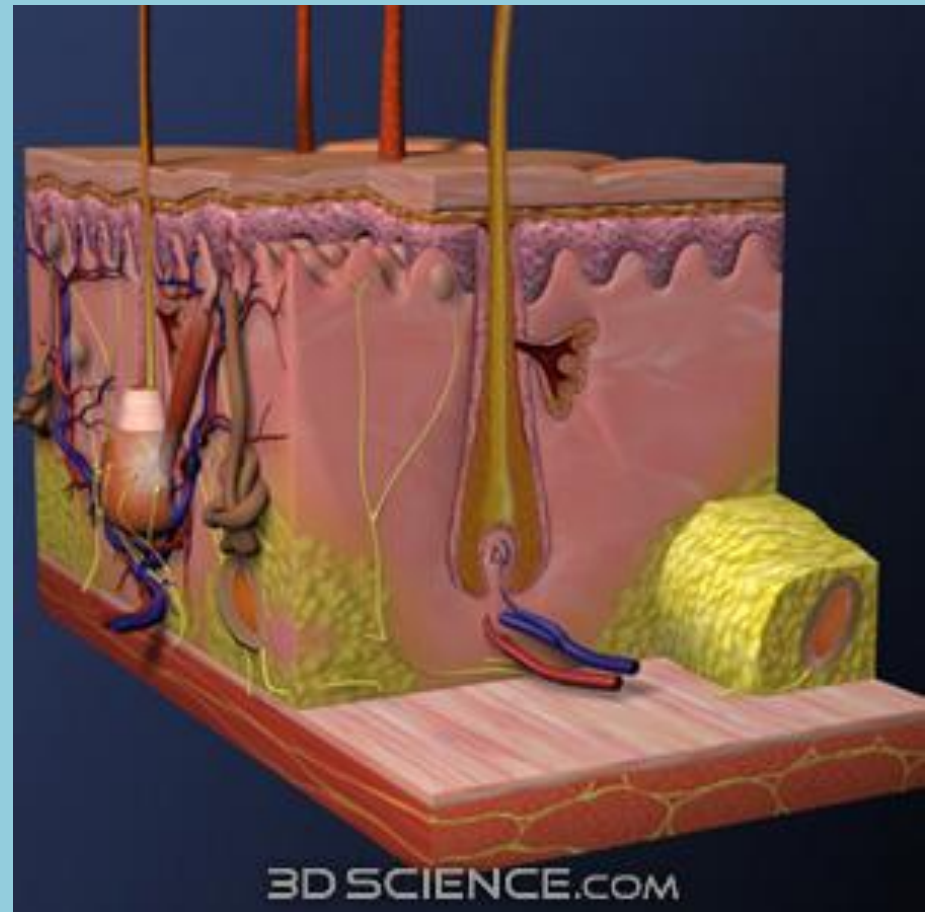
- E.g. Groin flap

- Based on superficial circumflex iliac artery



Classification of Flaps

- According to the tissue components
 - Cutaneous flap
 - Fasciocutaneous flap
 - Myocutaneous flap
 - Muscle flap
 - Composite flap



FLAPs

- Skin flap
 - Subcutaneous tissues
 - Random pattern 1:1 length to width ratio
 - Pedicle
 - Major artery
 - Perforator
 - Could be of high length to width ratio
 - Venous drainage of flap
 - Free
 - microsurgery

Choices

- Muscle flap
 - Cavity to fill
 - Bring in vascularity
- Myocutaneous flap
 - Donor site morbidity
- Composite tissue transfer
 - Skin, Muscles, Fascia, Tendons, Nerves, Blood vessels, Periosteum, Bone, Whole digits

Decision Making

- Tissues required
- Scarring and flap appearance
- Donor site morbidity
- Patient acceptance
- Surgeon factor

How to choose the correct flap ?

Recipient site:

- Where
- Size
- Shape
- Presence of contracture
- **Nature**

Nature of recipient site

- Clean / contaminated / infected ?
- Fresh / Granulation bed ?
- Tissue lost : muscle, tendon, nerve, bone
 - Thickness
 - Support
 - Sensation
 - motion
- Tissue status surrounding the wound :
circulation, adjacent joint

Choice of Donar

- Healthy with no previous surgery, injury , irradiation
- Minimal disturbance in appearance and function after flap harvest
- Stable arterial supply, few variation
- Diameter of artery, length of pedicle
- Cutaneous nerve

Different categories of FLAPs

- Blood supply
 - Random or Axial
- Method of transfer
 - Pedicle or Free
- Location
 - Local, regional, distant

