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Transfemoral amputations, knee and hip disarticulations

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...moving beyond physical disability

Transfemoral Amputation

- The original lifesaver
- Most common higher level of amputation
- Good healing properties
- Short stump = difficult prosthetic fitting
- Sometimes possible with osseointegration



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Knee disarticulation

- Good for sitting
- Best prosthetic fitting above the knee
- Some problems with wound healing
- Alternative surgery available
- Good level for children with sarkoma



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Hip disarticulation

- Very rare
- Indications: malignancy and severe trauma
- Difficult to get good function with a prosthesis



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General surgical principals

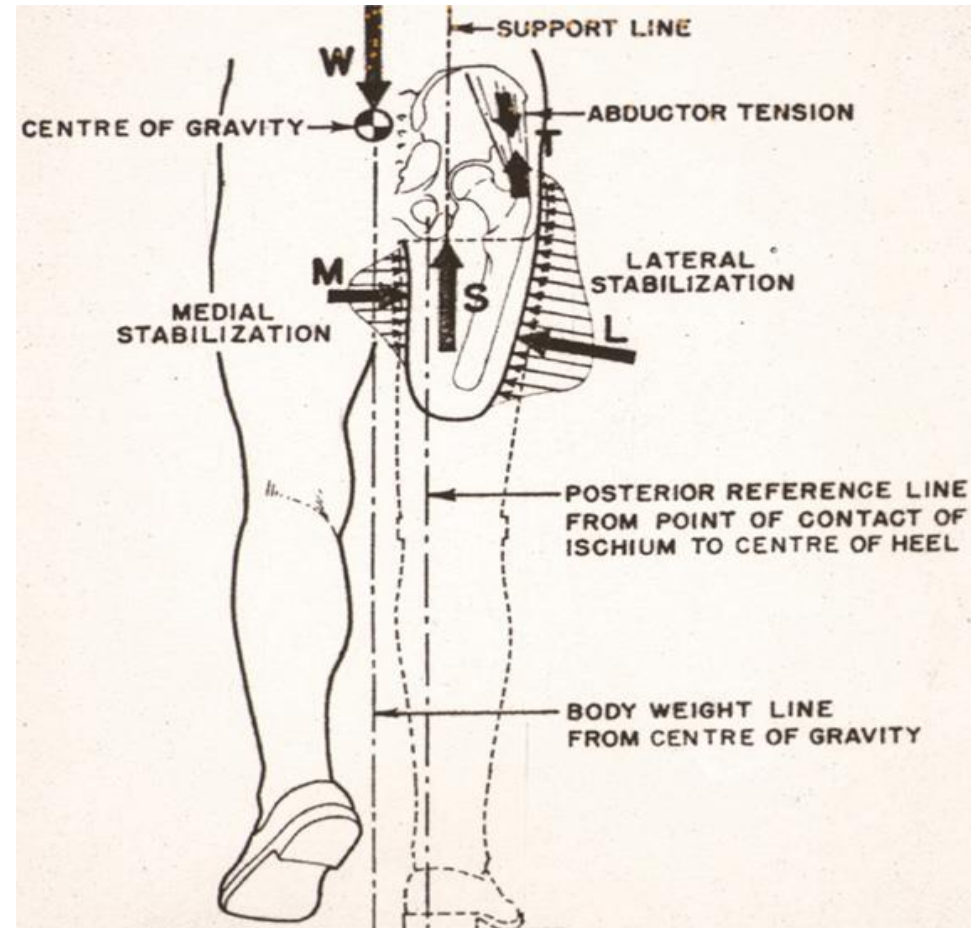
- Flaps designed before cutting
- Scalpel for skin
- Electrocautery for muscles and soft tissue
- Big vessels tied off
- Nerves pulled down and electrocautered
- Bones cut with oscillating saw



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Transfemoral Amputation

- Socket interface
- Indirect load
- Medial proximal and lateral stabilizing forces



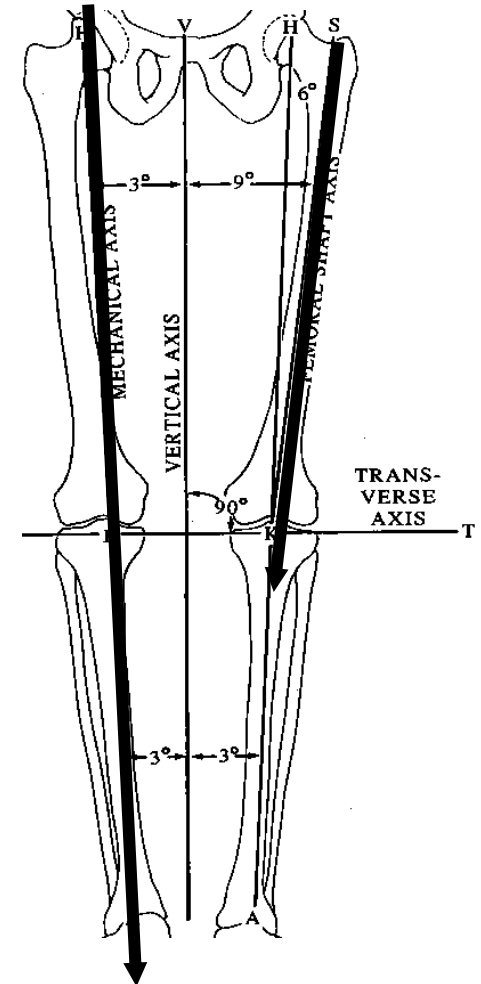
Transfemoral Amputation

- Socket shape does not affect position of femur
- Prosthetic alignment has no influence on femur position
- Surgical principles important
- Energy expenditure \uparrow > 65% with conventional amputation technique

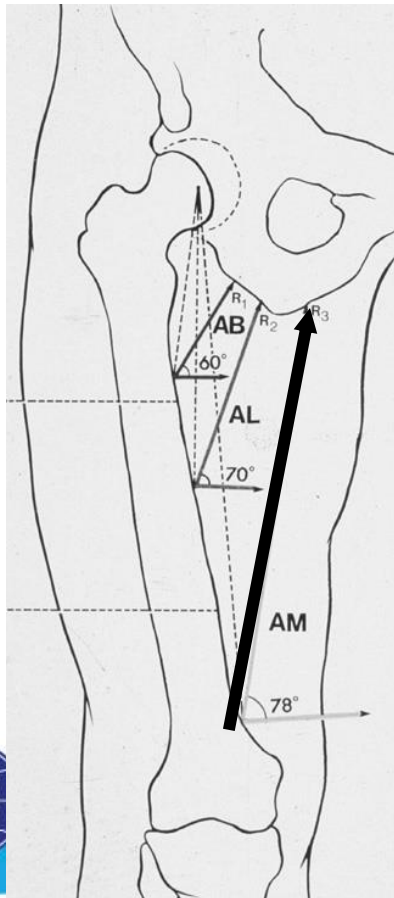


Biomechanics

- Normal lower limb alignment
- Femoral axis is 9° varus
- Mechanical axis - 3°
- Allows for energy efficient gait



Transfemoral Amputation



- Distal 1/3 amputation results in 70% loss of adduction moment
- Adductor Magnus is major thigh stabilizer in adduction



Biomechanics

- ↓ muscle strength
- ↓ adductor muscle mass
- Inadequate fixation
- Muscle atrophy

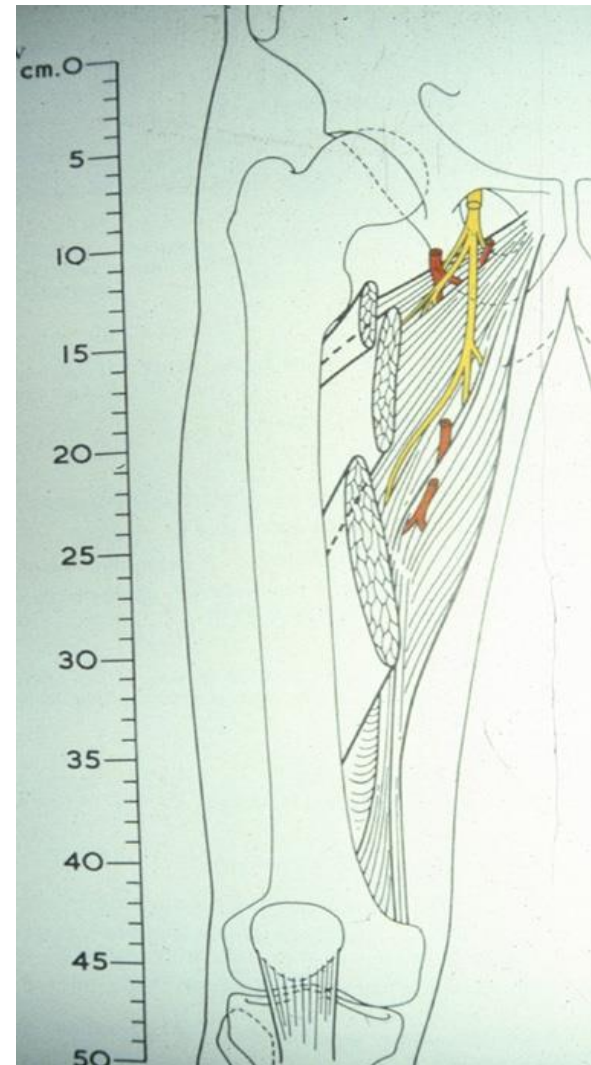


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Thiele B 1973

Biomechanics

- Adductor magnus
- Dual innervation
 - Obturator nerve
 - Sciatic nerve
- 3 – 4^x larger than longus and brevis



