Approaches to the Knee Joint

Primary and Revision

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APPROACHES

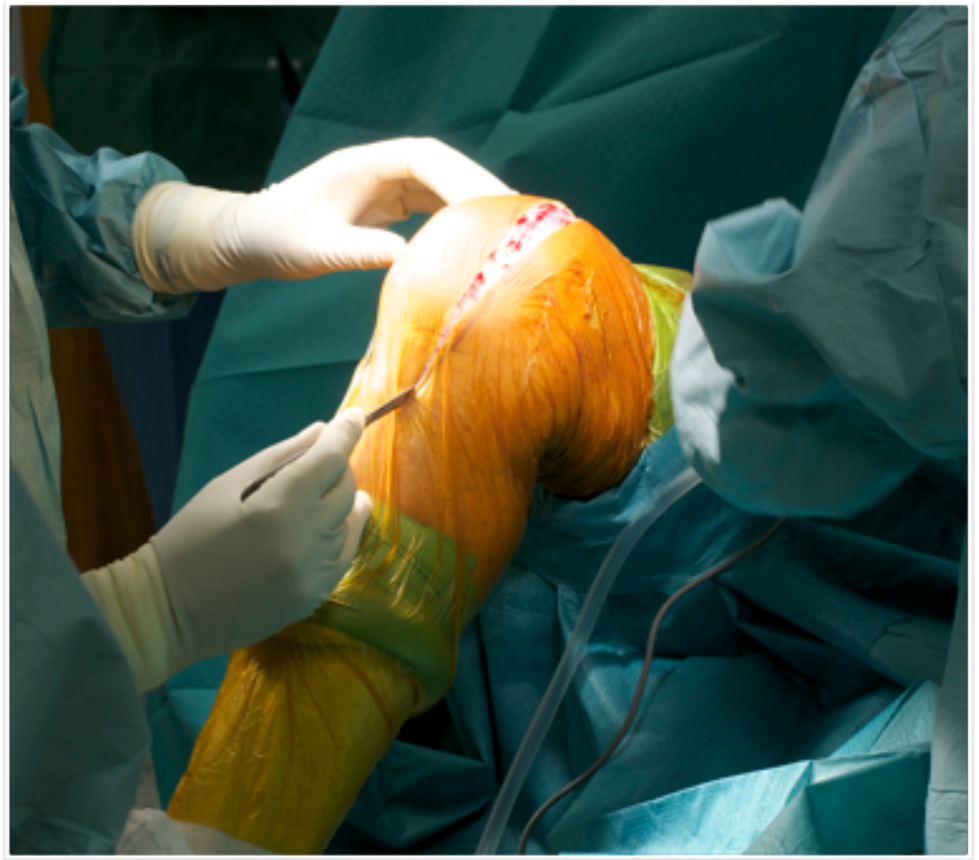
- Primary TKA
  - Medial Parapatellar (MPP)
  - Subvastus (SV)
  - Midvastus (MV)
  - Lateral Approach (Keblish)

APPROACHES

- Revision TKA
  - MPP
  - Quadriceps Snip
  - V-Y Quadricepsplasty (V-Y Turndown)
  - Tibial Tubercle Osteotomy (TTO)

PRIMARY TKA APPROACHES

GENERAL PRINCIPLES



- SKIN INCISION
  - Type
    - standard anterior midline incision
    - medial parapatellar incision
      - better oriented in relation to the cleavage lines about the knee
      - less tension during flexion: medial to the skin stress zone