Myocutaneous Flap

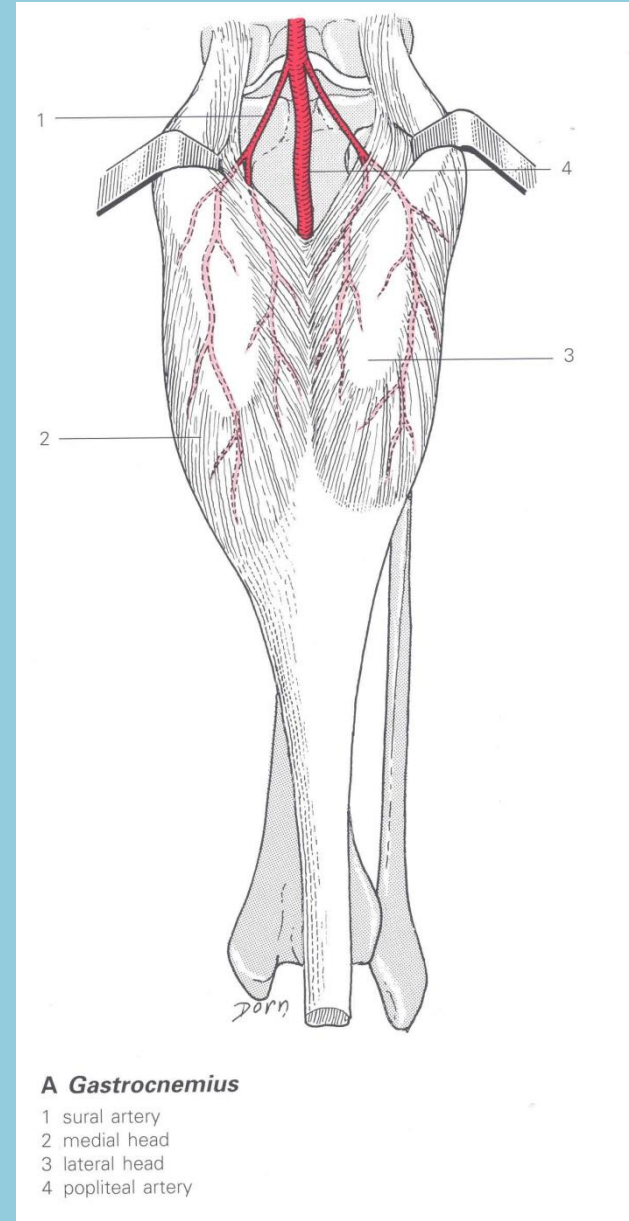
Mathes classification

- 5 types:
 - I One vascular pedicle
 - II One dominant & several minor
 - III Two dominant
 - IV Multiple pedicles
 - V One dominant and secondary segmental

(Dominant – sufficient to nourish the entire muscle)

Type I

- One vascular pedicle
 - Gastrocnemius
 - Rectus femoris
 - Tensor fascia lata



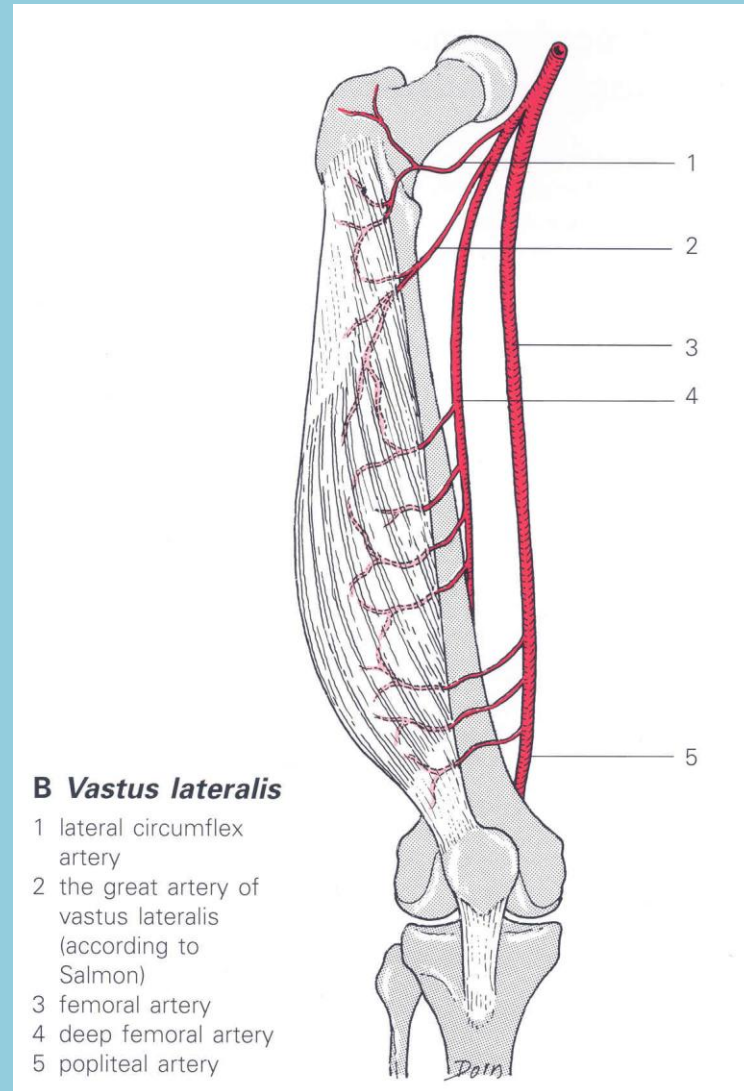
Medial Gastrocnemius Flap



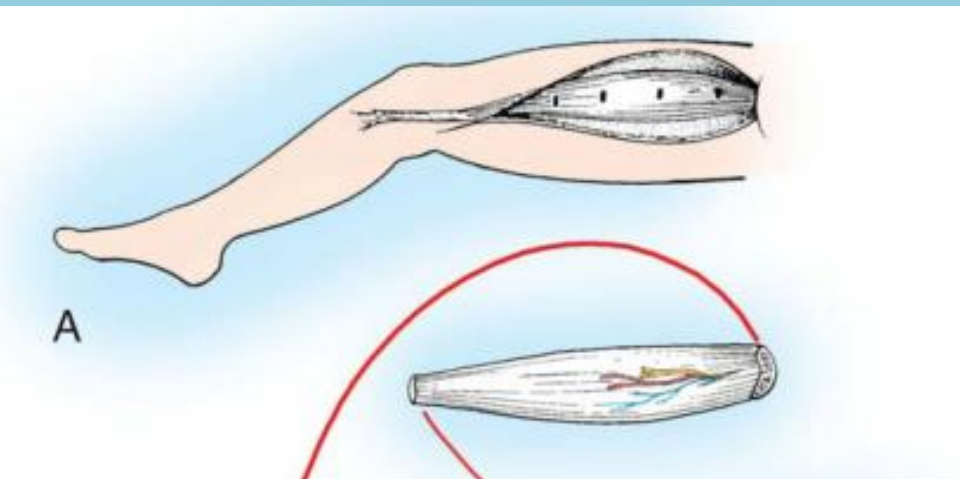


Type II

- One dominant and several minor
 - Vastus lateralis
 - Gracilis
 - Soleus
 - Peronei
 - Biceps femoris
 - Semitendinosus
 - Abductor digiti quinti
 - Abductor hallucis
 - Brachioradialis



