Bløddelenes biologi og betydning for knogleheling

Lasse Birkelund, OUH

Basic 2024

Disclosure: No potential conflicts of interest

Faculty: Lasse Birkelund, OUH

I have no financial relationships with commercial entities that produce health-care related products.

Learning objectives

Forstå bløddelenes betydning for knogleheling

Prioritere behandlingen af bløddelsskader

Gennemgå strategi for behandling af brud med samtidig bløddelsskade

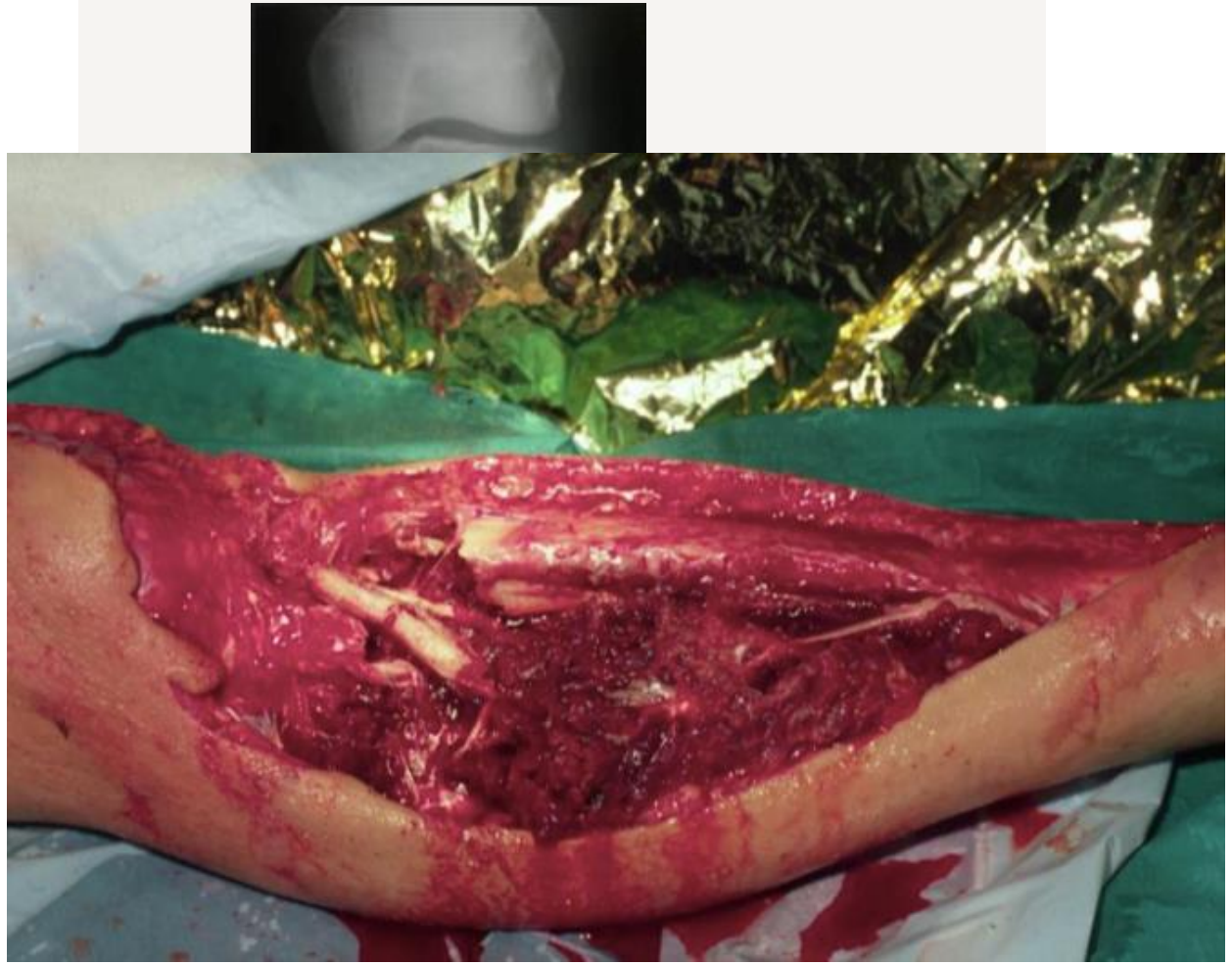
There is a fracture..