PRIMARY TKA APPROACHES

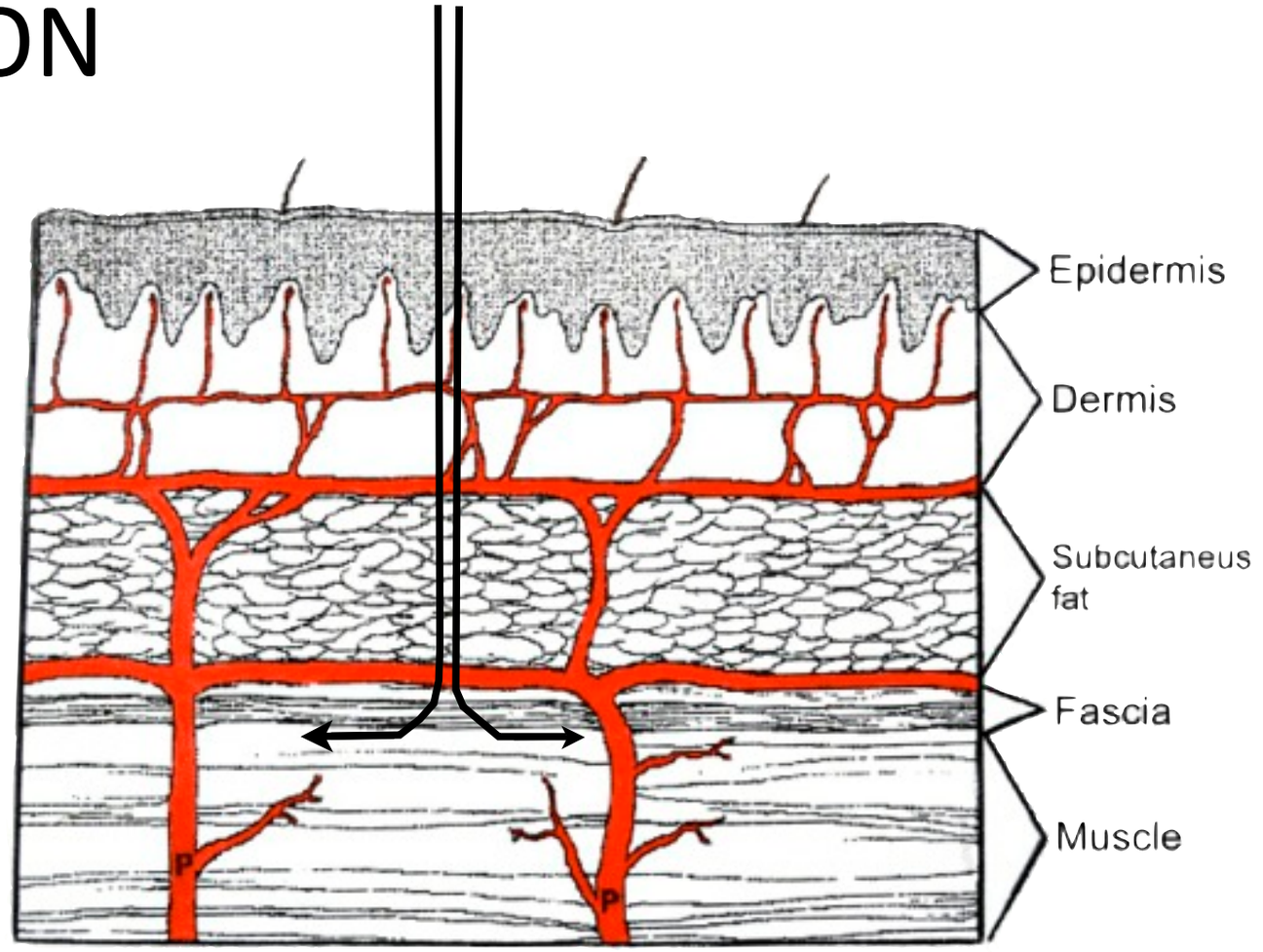
GENERAL PRINCIPLES

- SKIN INCISION
  - Length
    - no influence on pain
    - no influence on early recovery
    - skin corners:
      - U: under tension
      - V: no tension

PRIMARY TKA APPROACHES

GENERAL PRINCIPLES

- SOFT TISSUE DISSECTION
  - blood supply to the skin: supplied by perforating arteries, superficial to the deep fascia
  - creation of full-thickness skin flaps, deep to the fascia



PRIMARY TKA APPROACHES

GENERAL PRINCIPLES

- MIS TKA
  - Definition
    - short skin incision
    - no eversion of the patella (better flexion, better Q-force, less patella baja)
    - minimizing dissection in the suprapatellar pouch
    - sparing of the Q-muscle

PRIMARY TKA APPROACHES

PRE-OP PLANNING

- MEDICAL HISTORY
  - peripheral vascular disease
  - poorly controlled Diabetes Mellitus
  - chronic corticosteroid use
  - inflammatory arthritis (softer bones)

⇨ no MIS TKA

PRIMARY TKA APPROACHES

PRE-OP PLANNING

- PHYSICAL EXAMINATION
  - previous skin incisions: skin bridges ≤ 4 cm should be avoided
  - obesity/muscularity (MIS TKA?, submuscular approach?)
  - knee stiffness (MPP)
- RADIOGRAPHS
  - patella baja (MPP)
  - VR/VL deformity
  - bone loss

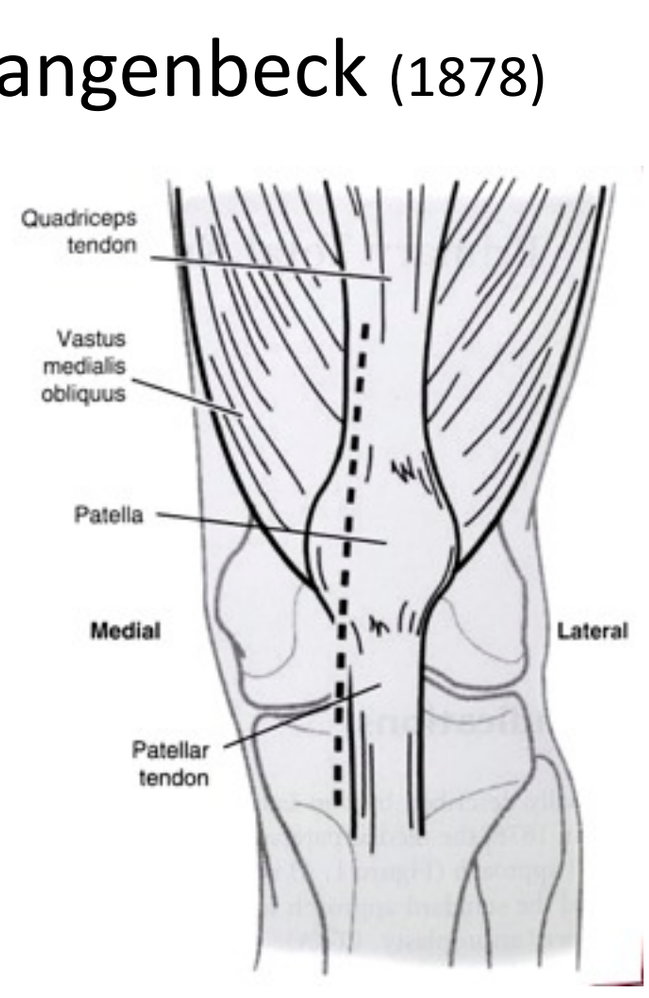
PRIMARY TKA APPROACHES

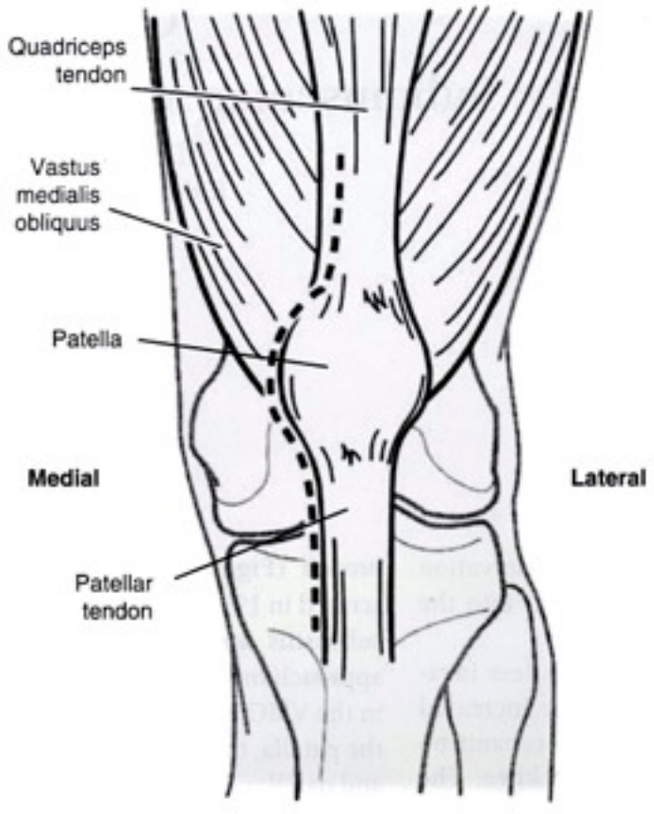
MEDIAL PARAPATELLAR APPROACH (MPP)