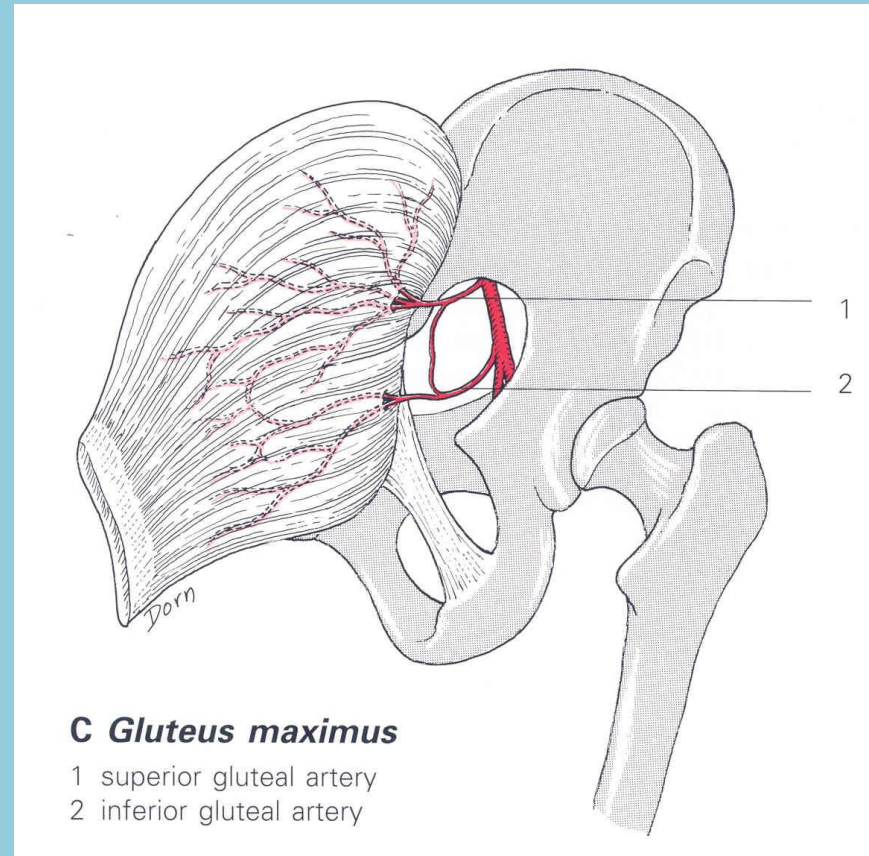
- Free Gracilis Flap



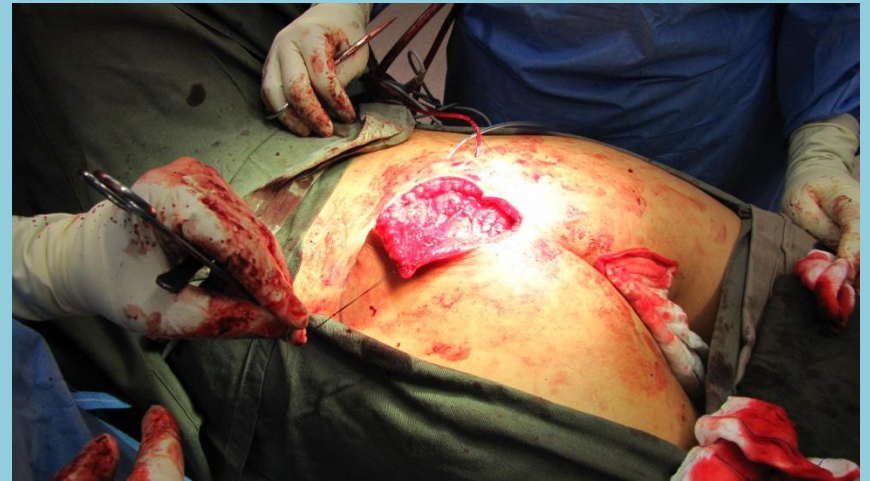


Type III

- Two dominant pedicles
 - Glut max
 - Rectus abdominis
 - Serratus anterior
 - Semimembranosus