Text (28pt)

Text (

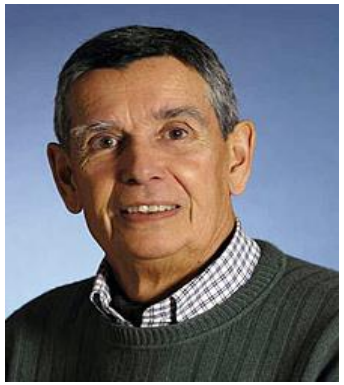
There is a fracture..

Tex



Bløddele

"a fracture first and foremost is a soft-tissue injury, in which the bone happens to be broken"



Thomas P Rüedi, MD, Professor, Founding and honorary member of the AO Foundation

Bløddele

" … the bone is a plant, with its roots in the soft tissue, and when its vascular connections are damaged, it often requires, not techniques of a cabinet maker, but the patient care and understanding of a gardener".

Gathorne Girdlestone 1881 - 1950

En fraktur består af:

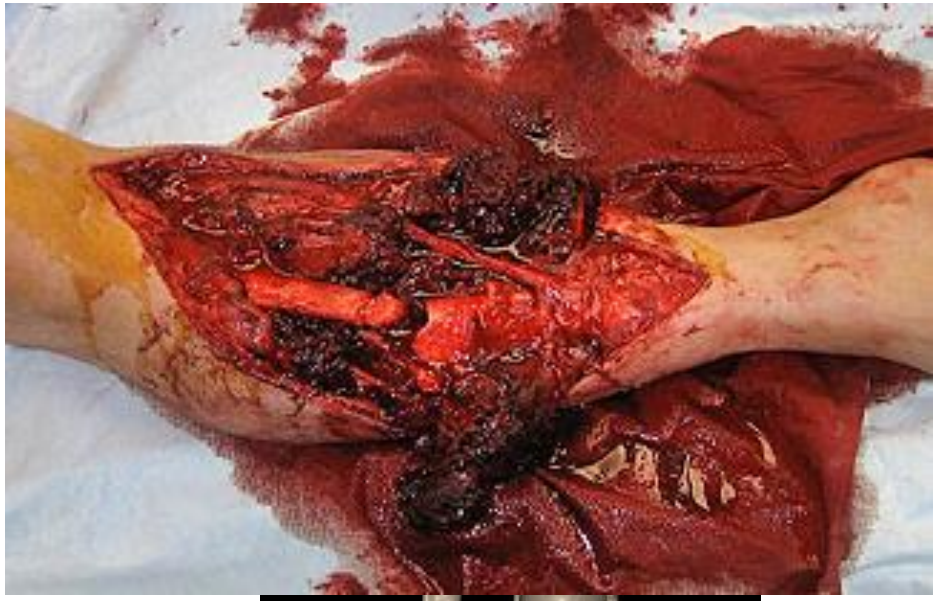
Knogle

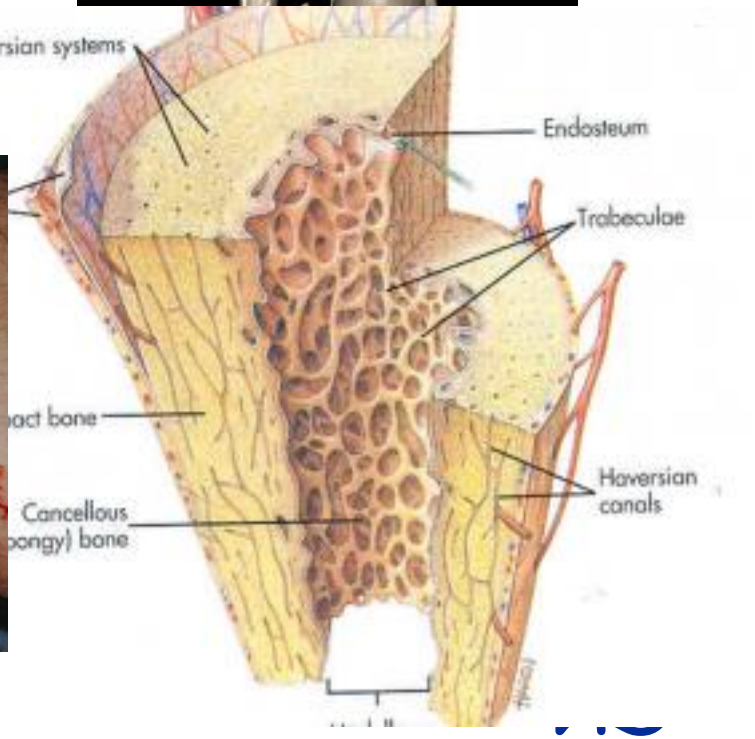
Periost

Muskel (med fascie)