Brash 1954



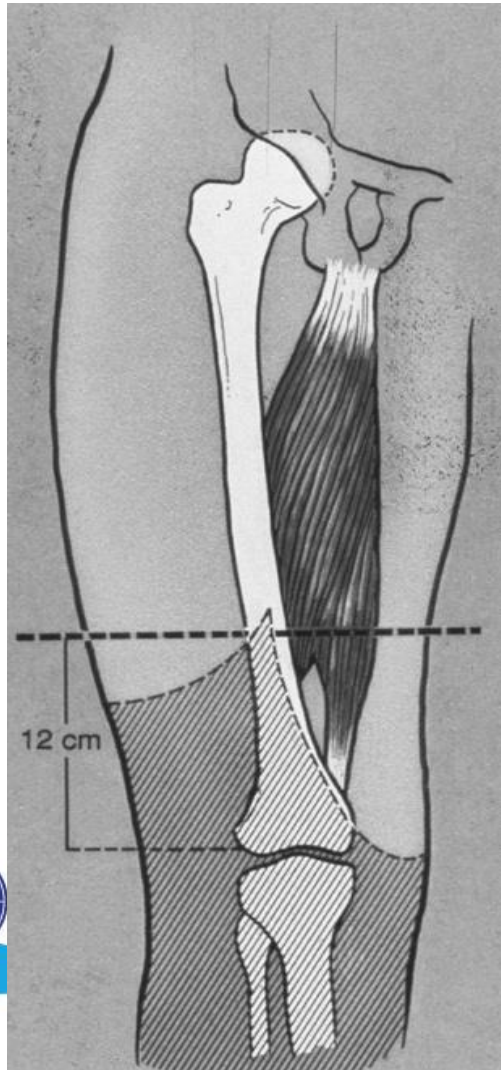
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Transfemoral Amputation

- Adductor magnus preserving amputation
- Blood supply from obturator artery; often remains patent in vascular disease
- Myodesis of Adductor magnus and Quadriceps.
- Muscle stabilization creates strong stump and easier prosthetic fitting



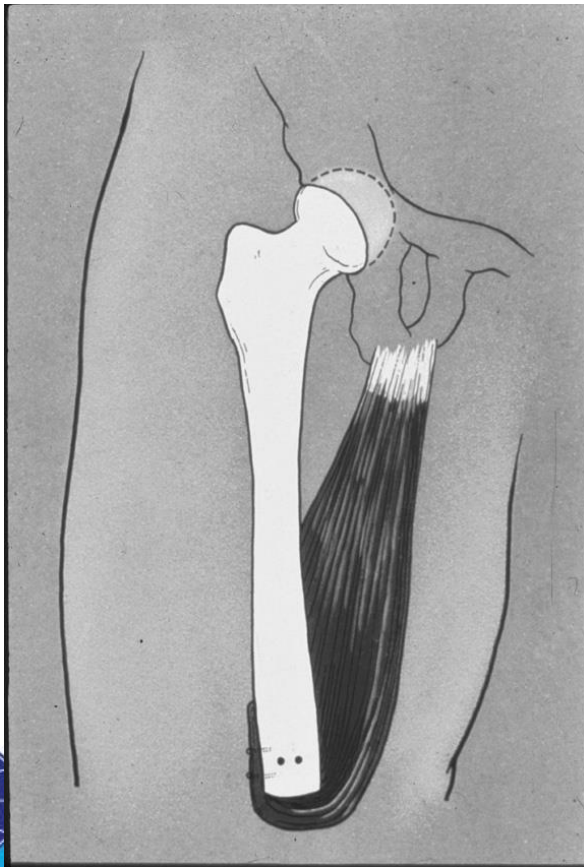
Transfemoral Amputation



- Use tourniquet
- Long medial flap
- Detach adductor magnus from tubercle
- Bone cut 12-14 cm proximal to joint
- Maintain attachment to linea aspera