Sacral Sore: Unilateral gluteal flap



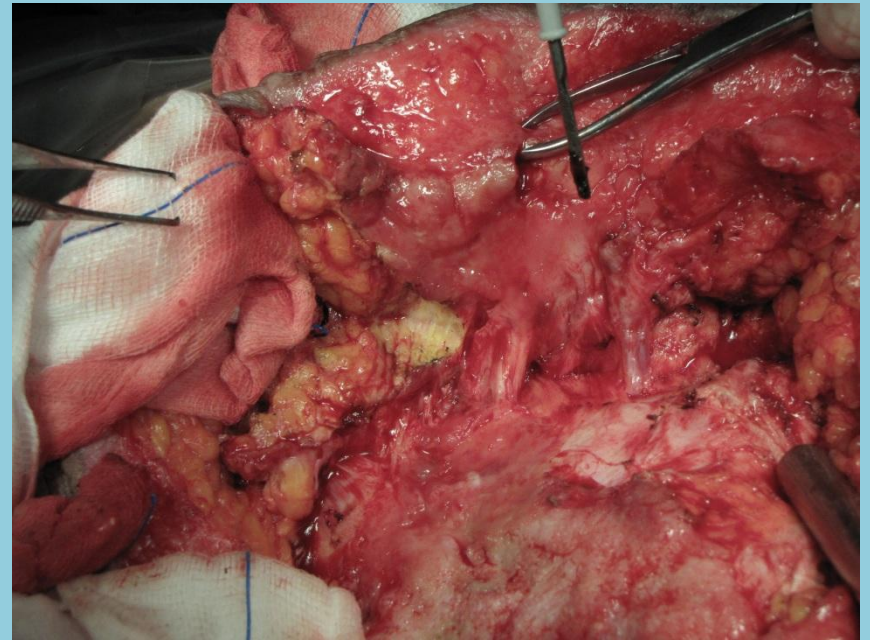
Sacral Sore: Unilateral gluteal flap

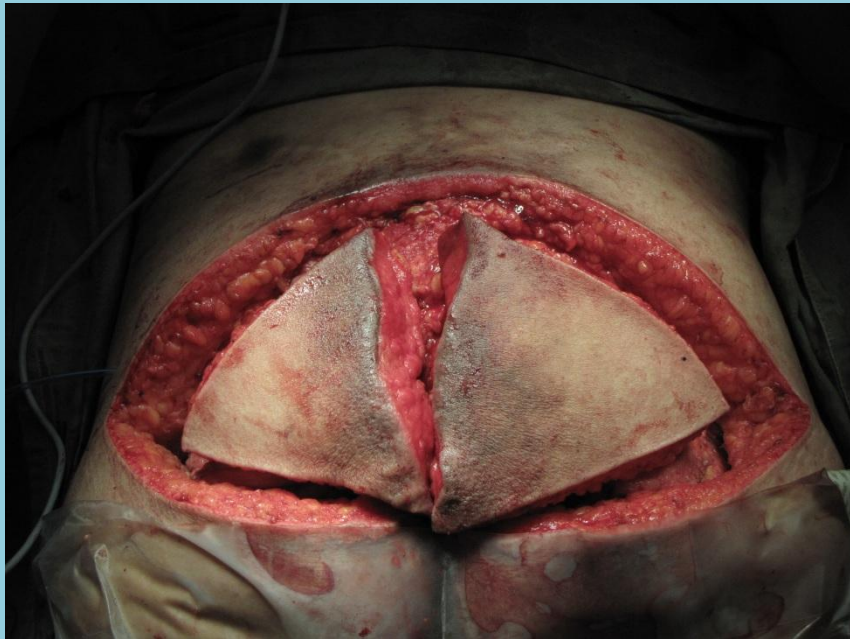


Sacral sore : Bilateral Gluteal flap



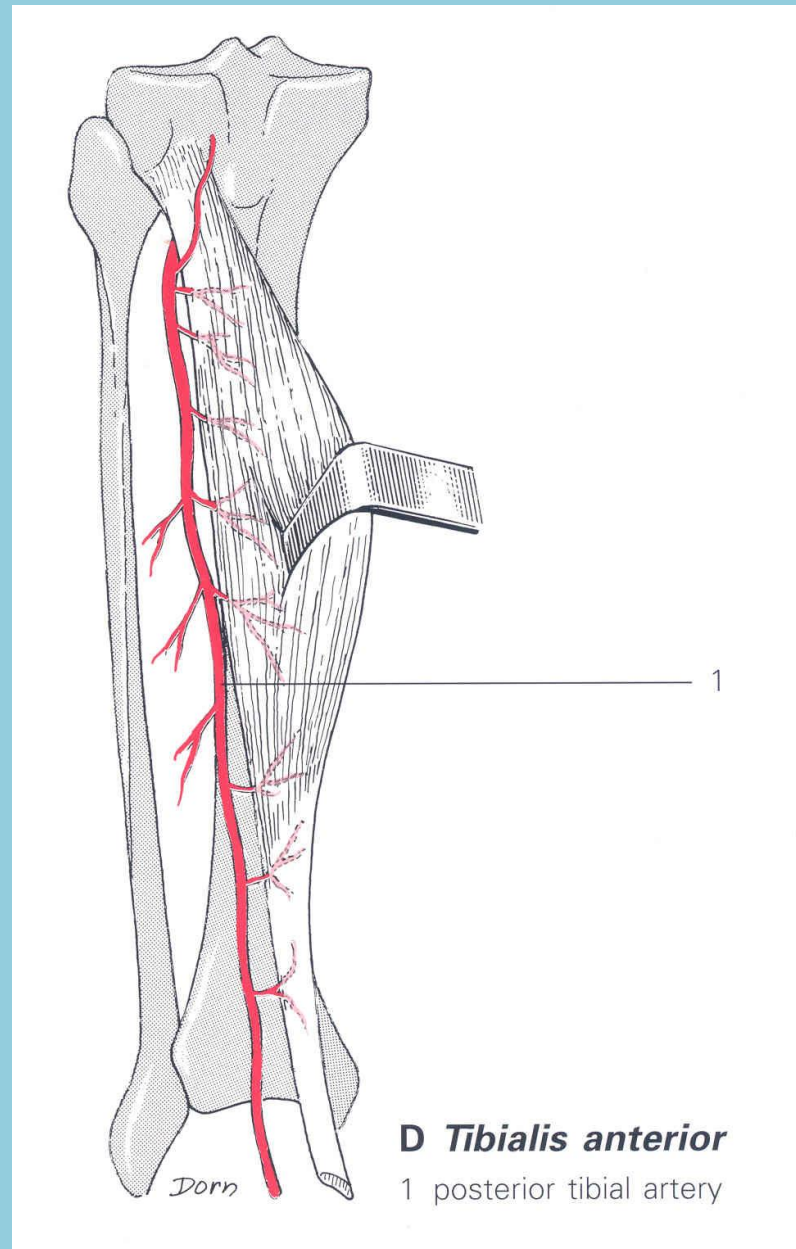
Sacral sore : Bilateral Gluteal flap





Type IV

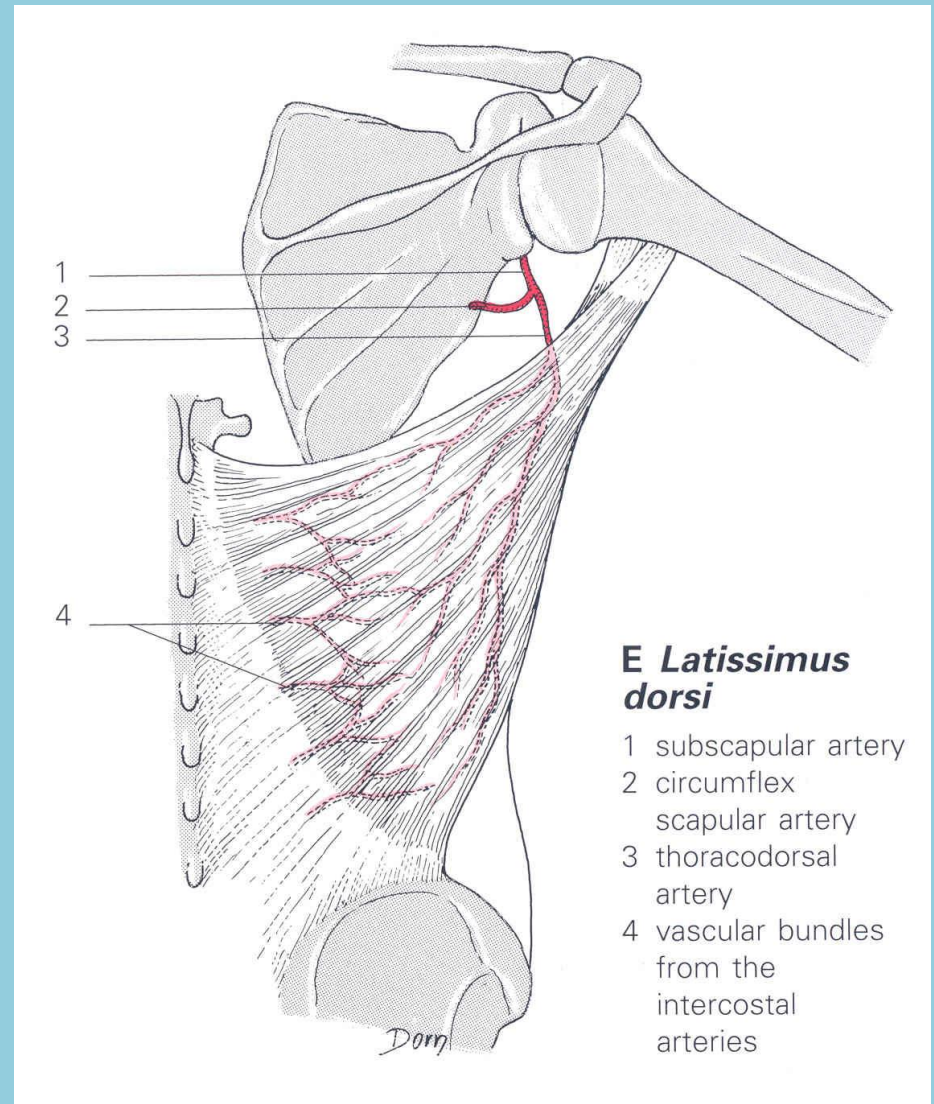
- Multiple pedicles
 - Tibialis anterior
 - Ext digitorum longus
 - Ext hallux longus
 - Flexor digitorum longus
 - Sartorius