- initially described by von Langenbeck (1878)
- modified by Insall (1971)

Standard Approach for TKA

- versatile
- extensile
- standard (>4 cm)/MIS (2-4 cm)





PRIMARY TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

INDICATIONS

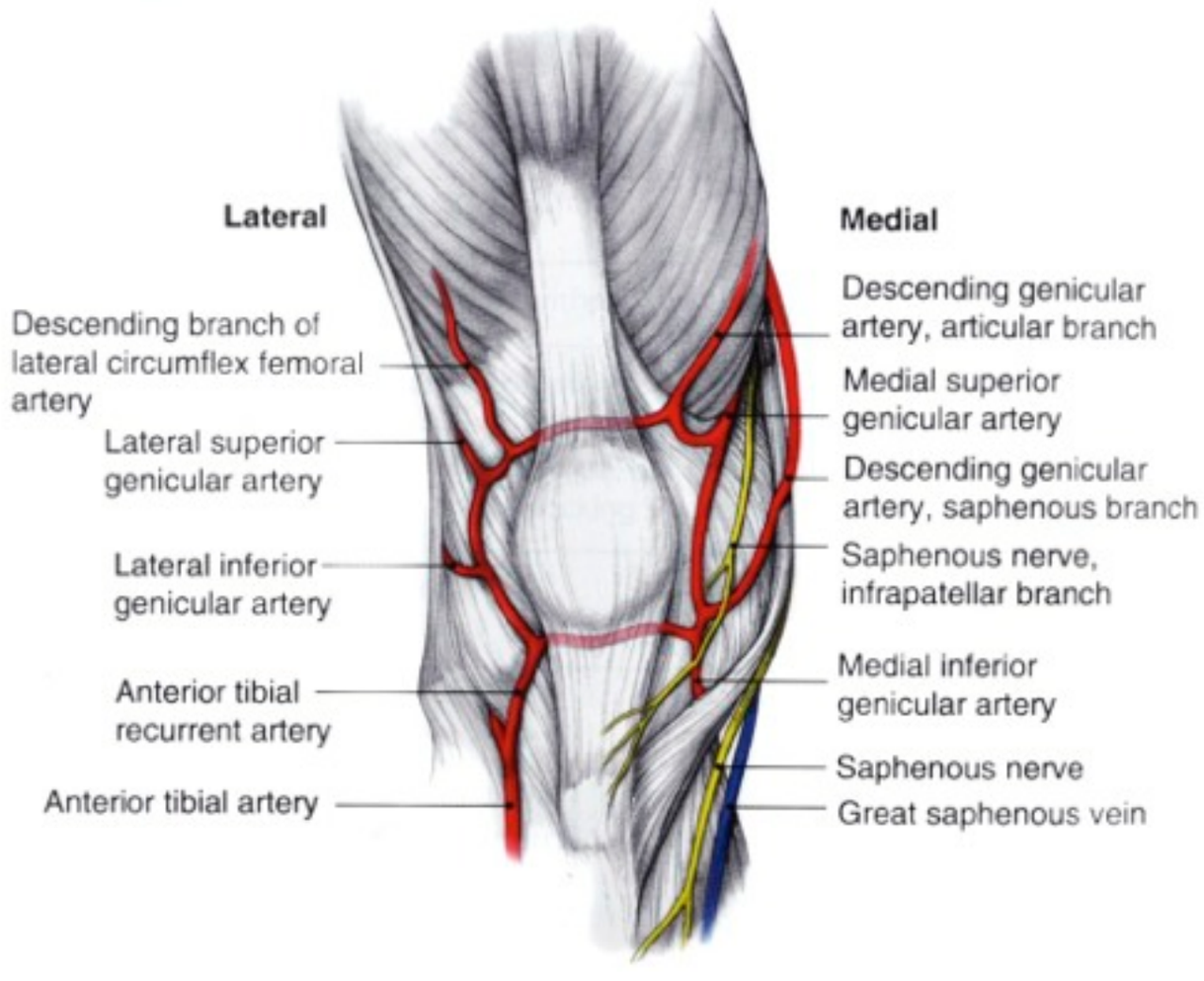
- primary and revision TKA
- regardless of preop. ROM
- short stature
- obese patients
- muscular lower extremities
- previous HTO or femoral osteotomy
- patella alta/baja

PRIMARY TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

CONTRAINDICATIONS

- previous surgery using a lateral approach (compromise blood supply to the patella)



PRIMARY TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

ADVANTAGES

- water tight closure of the arthrotomy
  - reduction of postop. hematoma
    - lesser risk of infection
    - less postop. blood loss (need transfusion)
    - faster rehabilitation

DISADVANTAGES

- standard MPP: high tendon cut (> 4 cm)