Subcutis

Hud





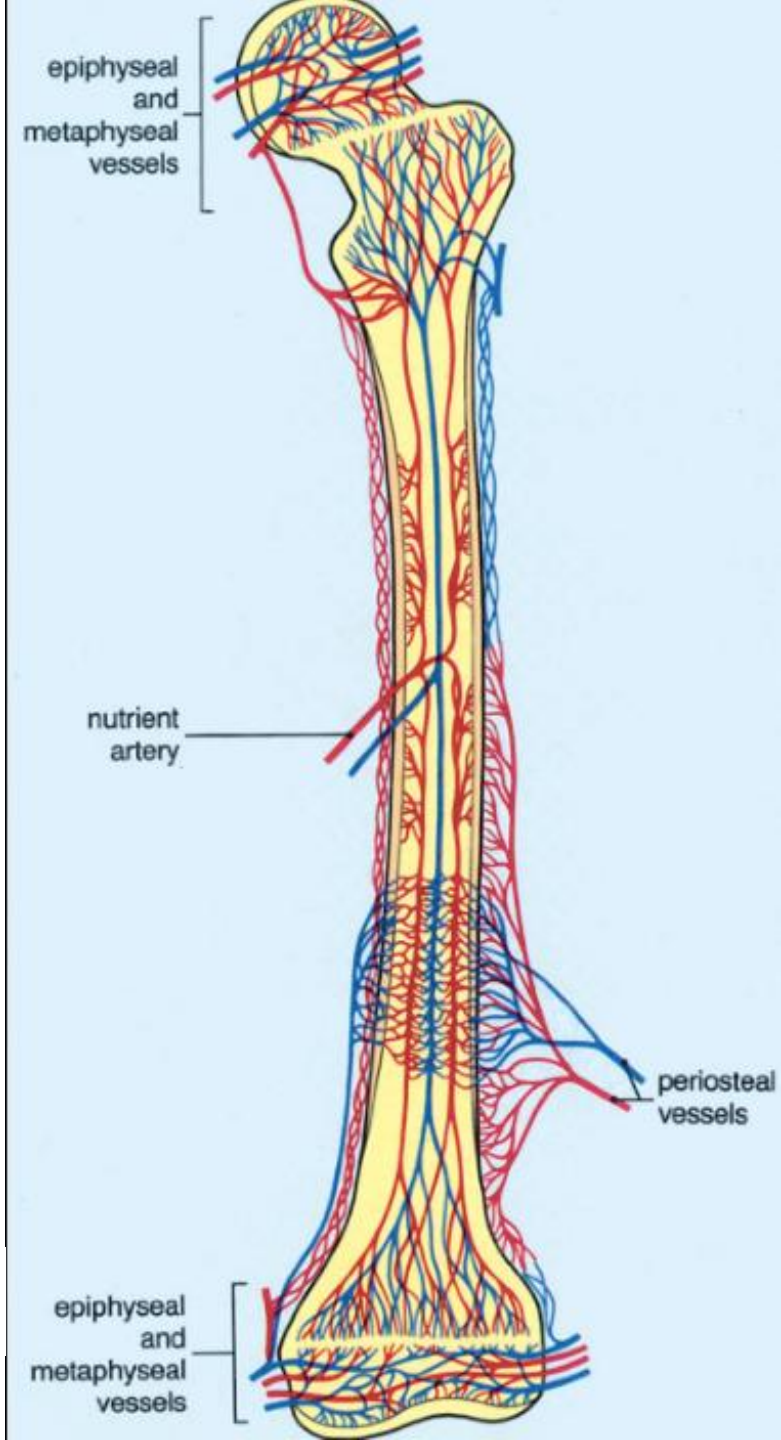
Blodforsyningen til knoglen

Ydre 1/3 - Periost

- Forsynet af periostale kar fra navngivne arterier
- Disse kar penetrerer dér, hvor fascie eller ligament hæfter

Indre 2/3 – Endost

- Forsynet af a. nutricae, der deles i arterioler, som så forsyner hele endostiet