Type V

- One dominant, secondary segmental pedicles
 - Latissimus dorsi
 - Pectoralis major

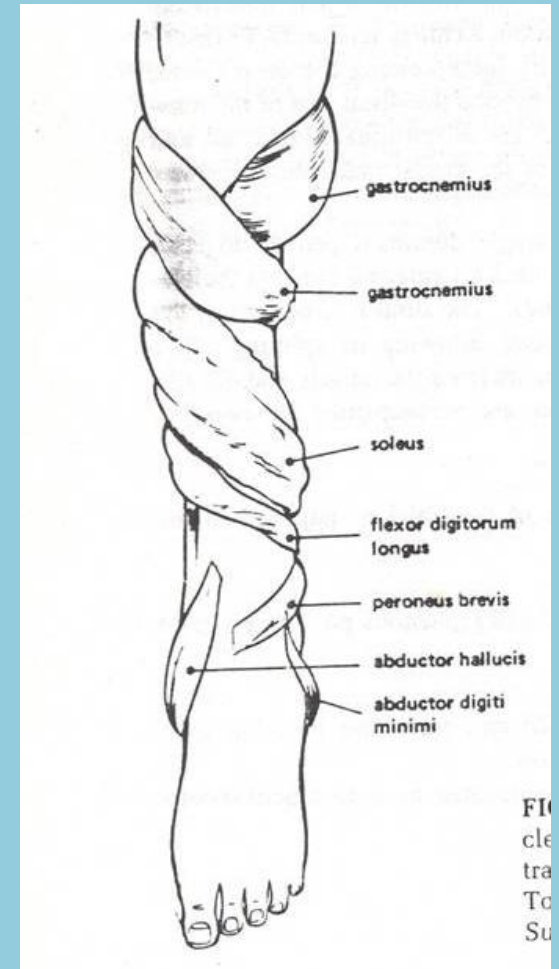


Which Flap should I use?

- Pre-operative Assessment
 - Size of defect
 - Location of defect
 - Vascular Status
 - Doppler
 - Angiogram
 - Surgeon's expertise and preference

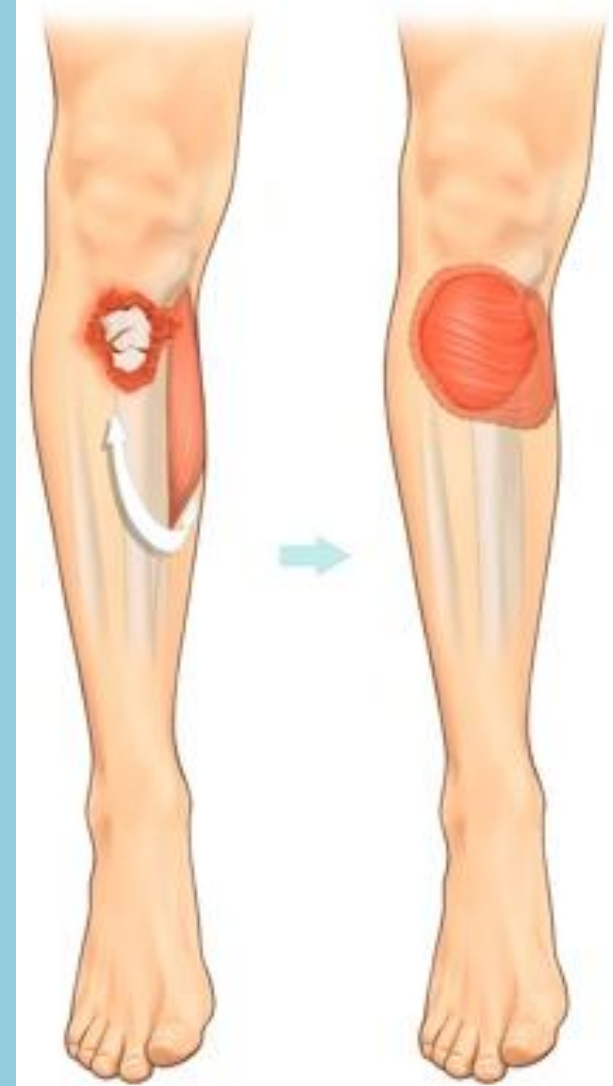
Flap Coverage for the Tibia

- Conventional teaching
 - Proximal 1/3
 - Gastrocnemius rotational flap
 - Middle 1/3
 - Soleus rotational flap
 - Distal 1/3
 - Free flap
 - Large defect- Latissimus Dorsi
 - Smaller defect- Sural flap