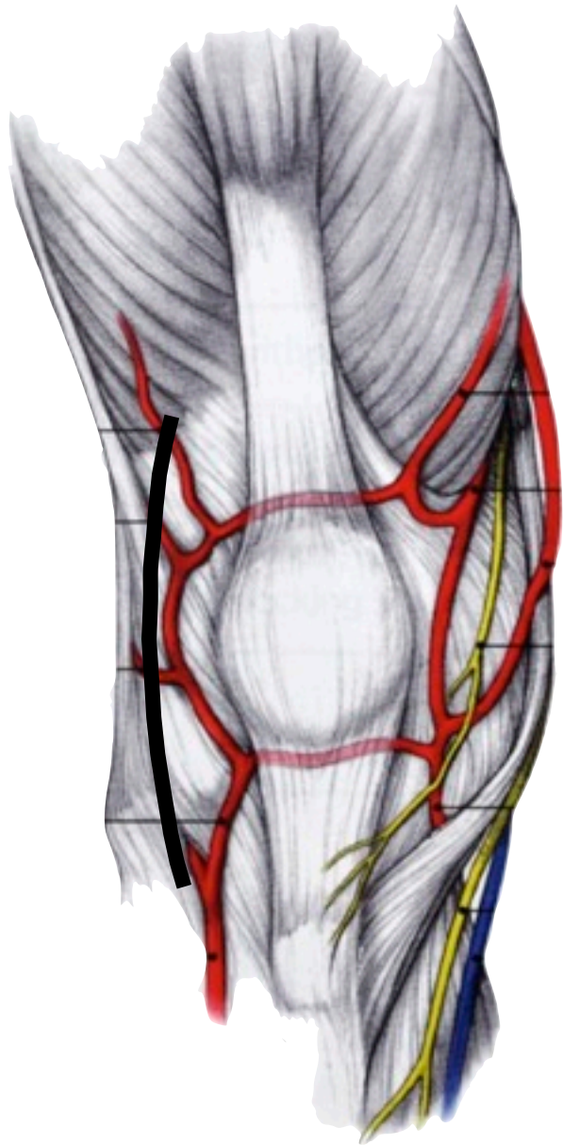
⇨ many adhesions, esp. suprapatellar pouch

PRIMARY TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

PITFALLS/COMPLICATIONS

- closure of the arthrotomy in flexion
  - avoids patella baja
  - avoids overtightening of the medial side
- avoid lateral release too close to the patella



PRIMARY TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

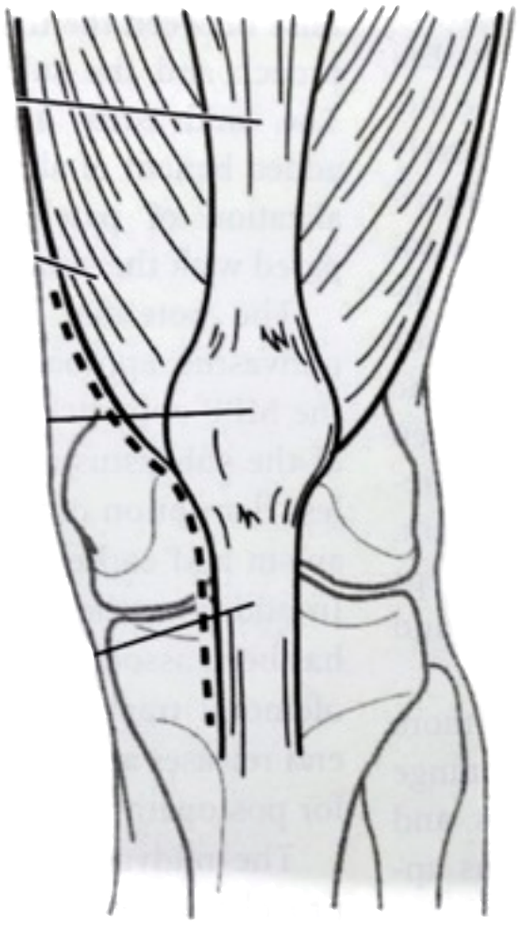
RESULTS

- MPP/SV/MV
  - MPP: ↑ lateral releases (standard version)
  - ROM/KSS/stair climbing: comparable

PRIMARY TKA APPROACHES

SUBVASTUS APPROACH (SV)

- initially described by Erkes (1929)
- described by Hofmann in the English Literature (1991)
  - only Q-sparing technique (preserves the insertion of the VMO)
  - preservation of the patellar blood supply
  - standard/MIS



PRIMARY TKA APPROACHES

SUBVASTUS APPROACH (SV)

INDICATIONS

- preop. ROM > 90°
- VR/VL deformity < 15°
- flexion deformity < 20°

PRIMARY TKA APPROACHES

SUBVASTUS APPROACH (SV)

CONTRAINDICATIONS (relative rather than absolute)

- very obese/very muscular patients
- patella baja
- marked knee stiffness
- short femur
- previous HTO (infrapatellar scarring/ patella baja)
- revision surgery: not proximally extensile

PRIMARY TKA APPROACHES

SUBVASTUS APPROACH (SV)

RESULTS

- SV/MPP
  - SV during <u>early</u> postop. period:
    - better knee flexion
    - earlier straight-leg raising
    - less blood loss
    - less postop. pain
    - shorter hospital stay

PRIMARY TKA APPROACHES

SUBVASTUS APPROACH (SV)

PITFALLS/COMPLICATIONS

- SV hematoma
  - excessive retraction VMO (control bleeding in the posterior VMO lift-off area)
  - no water tight closure of the arthrotomy
- risk of patellar tendon avulsion (pin through the patellar tendon into the prox. tibia)
- higher levels muscle enzymes (CPK/Myoglobin) in SV/MV (stretching/ cutting of the muscle)

PRIMARY TKA APPROACHES

SUBVASTUS APPROACH (SV)