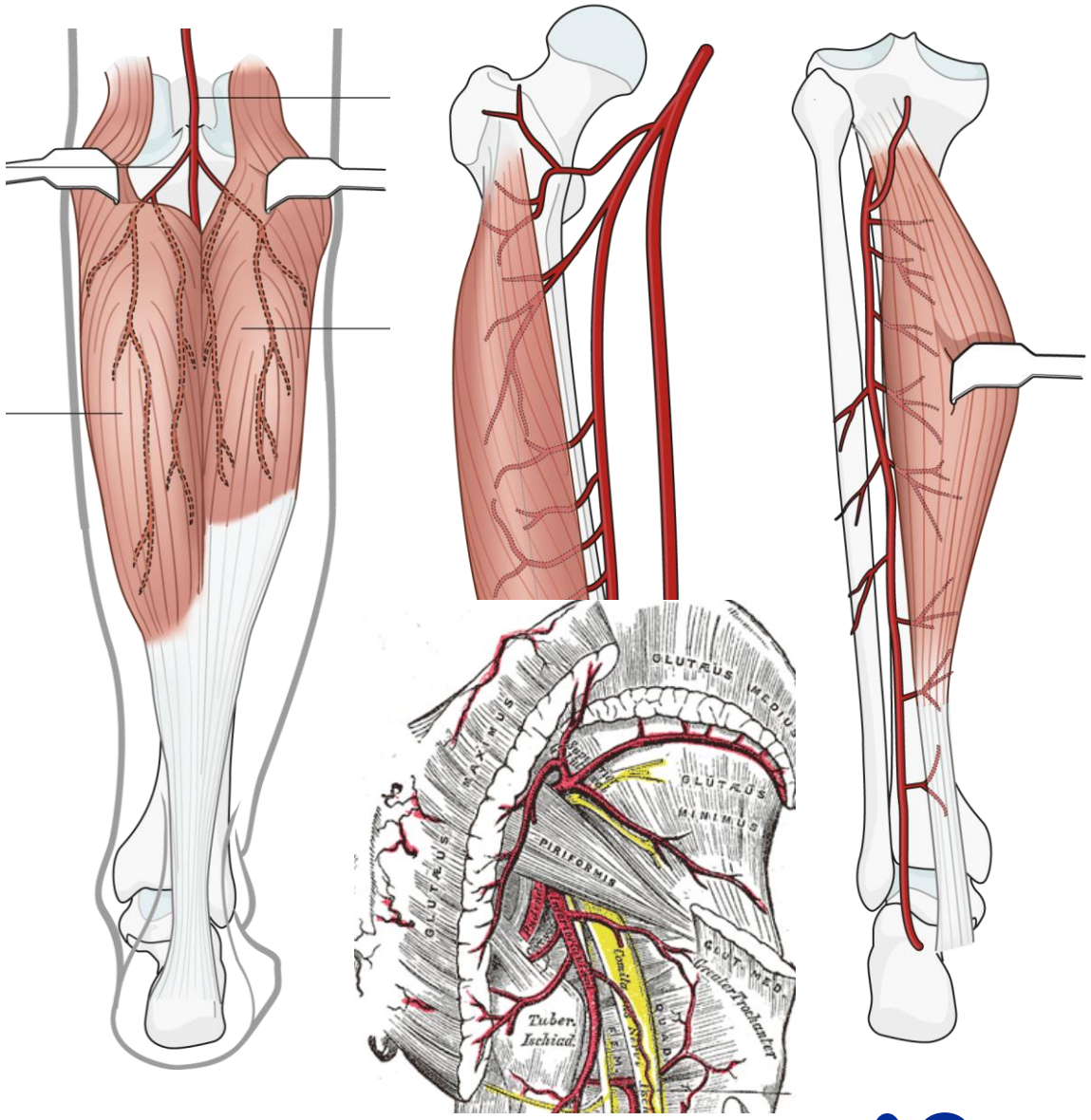
1. **Rhinelander FW.** Tibial blood supply in relation to fracture healing. *Clin Orthop Relat Res.* 1974 Nov-Dec;(105):34–81.
2. **Nelson GE Jr, Kelly PJ, Peterson LF et al.** Blood supply of the human tibia. *J Bone Joint Surg Am.* 1960 Jun;42-A:625–636