Transfemoral Amputation

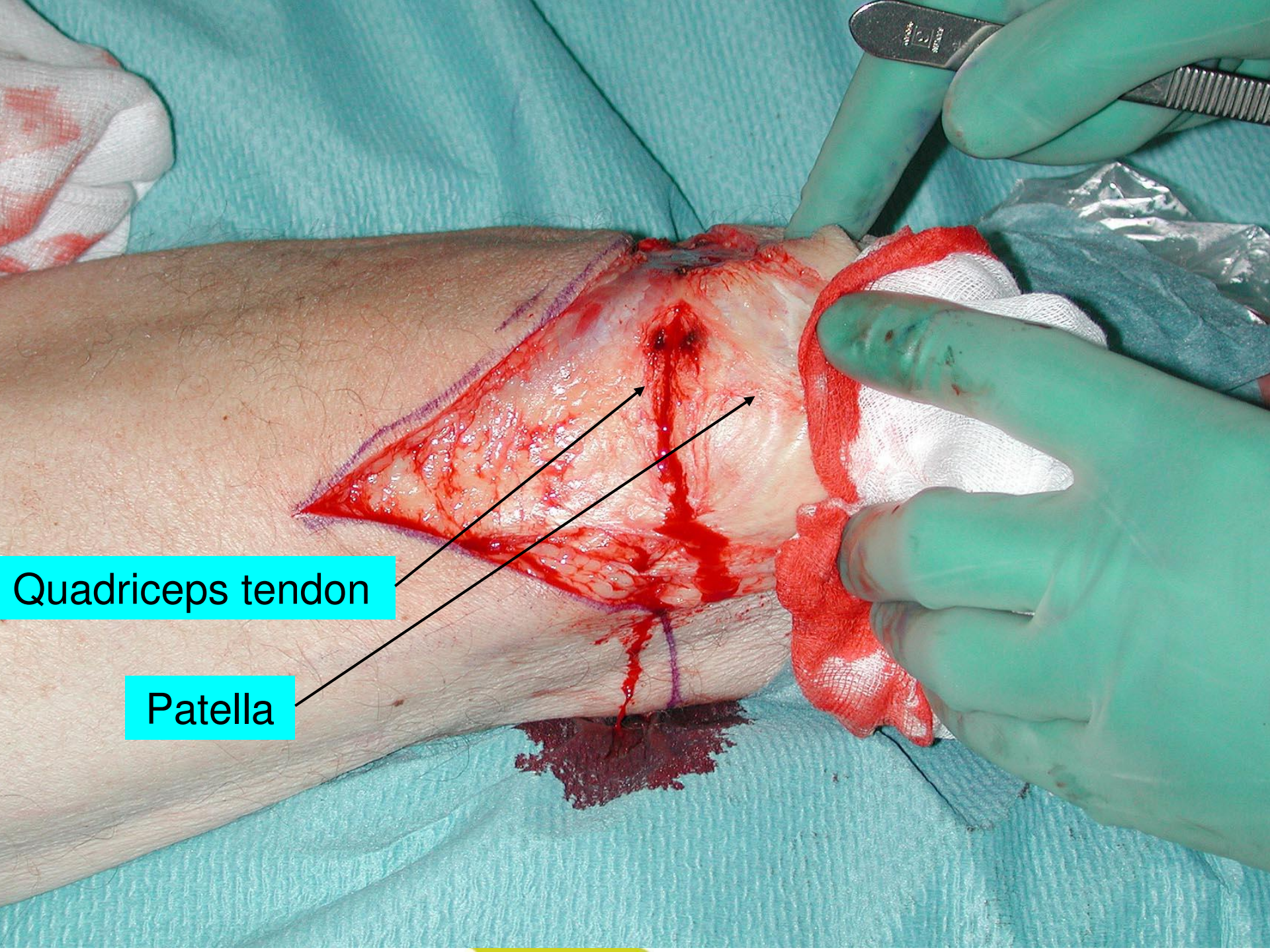


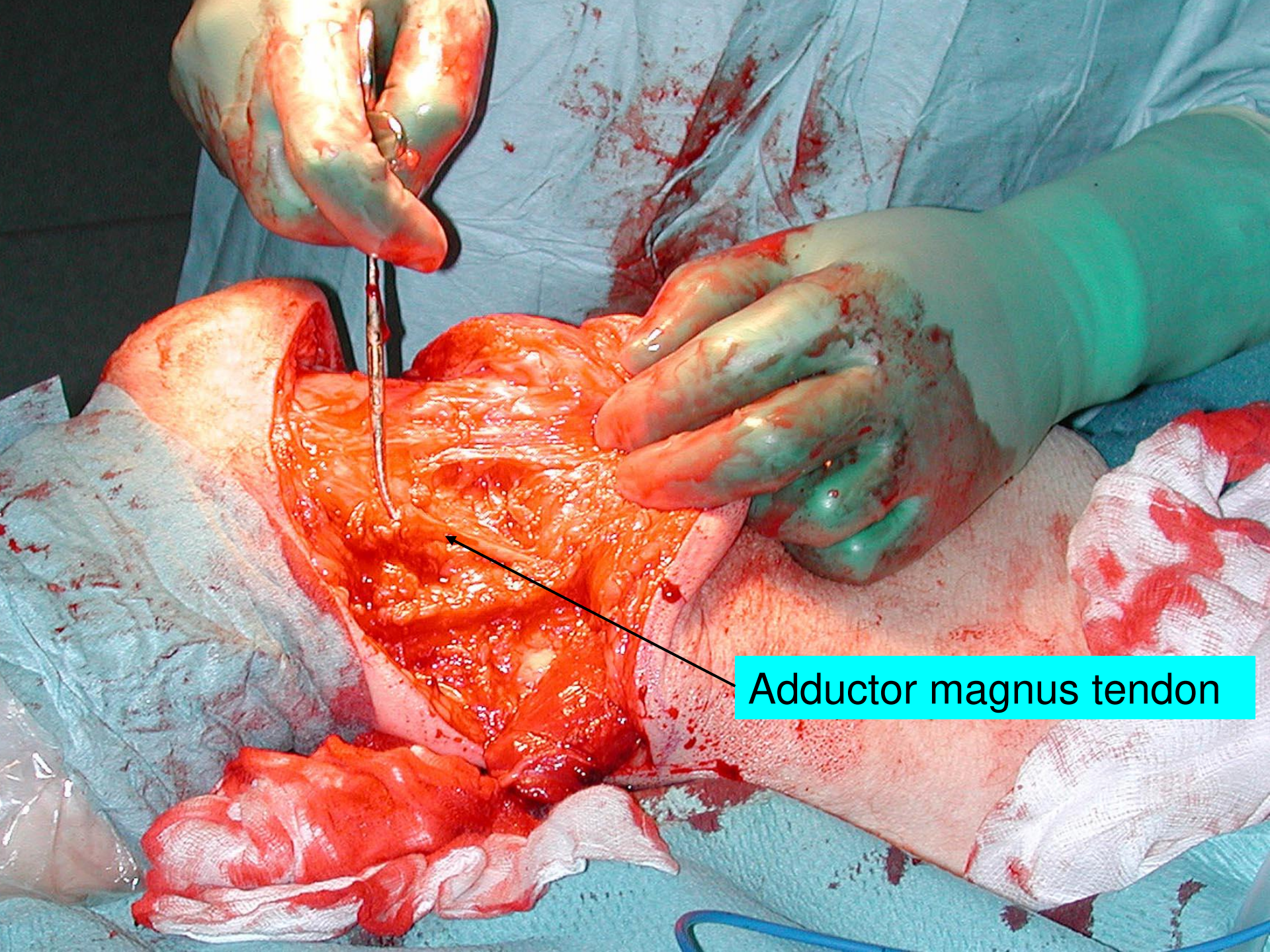
- Lateral and anterior drill holes
- Femur held in adduction
- Restore tension of adductor magnus