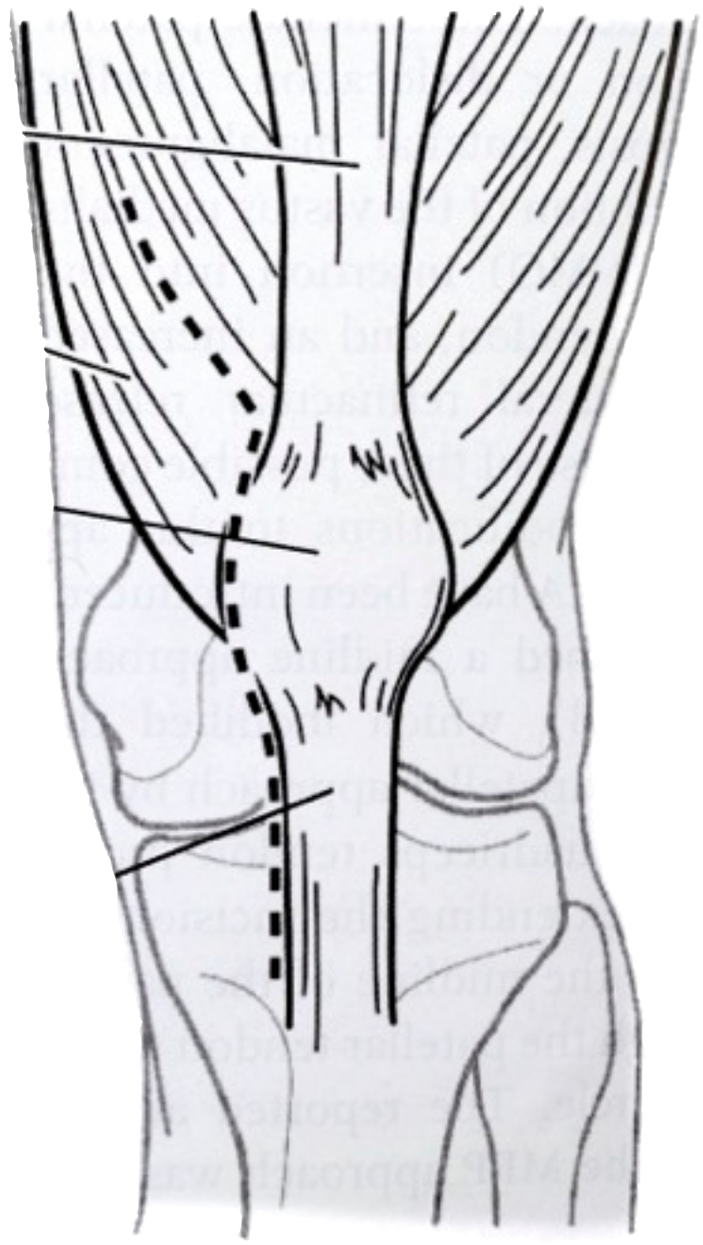
PITFALLS/COMPLICATIONS

- ↓ adequate exposure of the lateral compartment
  - avoid varus resection of the tibia
  - avoid underresection of the prox. tibia
  - avoid medialization of the tibial tray

PRIMARY TKA APPROACHES

MIDVASTUS APPROACH (MV)

- initially described in 1997 as an alternative to the SV
- combines advantages of MPP/SV
  - divides VMO in its midsubstance, in line with its fibers (2 cm split at the superomedial corner of the patella)
  - no disruption of the VMO insertion into the Q-tendon
  - easier visualization of patellar tracking



PRIMARY TKA APPROACHES

MIDVASTUS APPROACH (MV)

INDICATIONS/CONTRAINDICATIONS

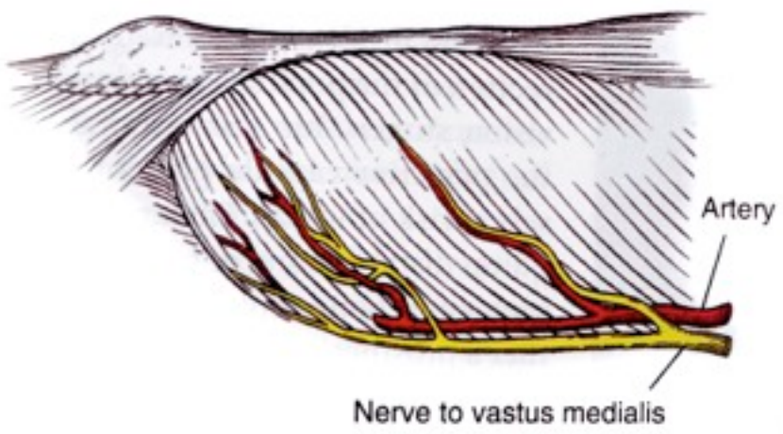
- Idem SV

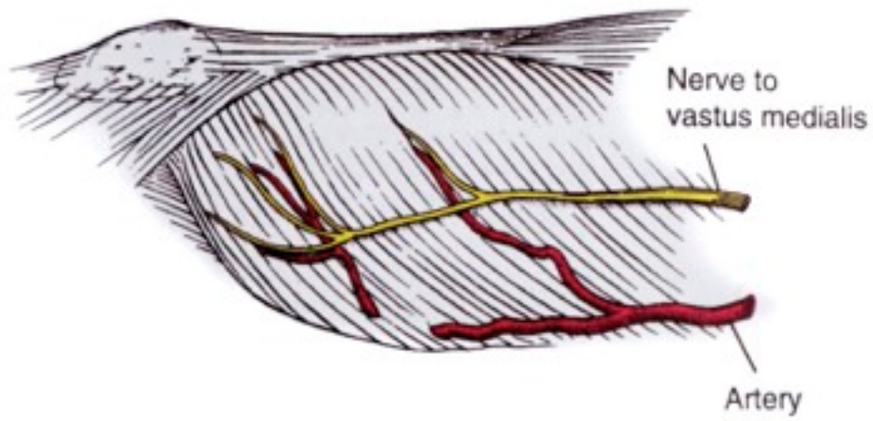
PRIMARY TKA APPROACHES

MIDVASTUS APPROACH (MV)

PITFALLS

- VMO:
  - innervated by terminal branches femoral nerve
  - safe dissection zone = 4,5 cm
- not proximally extensile





PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

- direct approach: optimal exposure of the concave side contractures and the sequential soft tissue releases
- extensive lateral release with exposure (optimizes patellar tracking)
- less skin undermining
- internally rotates the tibia: improved access to the pathologic PL corner
- preserves vascular supply to the patella (medial side untouched)

PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

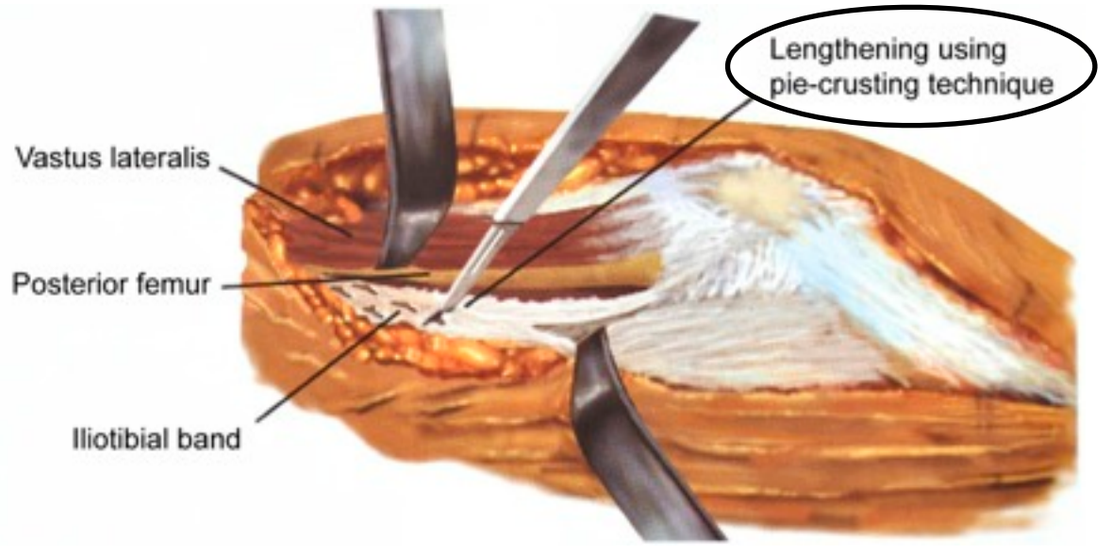
- ensures covering of the deep lateral soft tissue gap (joint seal)
- fixed VL knee: requires more complex soft tissue and bone management than VR knee
  - tibiofemoral malrotation
  - deficiency of the lateral femoral condyle
  - soft tissue contractures (PL, ITB, lateral retinaculum)
  - patella: deformed/small/subluxated/patella alta
  - osteopenia (females/RA)

PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

1. <u>Iliotibial band release and lengthening</u>



PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

2. <u>Retinacular release and lateral arthrotomy</u>

- coronal plane Z-plasty expansion technique
- fat pad preservation

PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

2. <u>Retinacular release and lateral arthrotomy</u>
   - osteoperiosteal elevation distal tubercle

3. <u>Patellar dislocation medially and joint exposure</u>

PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

4. <u>Tibial sleeve release</u>

- osteoperiosteal release L → PL tibia

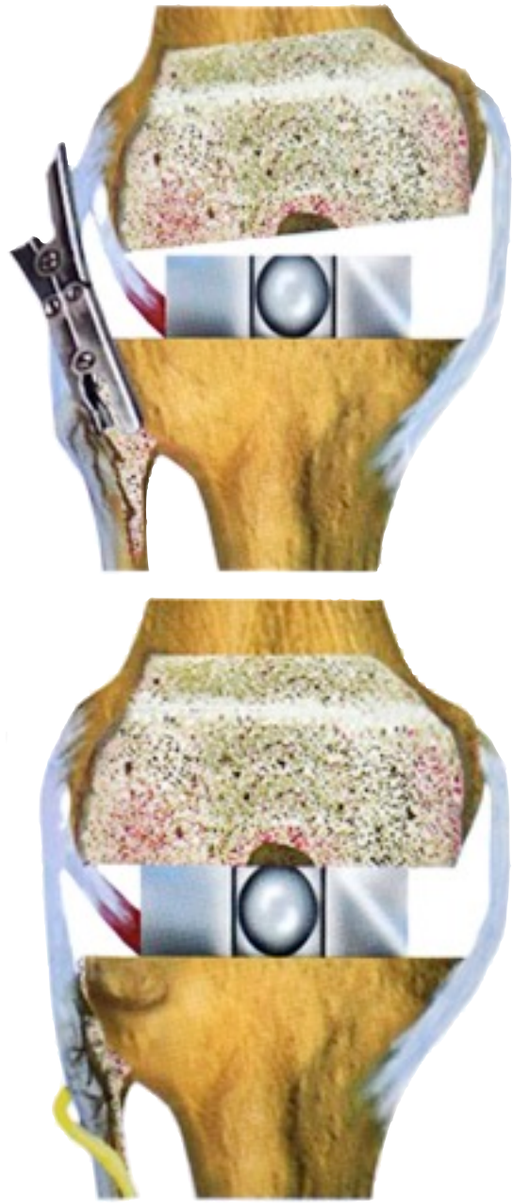
PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