Blodforsyningen til musklen

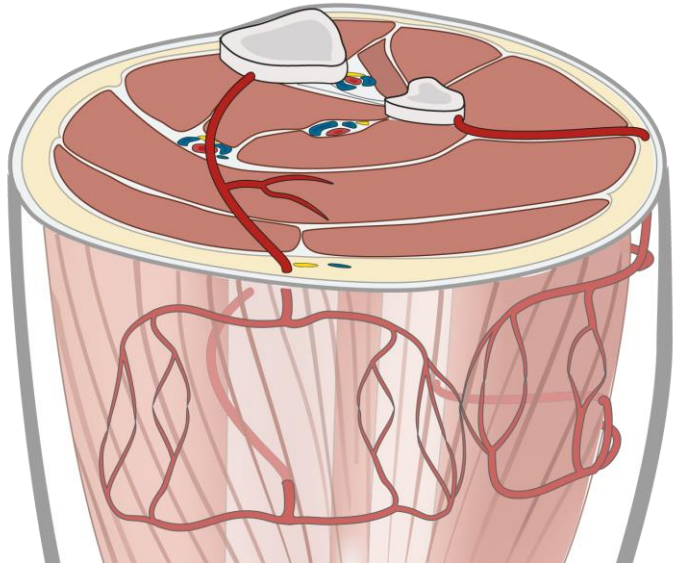
Kommer normalt fra navngivne arterier

Forskellige mønstre af blodforsyning

- Single pedicle (proximal)
- Single major pedicle + multiple minor pedicles
- Two major pedicles (m. glut. max.)
- Segmental pedicles