Quadriceps tendon

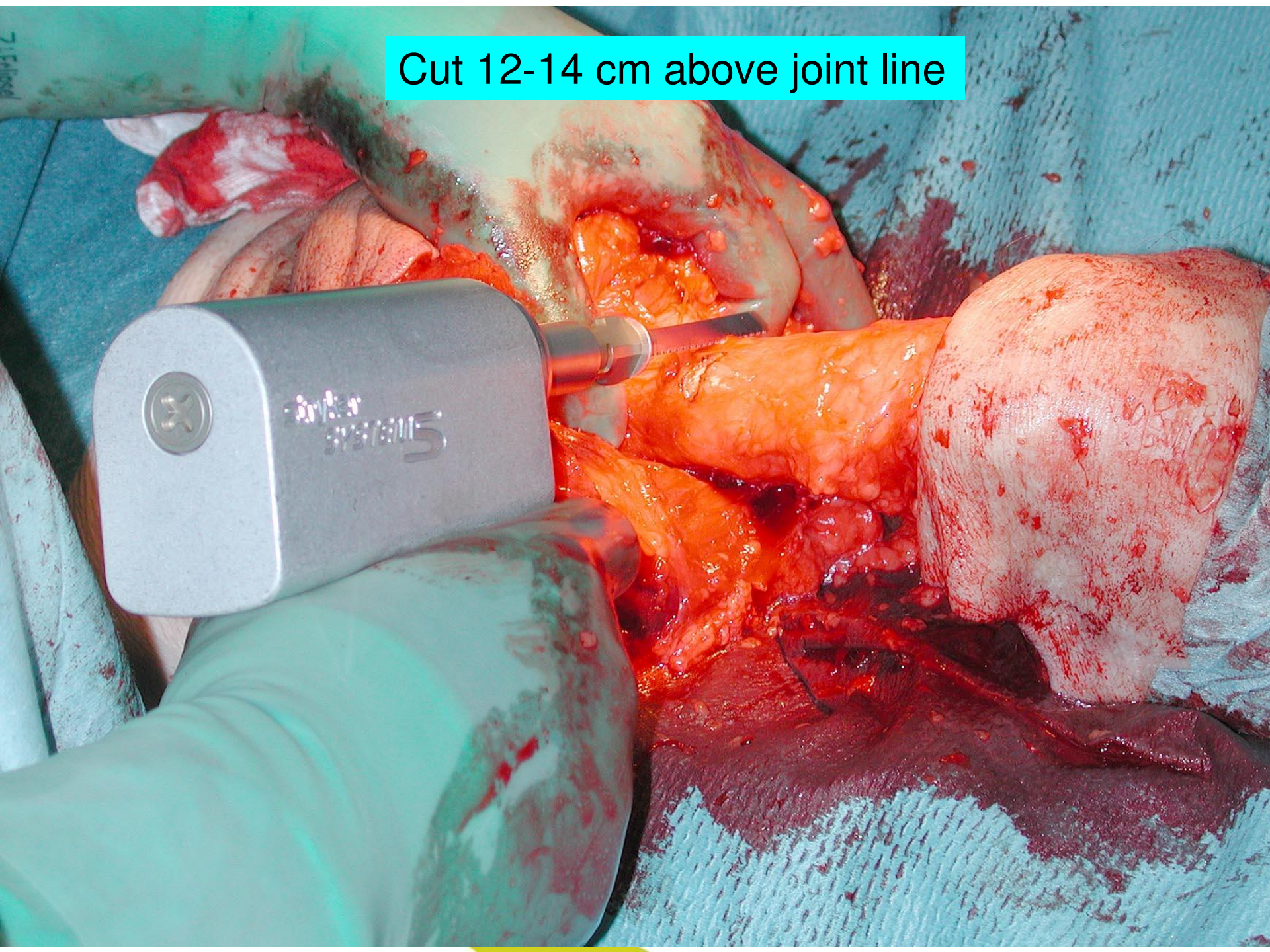
Patella





Adductor magnus tendon

Cut 12-14 cm above joint line





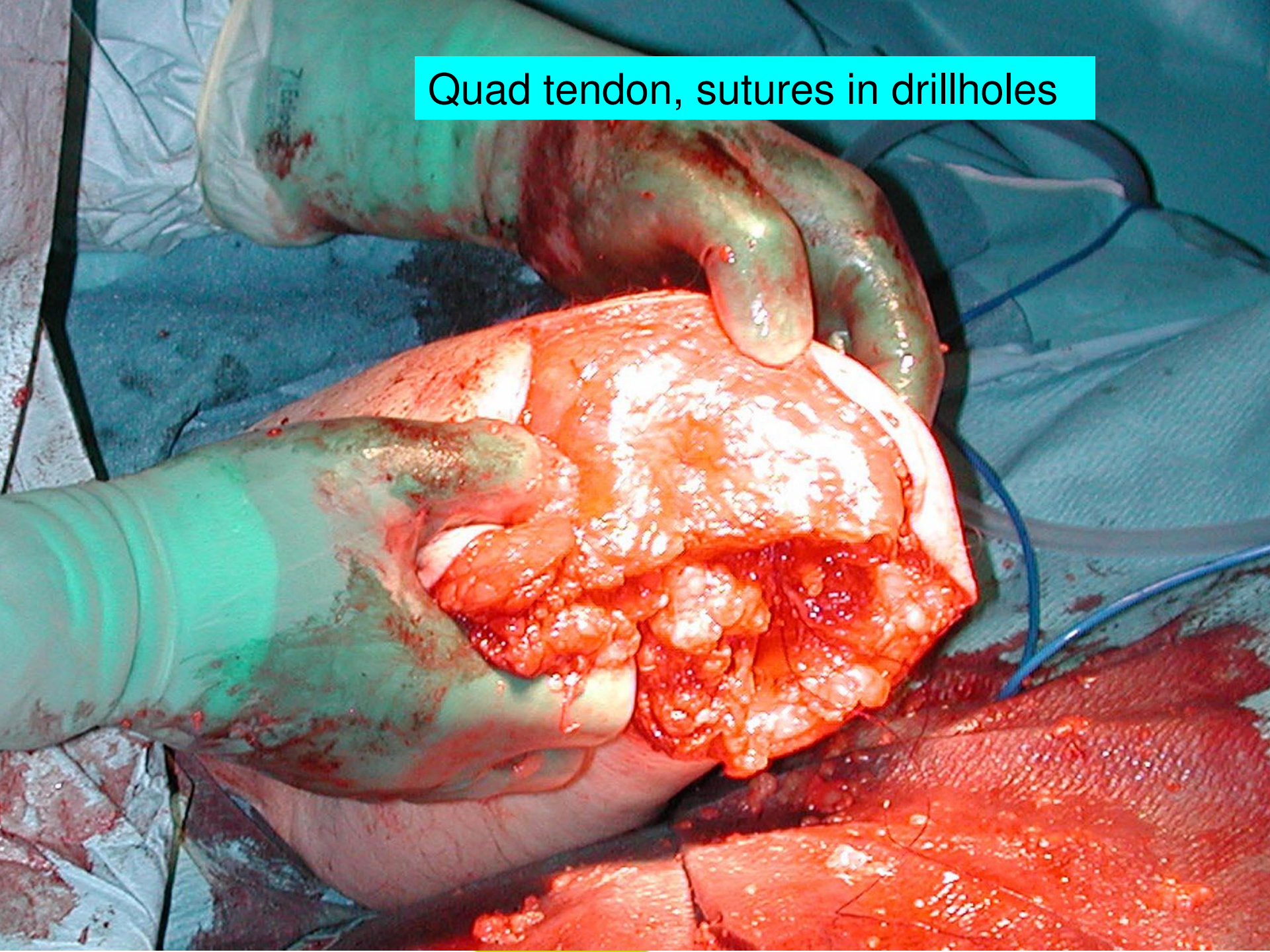
Drill holes in distal lateral femur

Courtesy J
Bowker



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Quad tendon, sutures in drillholes





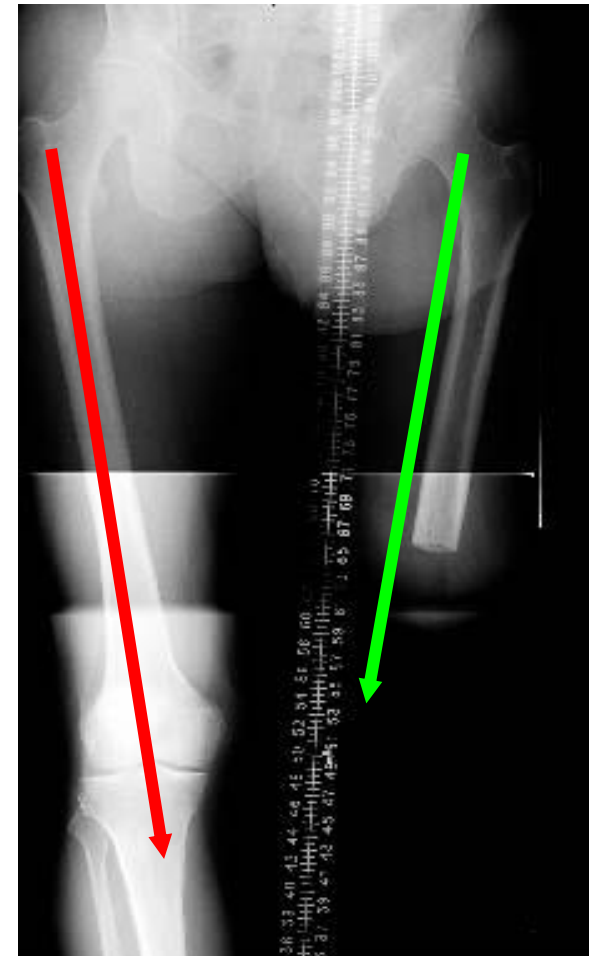
Healed Gottschalk- stump



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Transfemoral Amputation

- Femoral axis maintained
- Soft tissue stable



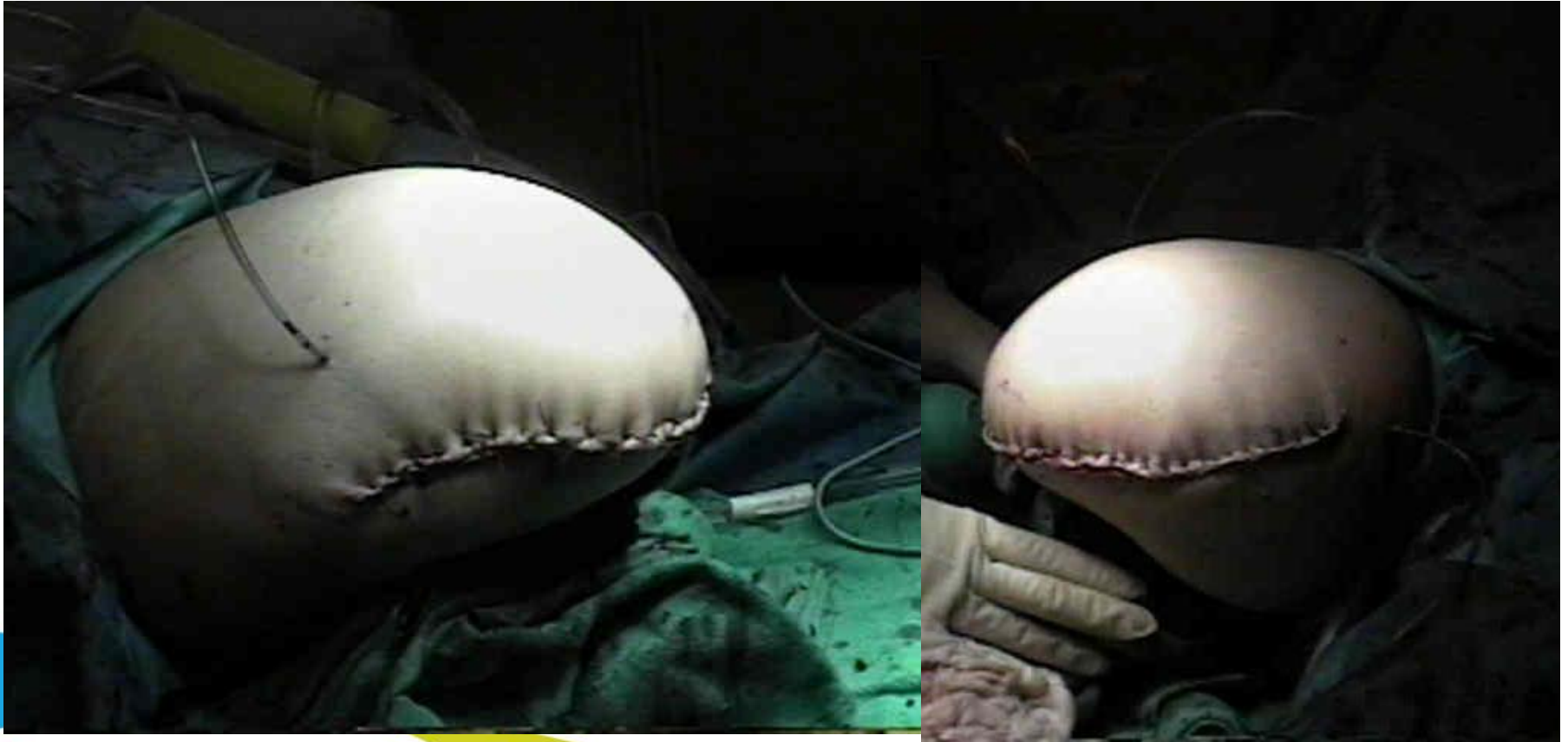
Amputation for non walking patients

- Fish mouth incision
- Myoplasty (fascia to fascia) is enough
- Start with medial muscles to lateral muscles
- Continue with anterior to dorsal muscles
- Soft dressing, compression is recommended