Proximal 1/3 tibia

- Medial Gastrocnemius Flap
- Pedicled flap



Medial Gastrocnemius Flap



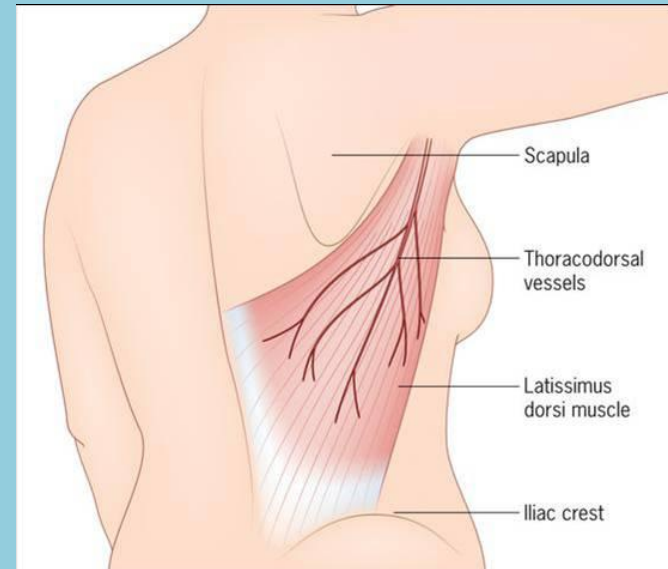
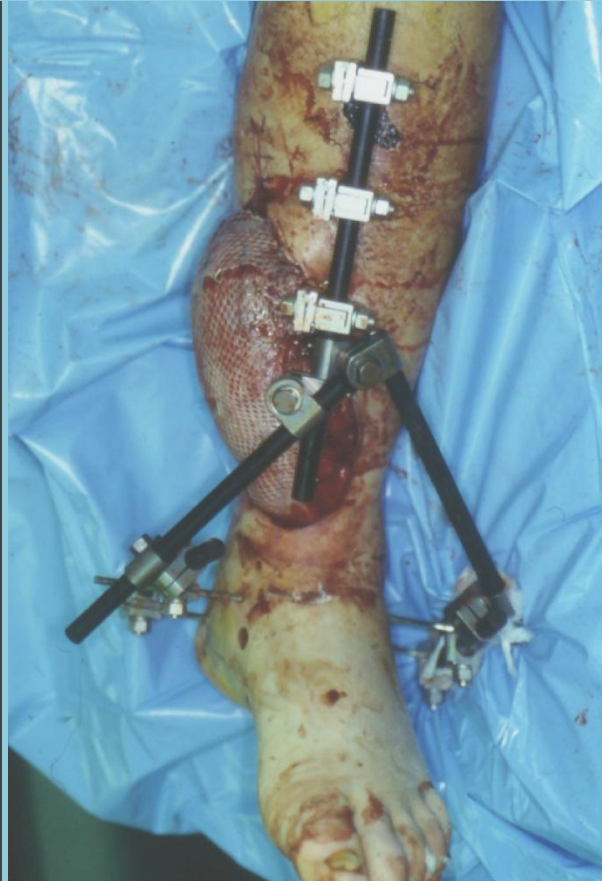


Middle 1/3 Tibia

- Soleus flap



Distal 1/3 tibia



LD flap + skin graft

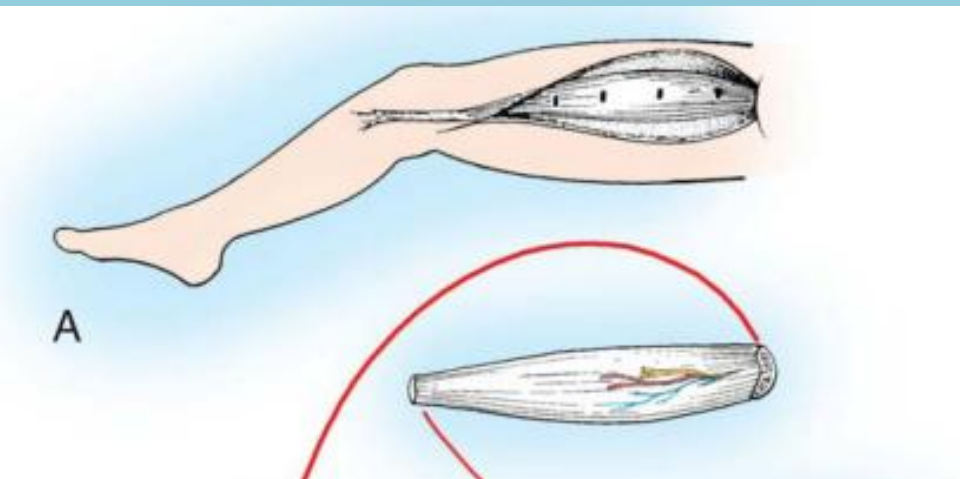
Distal 1/3 Tibia



- Implant exposed



- Free Gracilis Flap



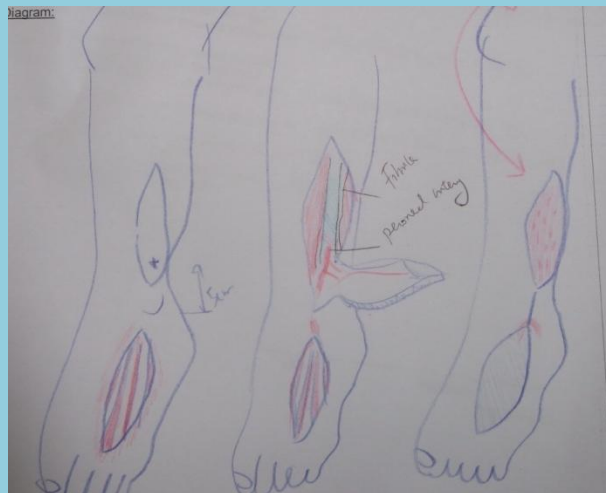
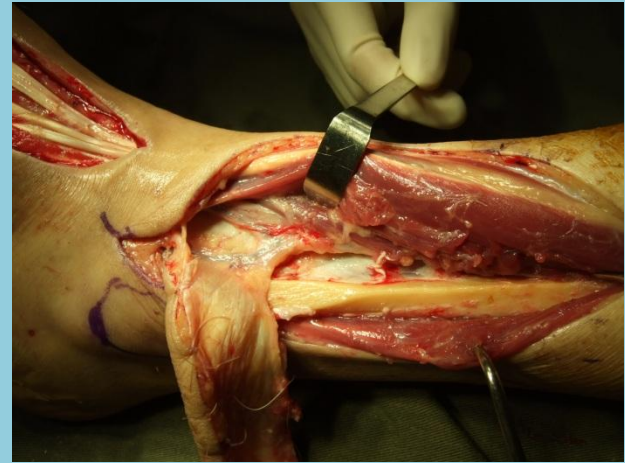