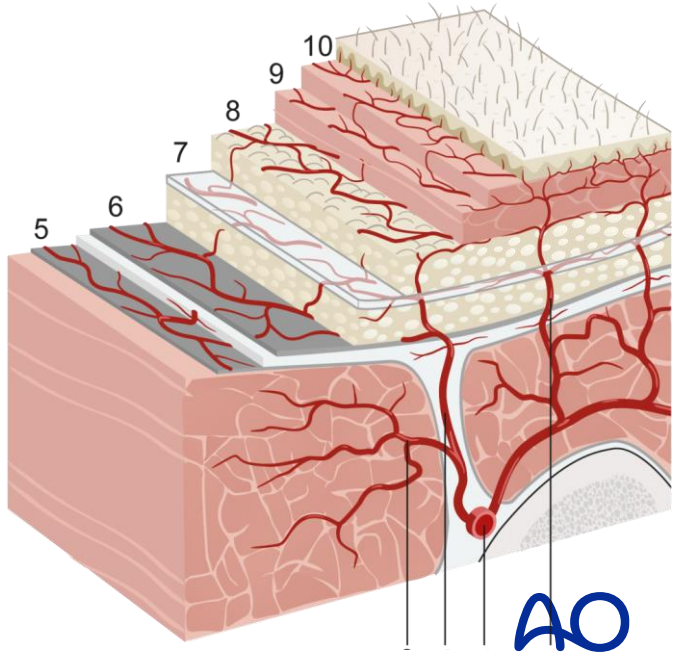
Blodforsyningen til huden



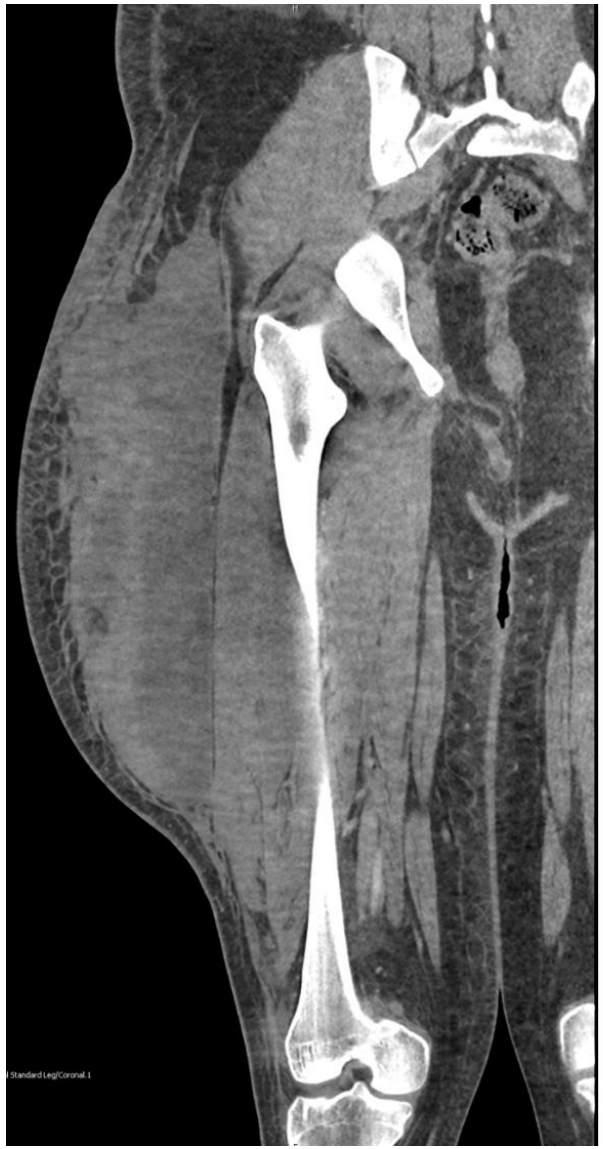
Direkte relateret til perforanterne

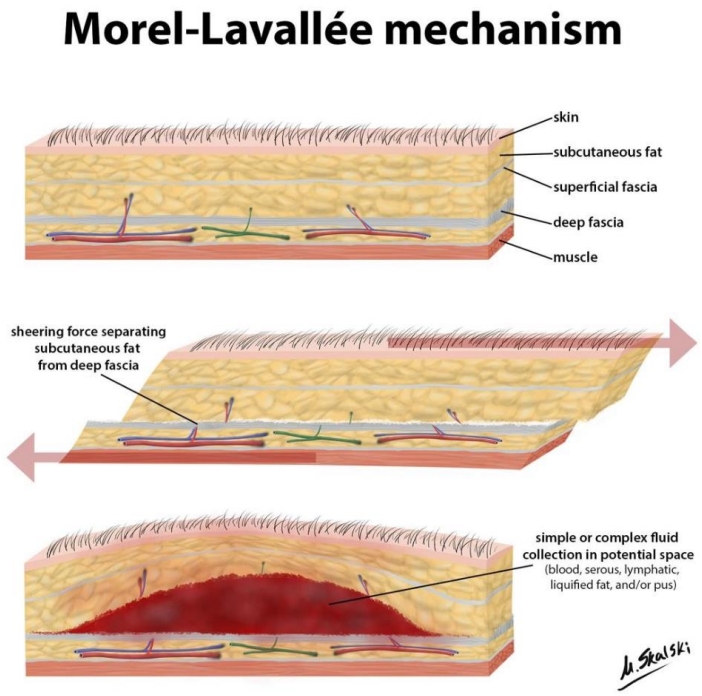
Perforanterne kommer gennem musklerne fra navngivne arterier

Pas på (!!) knogler uden muskeldække



Blodforsyningen til huden





Alt kirurgi ville være lettere uden bløddele, men…

Hud er den primære barrier ifht. infektion

Muskel

– Sørger for blodforsyning til huden
– Er nødvendig for bevægelse
– Beskytter knoglen

Periost

– Sørger for blodforsyning til knogle (ydre 1/3)

Altså respektér bløddelene – **kirurgiske teknikker**!

Beskrivelse af bløddele efter skade

Rent deskriptiv

AO soft-tissue classification

Gustilo klassifikation (åbne frakturer)

AO soft-tissue classification

Integumentum closed (IC)

- IC 1 = no skin injury
- IC 2 = contusion without skin laceration
- IC 3 = local degloving
- IC 4 = extensive, closed degloving
- IC 5 = necrosis due to deep contusion

Integumentum open (IO)

- IO 1 = skin perforated from inside out
- IO 2 = skin perforation from outside < 5 cm
- IO 3 = local degloving, contusion > 5 cm
- IO 4 = loss of skin, deep contusion
- IO 5 = open degloving

Neurovascular injury (NV)

- NV 1 = no injury
- NV 2 = isolated nerve injury
- NV 3 = local vascular injury
- NV 4 = combined neurovascular injury
- NV 5 = sub/total amputation

Muscle and tendon injury (MT)

- MT 1 = no injury
- MT 2 = isolated (one group)
- MT 3 = two or more groups
- MT 4 = loss of muscle groups, tendon
- MT 5 = compartment/crush syndrome