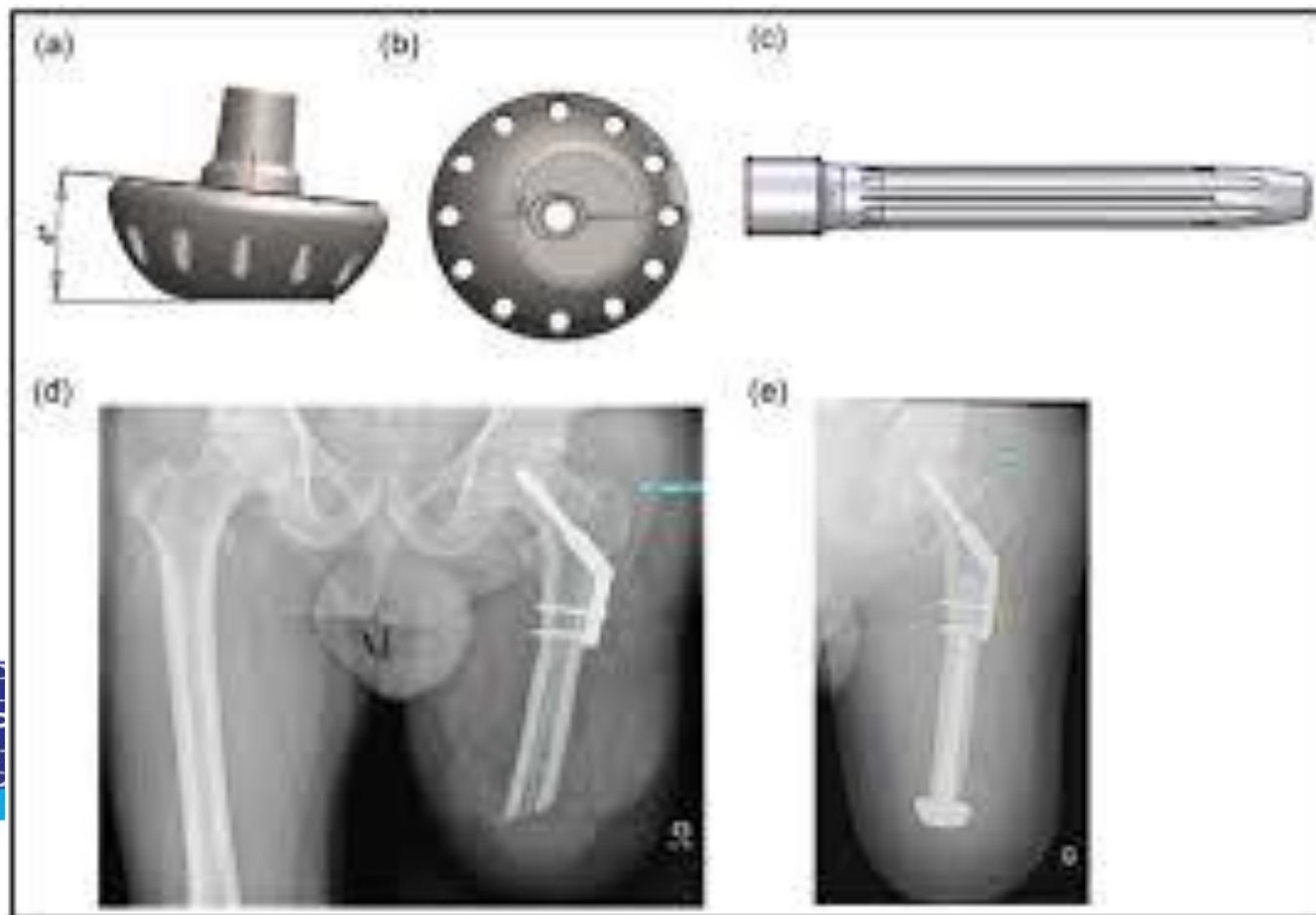


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Transfemoral amputation fishmouth



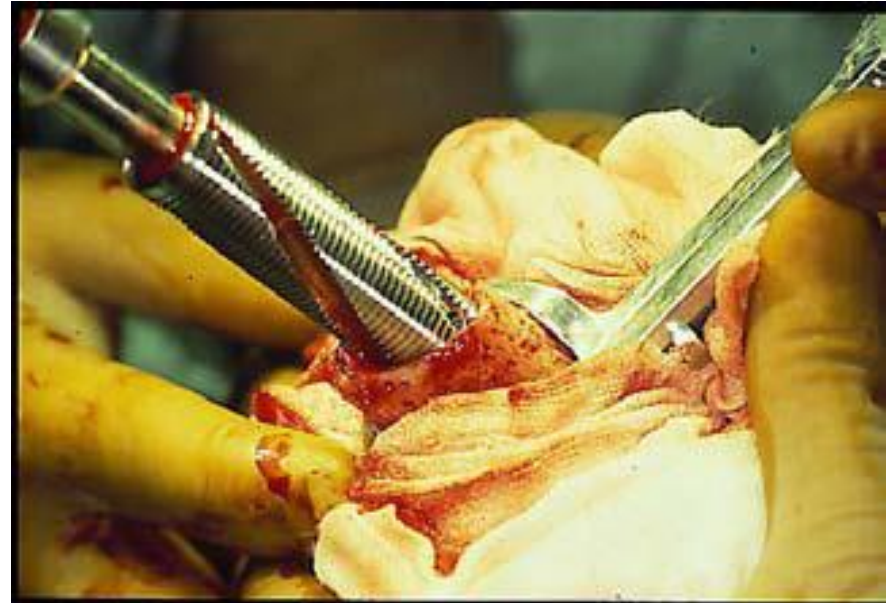
New developments of TFA





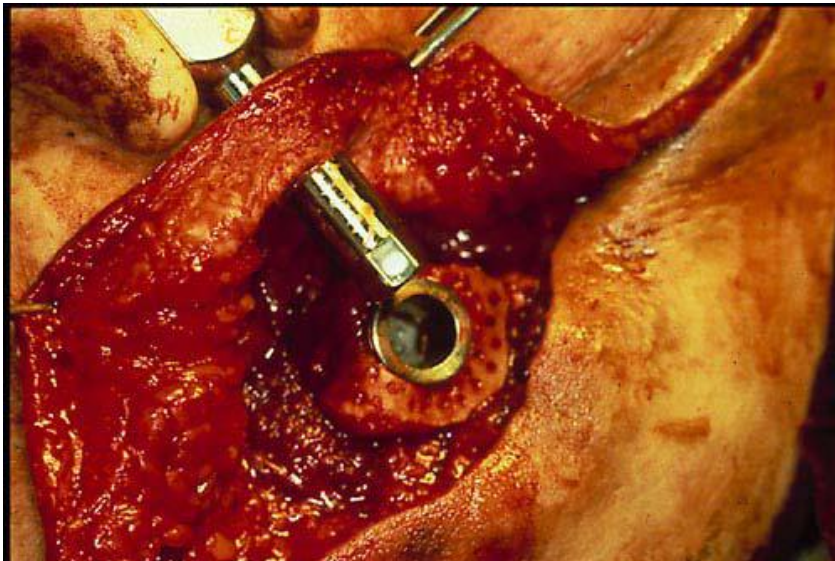
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Osseointegration 1



Rickard Brånemark, Sahlgrenska sjukhuset Göteborg, Sweden

Osseointegration 2



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Rickard Brånemark, Sahlgrenska sjukhuset Göteborg, Sweden