Foot Dorsum Defect

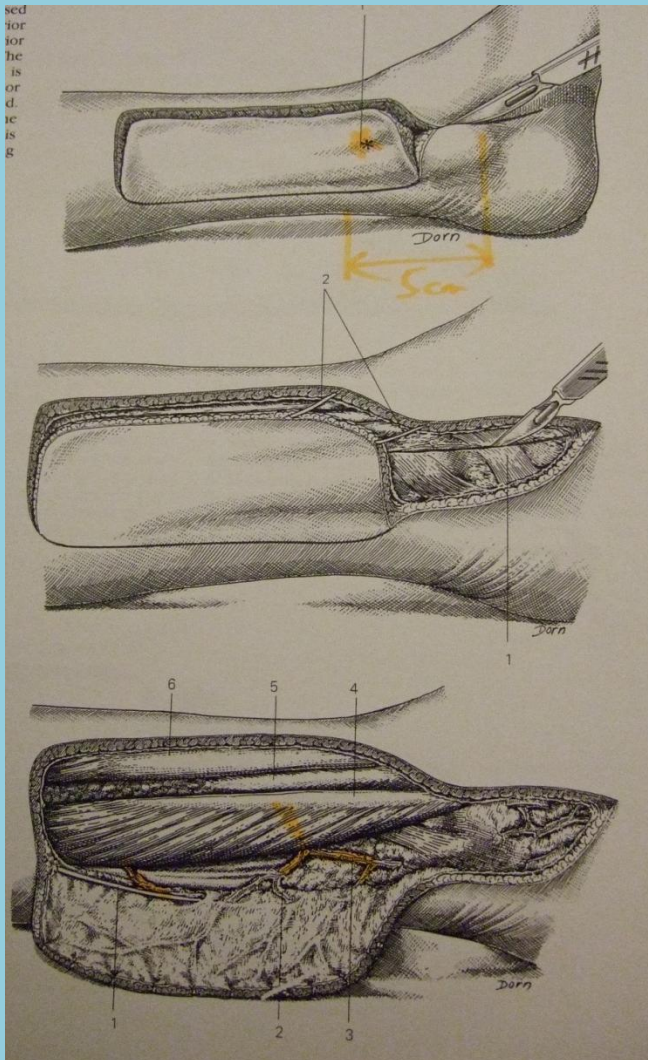
- M / 47
- IDDM, HT, IHD
- Left foot dorsum abscess admitted with diabetic ketoacidosis



Lateral supramalleolar flap based on peroneal artery



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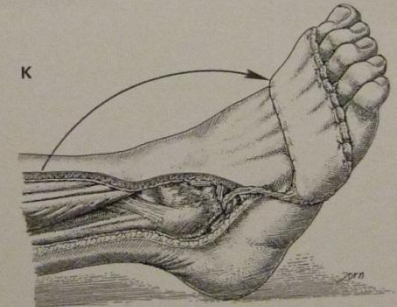
- 1 pedicle of flap
- 2 retinaculum, divided



J The flap is raised.

The final step is to precisely isolate the pedicle and to release it as far as the sinus tarsi. When the flap is isolated it is very important to divide the posterior border of the fascia of extensor digitorum brevis in order to avoid compression of the pedicle. The closure of the donor site is achieved by suturing the peroneal and the extensor muscles together. A split-skin graft is applied immediately or a few days later.

K



K The arc of rotation allows coverage of the medial aspect of the lower leg, the posterior aspect of the heel and the dorsum and the borders of the foot.

Peninsular rotation flap

L The rotation flap is a very quick and easy procedure. The pedicle need not be exposed. A distal hinge may be maintained.