Åben fraktur klassifikation

Gustilo	
Type I	• Low energy • Minimal soft-tissue damage • Wound < 1 cm
Type II	• Higher energy • Laceration > 1 cm • No flaps/crushing minimal contamination • Slight comminution
Type IIIA	• High energy • Adequate soft-tissue coverage despite flaps/lacerations • Comminution/segmental fracture
Type IIIB	• High energy • Extensive soft-tissue stripping • Inadequate cover • Massive contamination
Type IIIC	• Vascular injury requiring repair

Infektion og Gustilo grad

Metaanalyse, åbne tibiafrakturer

Marvsømmet

Fracture grade	Number of studies	Number of fractures	Number of infections
I	9	469	18 (4%)
II	10	510	33 (6%)
III, A	7	186	31 (17%)
III, B-C	6	109	25 (23%)

International Orthopaedics 2014, 38:1025–1030

Heling og Gustilo grad

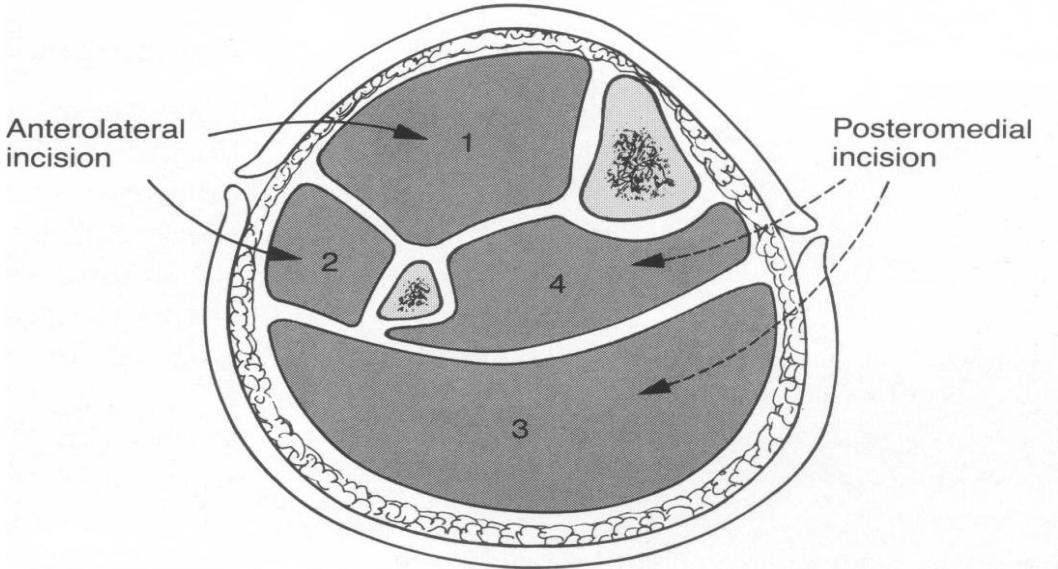
Gustilo grade, tibial fracture	Time to union
I	15 weeks
II	24 weeks
IIIA	27 weeks
IIIB	38 weeks
IIIC	74 weeks

J Bone Joint Surg Br 1990;72(4):605-11

Compartment syndrom

Dekompression af compartment

- Minimere yderligere bløddels skade
- Lange incisioner



I skadestuen

Standards for the management of
OPEN FRACTURES
OF THE LOWER LIMB

BAPRAS/BOA, 2009

ATLS – liv før lemmer

Åben fraktur:

- IV AB asap + tetanus
- Én eksposition
  - Værste snavs væk
  - Klinisk foto
- Fugtig meche + steril bandage
- Immobilisering + rtg

Kar-/nerveforhold?

Compartmentsyndrom?

Ud over fraktur og bløddele..

Pt faktorer

- Medicin
- Komorbitet
- Rygning
- Forventninger
- Andre skader

Energi

- Lav- vs højenergi

Team

- Har vi grejet?
- Er det mig der skal lave det?
- Specialeplan?

Infrastruktur

- Præhospitalt
- Sygehus

Take-home messages

En fraktur er (desværre) ikke bare en brækket knogle

Anerkend bløddelenes betydning for knogleheling

Hav kendskab til blodforsyning til både hud, muskel og knogle

Vær i stand til at vurdere og beskrive bløddelene

Mange faktorer bestemmer udkommet

Husk liv før lemmer

Spørgsmål?