Osseointegration in function

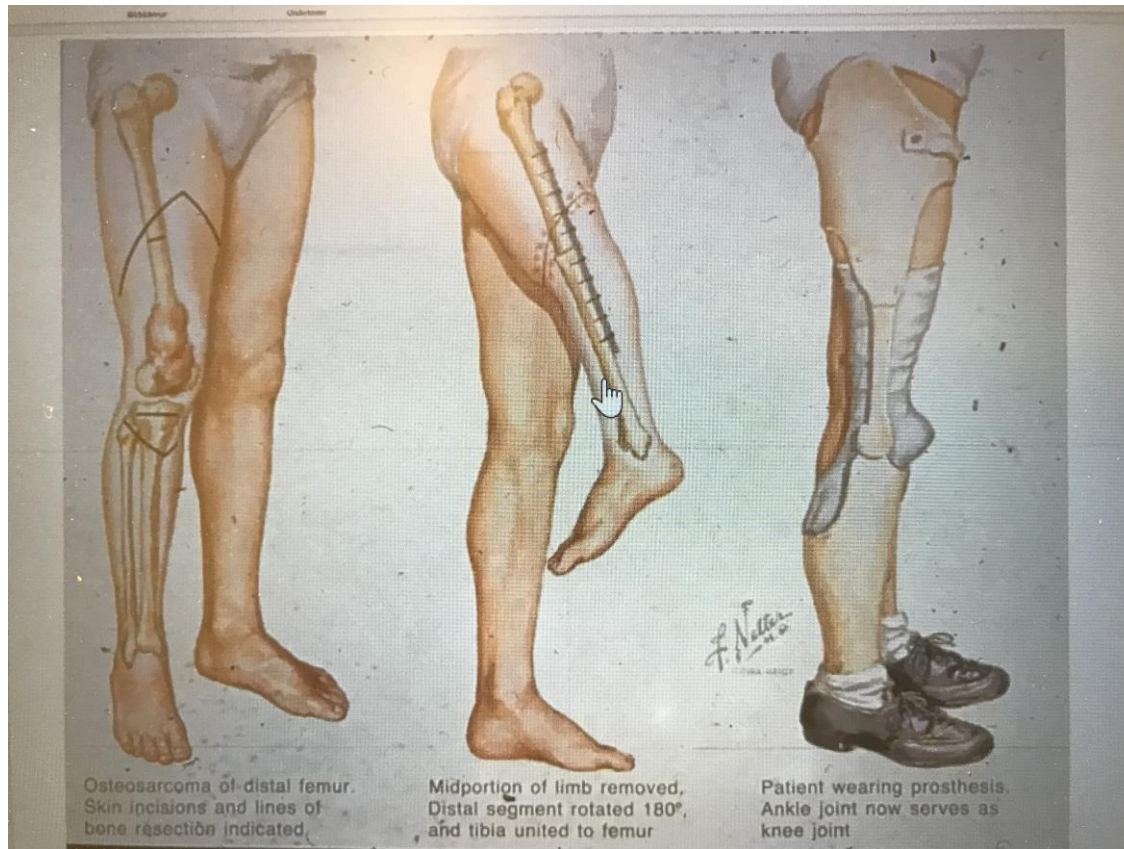
- Need solid femur
- Reasonably healthy
- Psychologically stable
- Some problems with infections
- Stability and sensation biggest gains
- Improved sitting comfort



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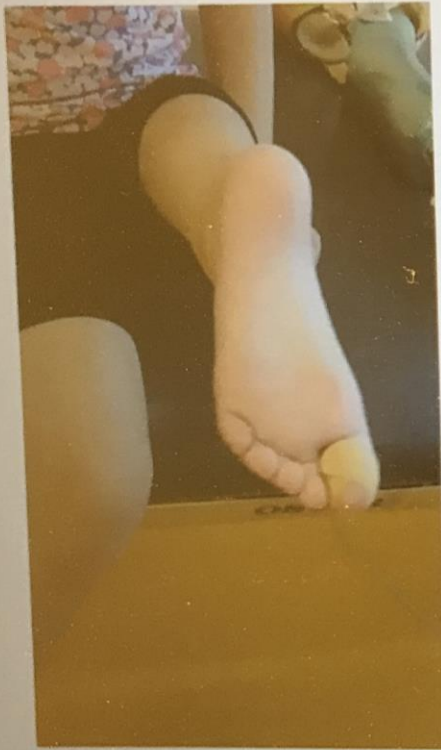


Van Ness rotationplasty



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Van Ness rotationplasty



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Van Ness rotationplasty

- lokal excision
- vid marginal
- van Nes rotationsplastik

femur



tibia



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Van Ness rotationplasty

- frisk 15 år postop.
- springer och spelar fotboll med protes

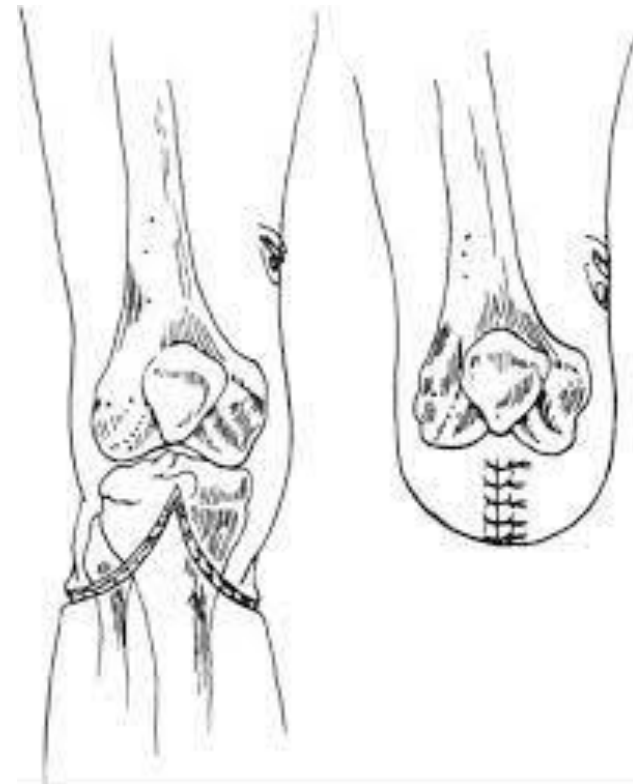
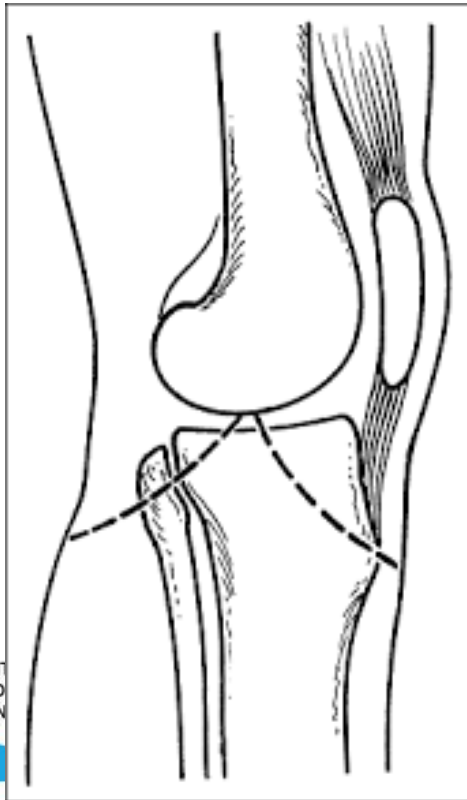


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Van Ness Rotationplasty



Knee disarticulation



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AN

Knee disarticulation

- The original one with or without tying down the patellar tendon to the cruciate



Knee disarticulation

- Sagittal flaps



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- Often skin problems dorsally

Knee disarticulation anterior-posterior



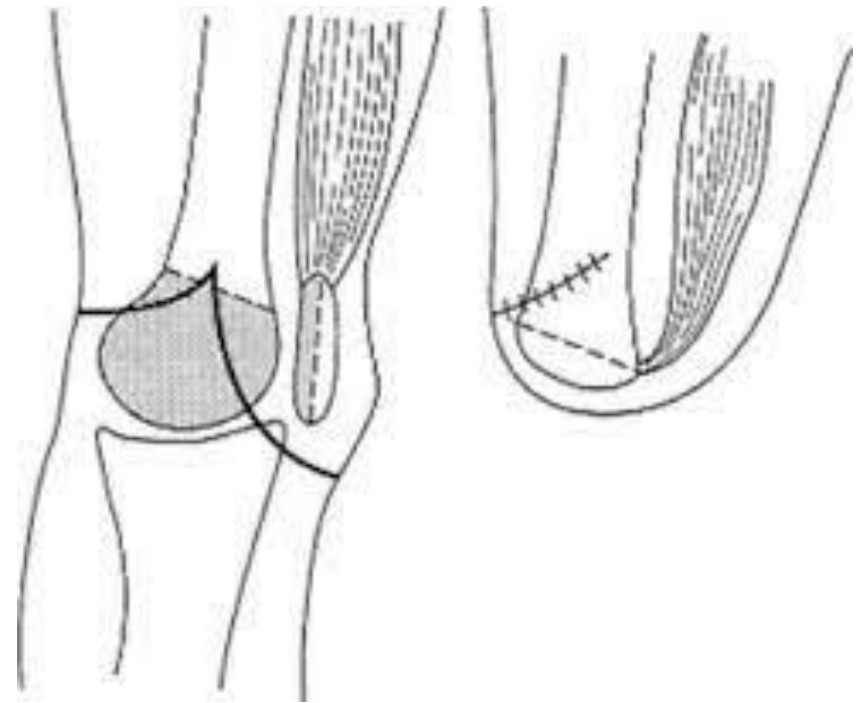
Knee disarticulation with prosthesis



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Knee disarticulation

- Gritti-Stokes is an alternative method
- Higher risks
- Shorter stump with good end bearing capacity
- Patella fastened with sutures or screws