4. <u>Tibial sleeve release</u>

- distal LCL release: enucleation of the proximal fibula/capsulotomy T-F joint



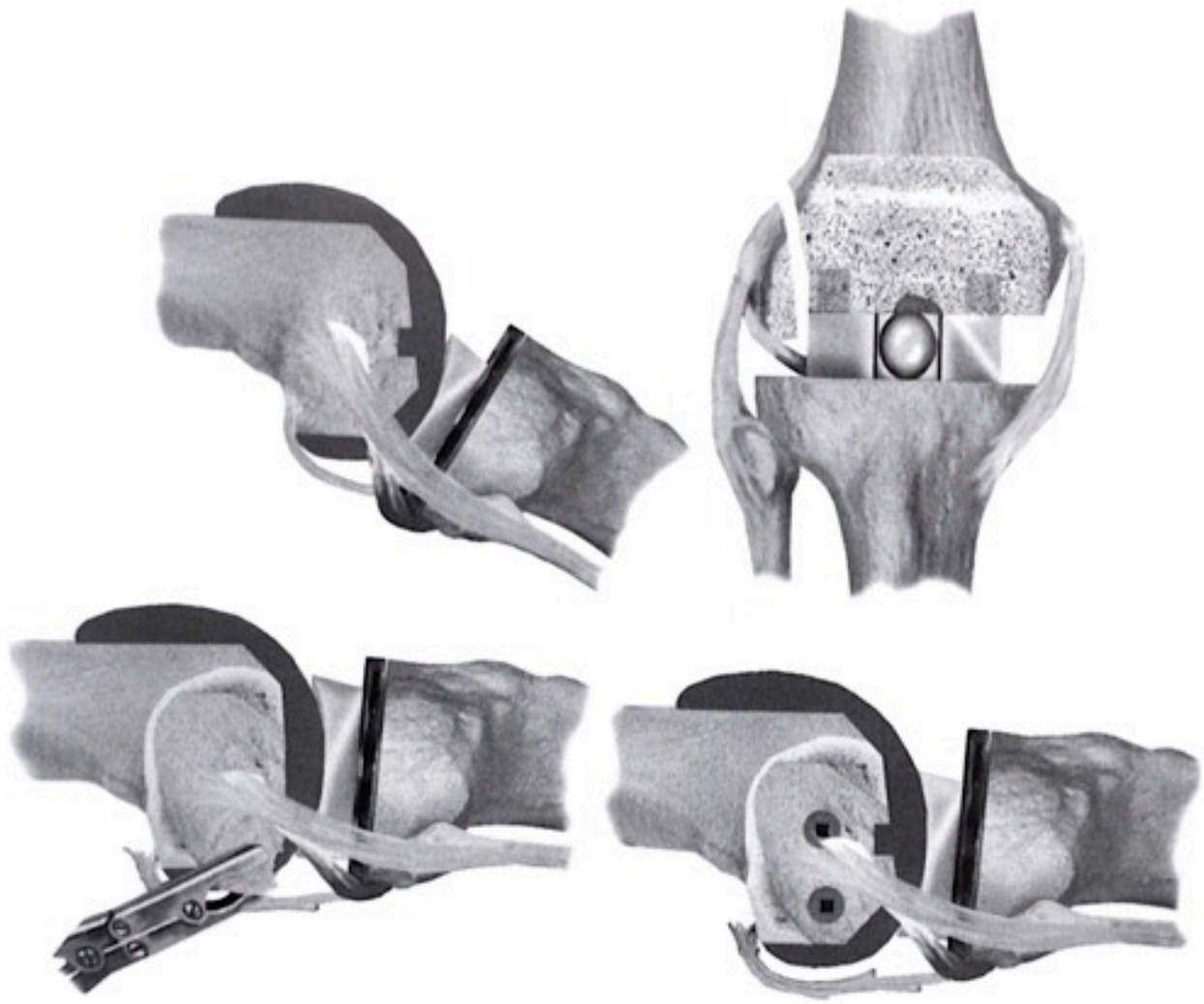
PRIMARY TKA APPROACHES

DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

4. <u>Tibial sleeve release</u>

- femoral condylar sliding osteotomy (Brilhault)



PRIMARY TKA APPROACHES

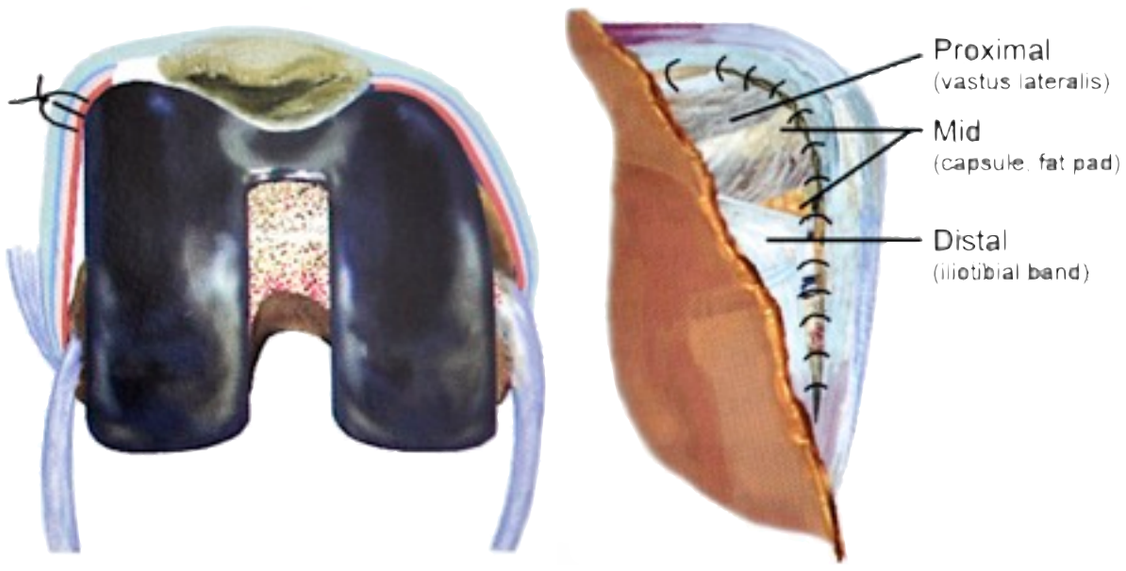
DIRECT LATERAL APPROACH (KEBLISH)

TECHNIQUE

5. <u>Instrumentation and prosthesis insertion</u>

6. <u>Soft tissue closure in flexion</u>

- 60° -> 90°
- distal-to-proximal closure



REVISION TKA APPROACHES

CHALLENGES

- multiple earlier incisions
- lack of skin and soft tissue pliability
- knee stiffness
- patella baja
- significant knee deformity

⇨ extensile approaches

REVISION TKA APPROACHES

GENERAL PRINCIPLES

MPP ARTHROTOMY with all extensile exposures

INCISION

- ideally: use earlier midline incision
- use **most lateral and anterior** incision with multiple longitudinal prior incisions (preserve blood supply to the medial aspect of the lateral skin flap)

REVISION TKA APPROACHES

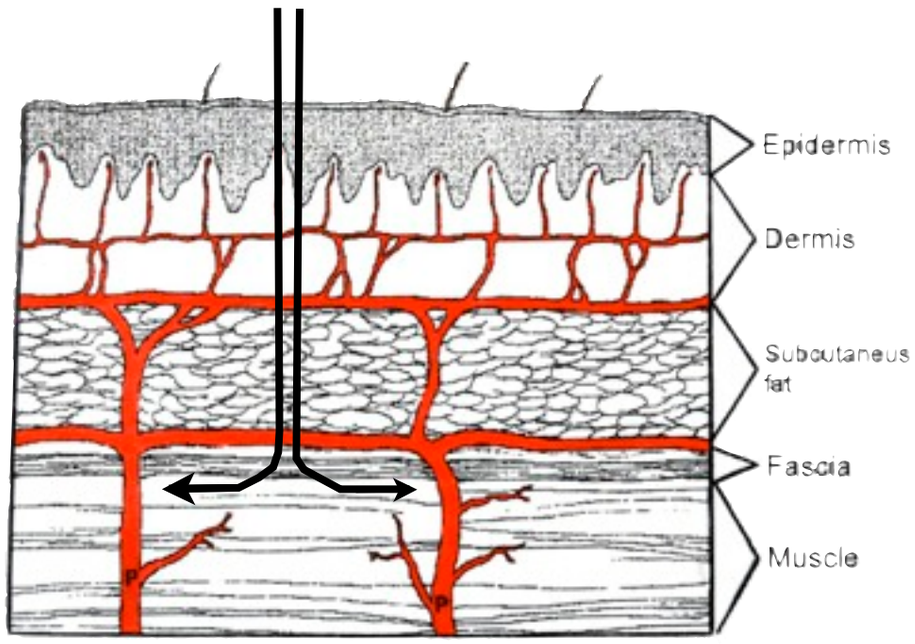
GENERAL PRINCIPLES

INCISION

- maintain a skin bridge > 6 cm
- cross transverse incisions at 90° (no less than 60°)