L





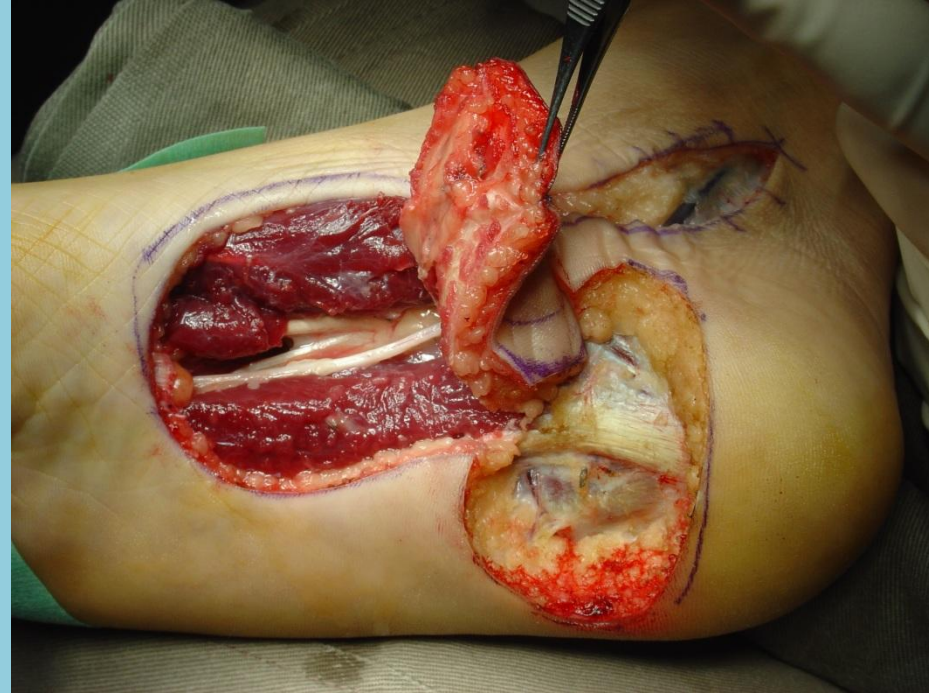
FU 9 week



Heel Defect

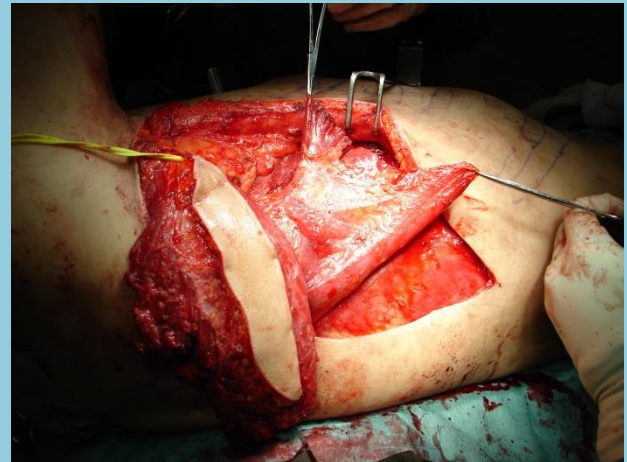
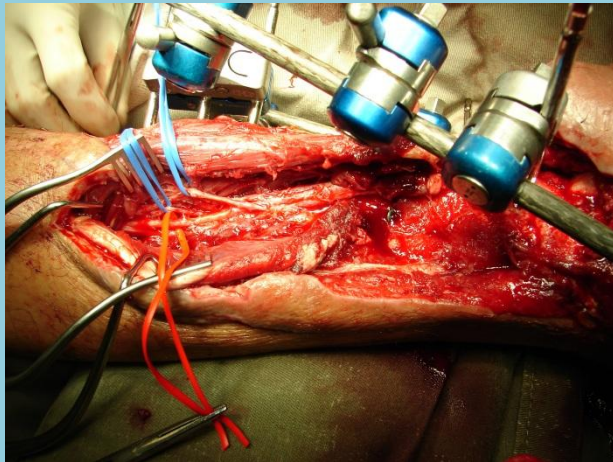


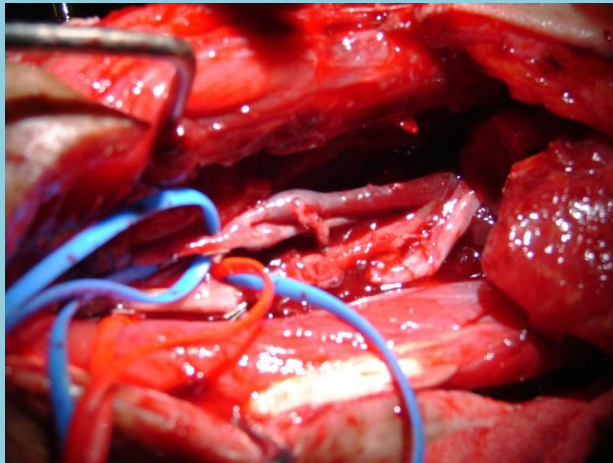
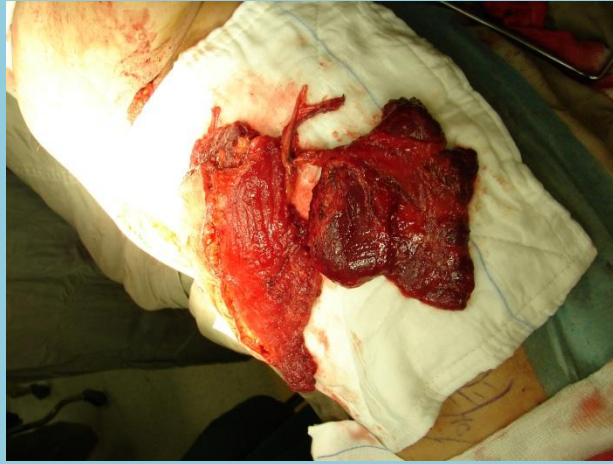
Avoid vital structures

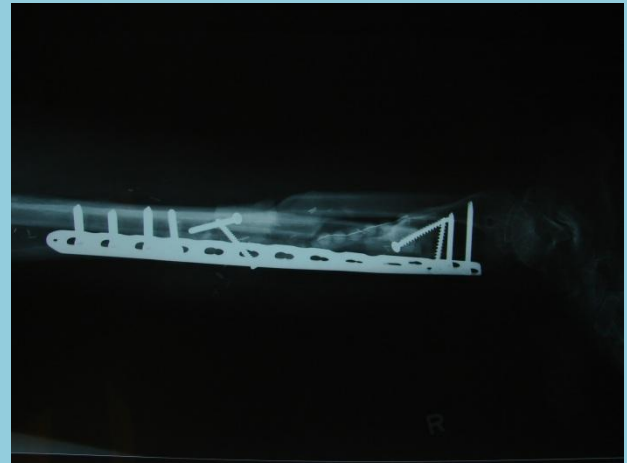
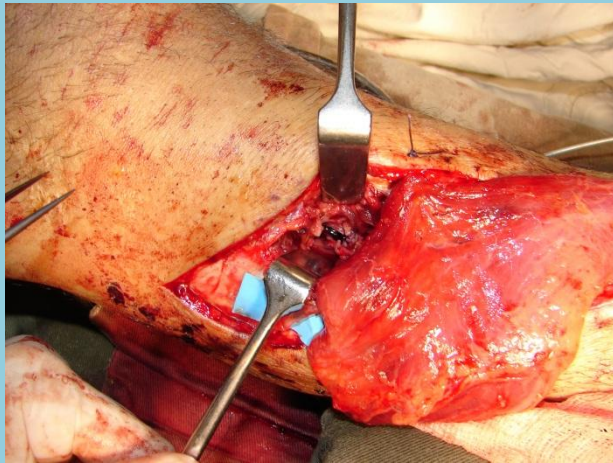


Free Flap









Flaps may fail !!!



- No pressure /compression on pedicle
- Elevation
- Hydration
- Close monitoring of circulation
- Haematoma
- Infection
- Anticoagulation

Nursing care & Multidisciplinary Team Work

Flap may failed



THANK YOU!