Knee disarticulation

- Shortening can be an option in wound healing problems
- Not for dysvascular patients

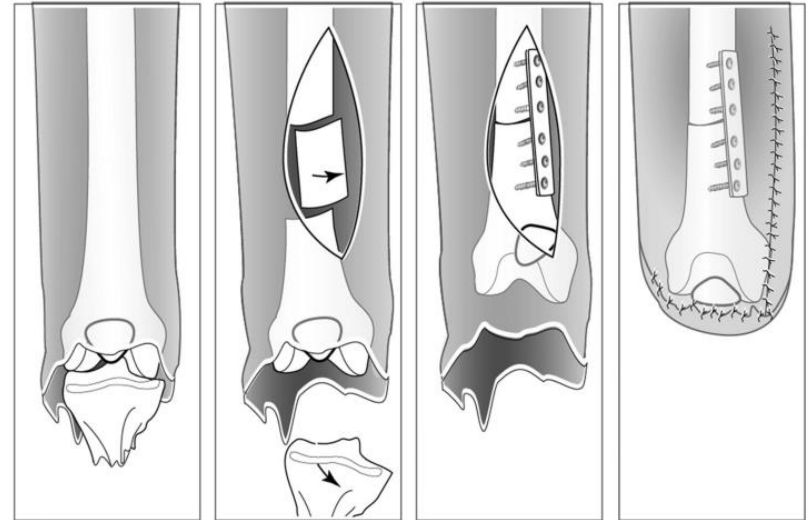


Fig. 1
Operating procedure: shortening osteotomy of the femur.



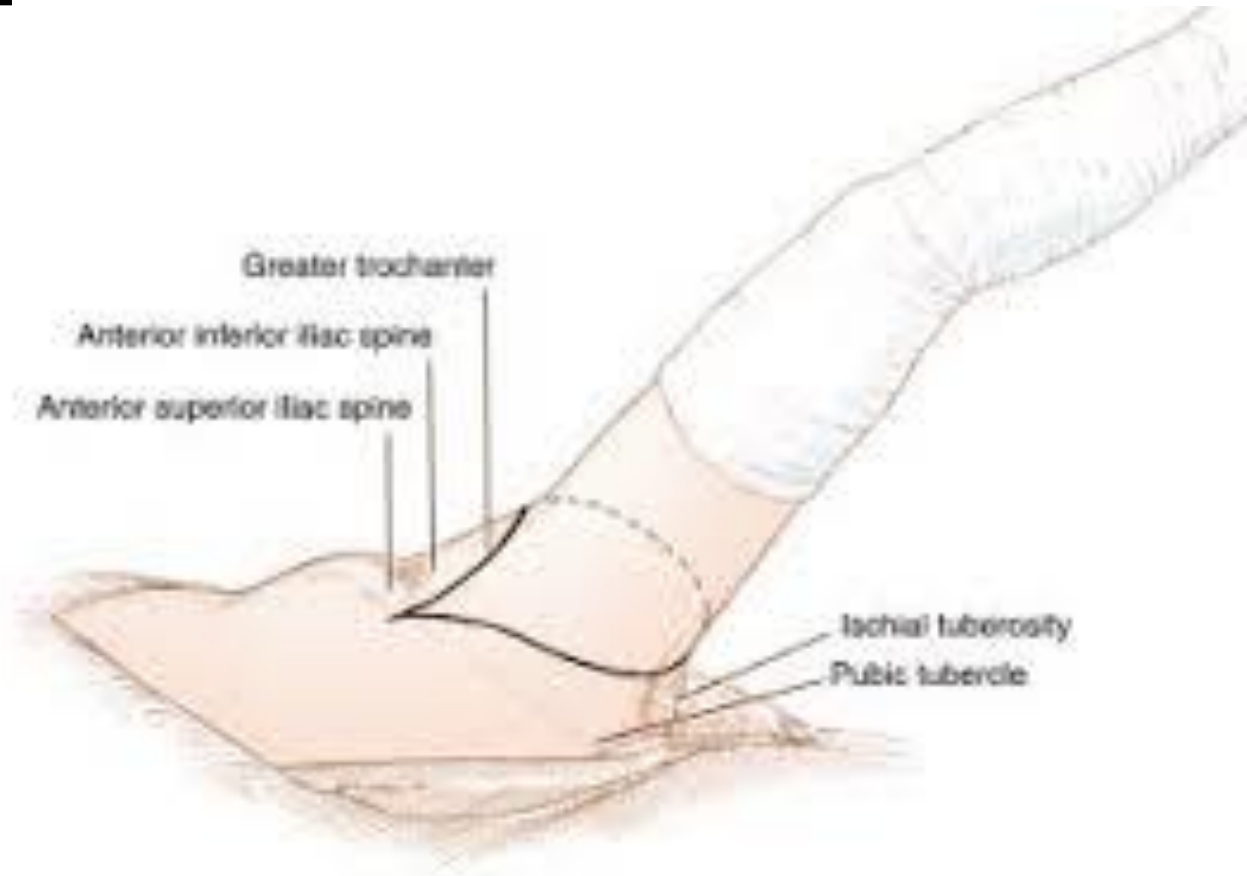
Hip disarticulation

- Almost exclusively tumour patients
- Average 15 patients per year in Sweden



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Hip disarticulation



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Basic principals for hip disarticulation

- Posterolateral position
- Design flaps
- Start anteriorly
 - Skin incision
 - Vessels and nerv
 - Muscles from lateral to medial off the pelvis
 - Iliopsoas and obturator muscles cut at lesser troch
 - Quadratus femoris preserved
 - Flexors cut at ischial tuberosity

Basic principals for hip disarticulation

- Move the patient to anterolateral
- Continue posteriorly
 - Skin incision
 - Incise fascia and divide the fascia lata
 - Transect the muscles to the greater trochanter
 - Divide the joint caspule
 - Pull down and divide the sciatic nerve to retract
 - Remove the leg
 - Close the opening whith the saved muscles to inguinal ligament
 - Skin closure



Hip disarticulation

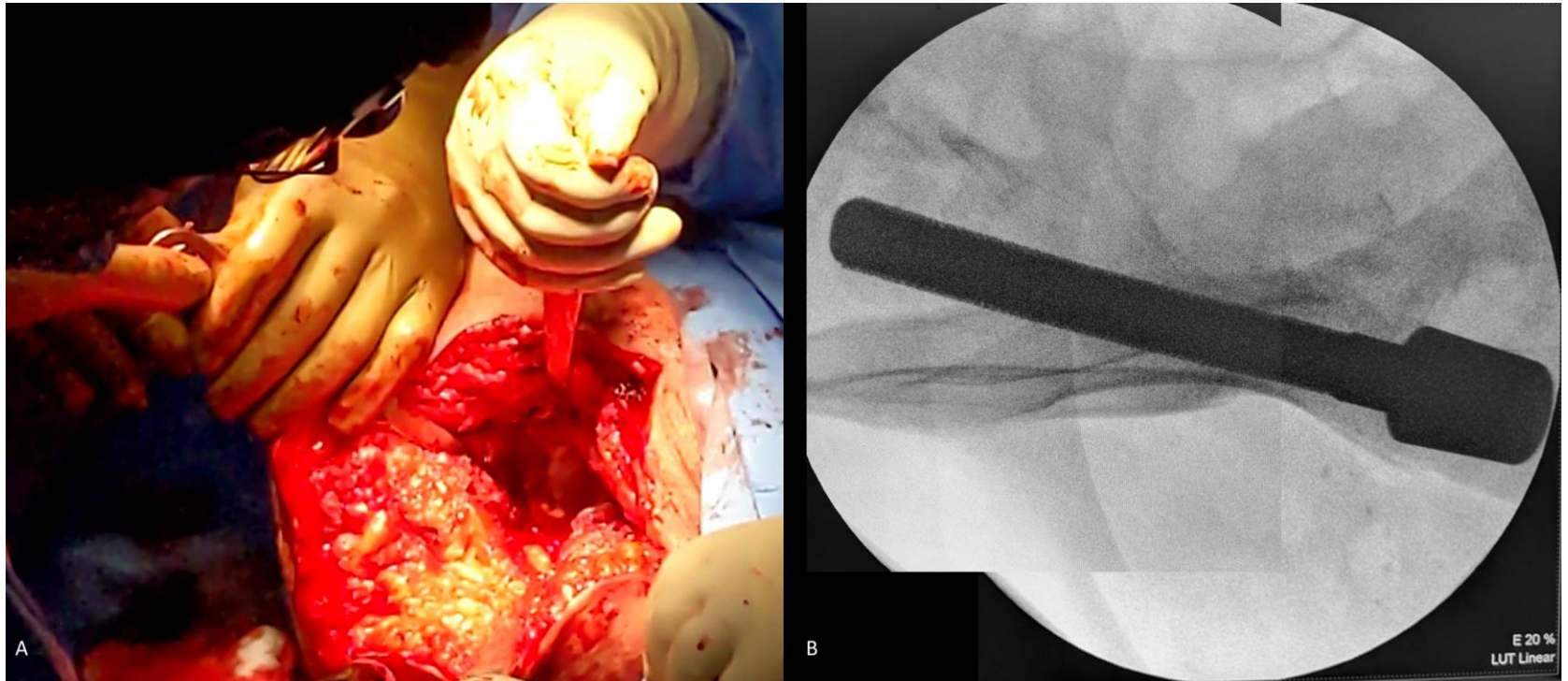


Hip disarticulation



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Hip disarticulation w osseointegration



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Hip disarticulation w osseointegration



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Hip disarticulation w osseointegration



Hip disarticulation w osseointegration



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Hemipelvectomy

- Extremely rare
- Malignancy
- Sitting is very difficult
- Prosthesis very heavy and difficult to use



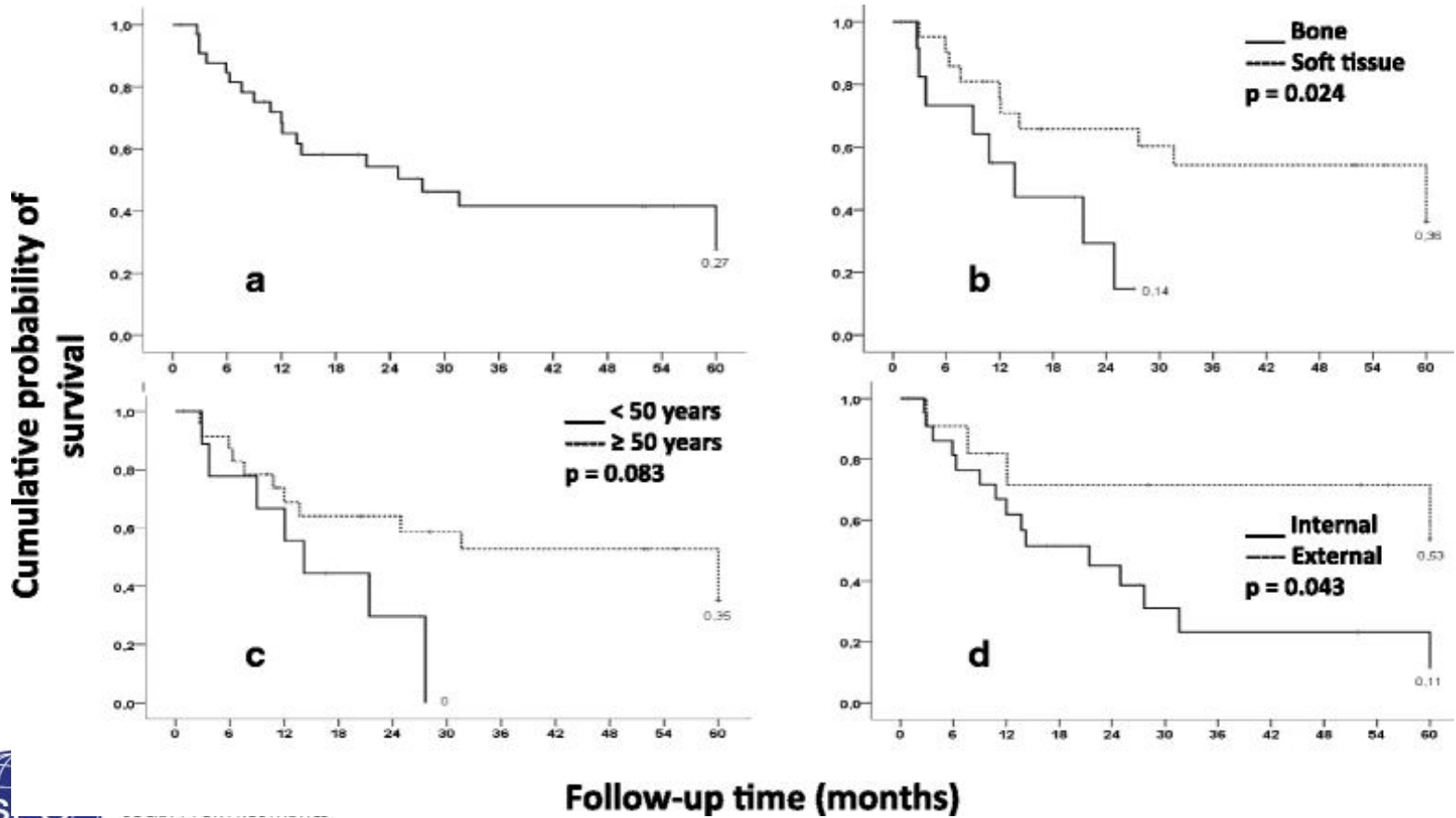
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Hemipelvectomy



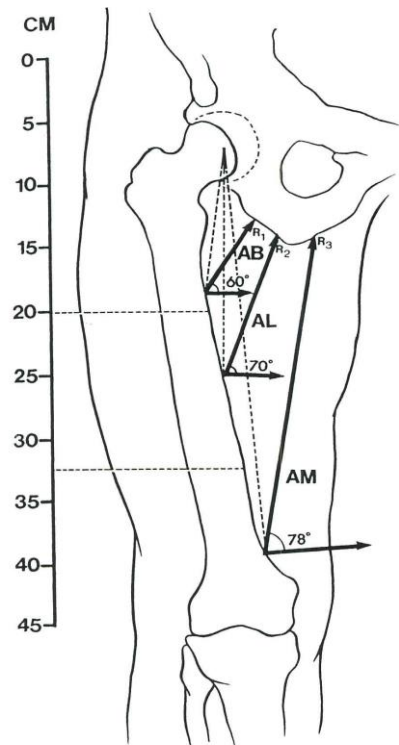
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Hemipelvectomy



Kaplan-Meier

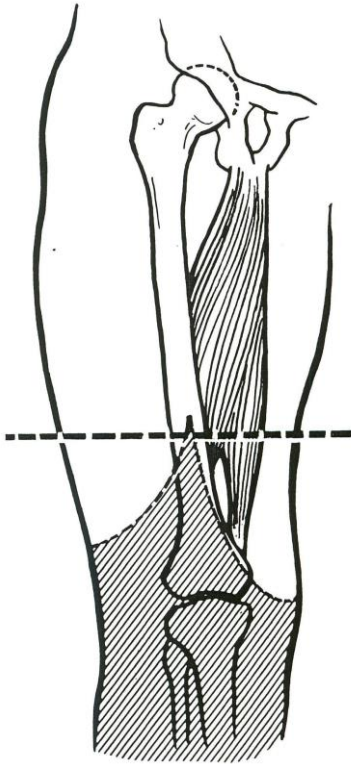
Gottschalk 1



- Bad control of femur means bad walking ability
- Prosthetic design can not compensate for this
- Adductor magnus is the most important muscle biomechanically



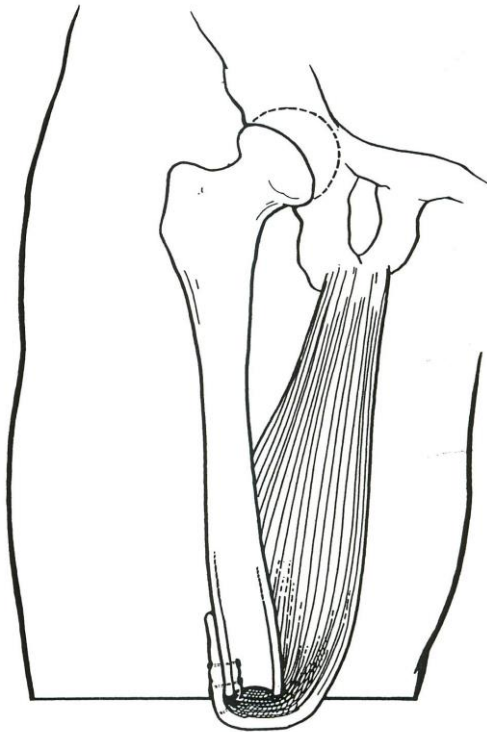
Gottschalk 2



- Longer medial flap
- Release adductor magnus sharply
- Cut Q-ceps close to patella
- Cut hamstrings a few cm distal to the planned bone cut
- Cut femur 12 to 14 cm above the joint line



Gottschalk 3



- Several drill holes laterally, anteriorly and dorsally
- Secure adductor tendon with femur in adduction
- Suture Q-ceps to dorsal holes
- Hamstrings to the tendons