SOFT TISSUE DISSECTION

- limited subcutaneous dissection
- no wide skin flaps, esp. laterally
- skin flaps as thick as possible
- subfascial



REVISION TKA APPROACHES

GENERAL PRINCIPLES

PATELLA

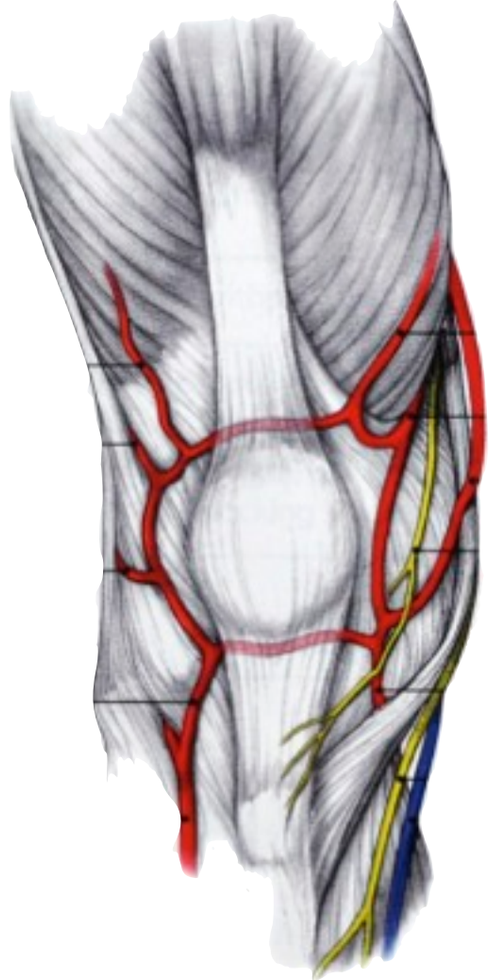
- respect/maintain vascular supply (osteonecrosis, #)

PATELLAR TENDON

- avoid iatrogenic avulsion

SOFT TISSUE EXPANDERS

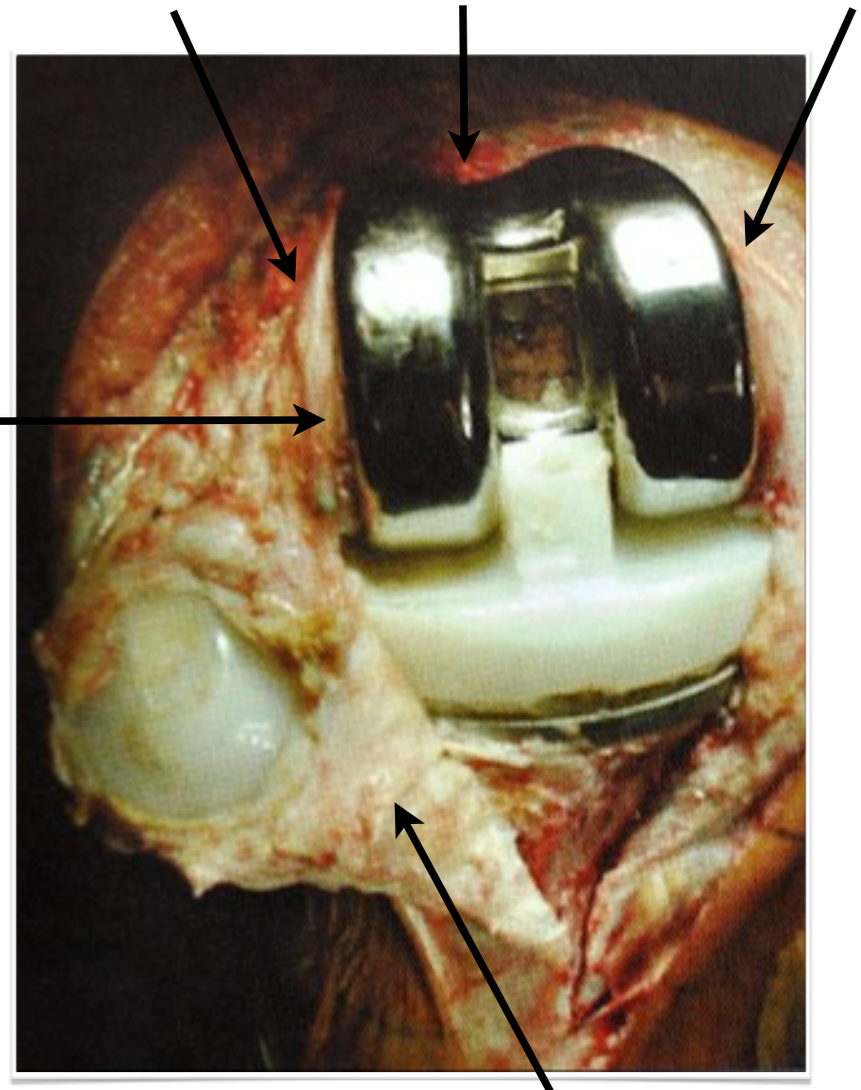
- multiple crossing incisions
- densily adherent soft tissue



REVISION TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

- always start with a standard medial parapatellar arthrotomy
- excision fibrous adhesions in the supra-patellar pouch/medial and lateral gutters
- excision retropatellar fat pad (contracted/scarred)
- division lateral patellofemoral ligament
- eventually, lateral release

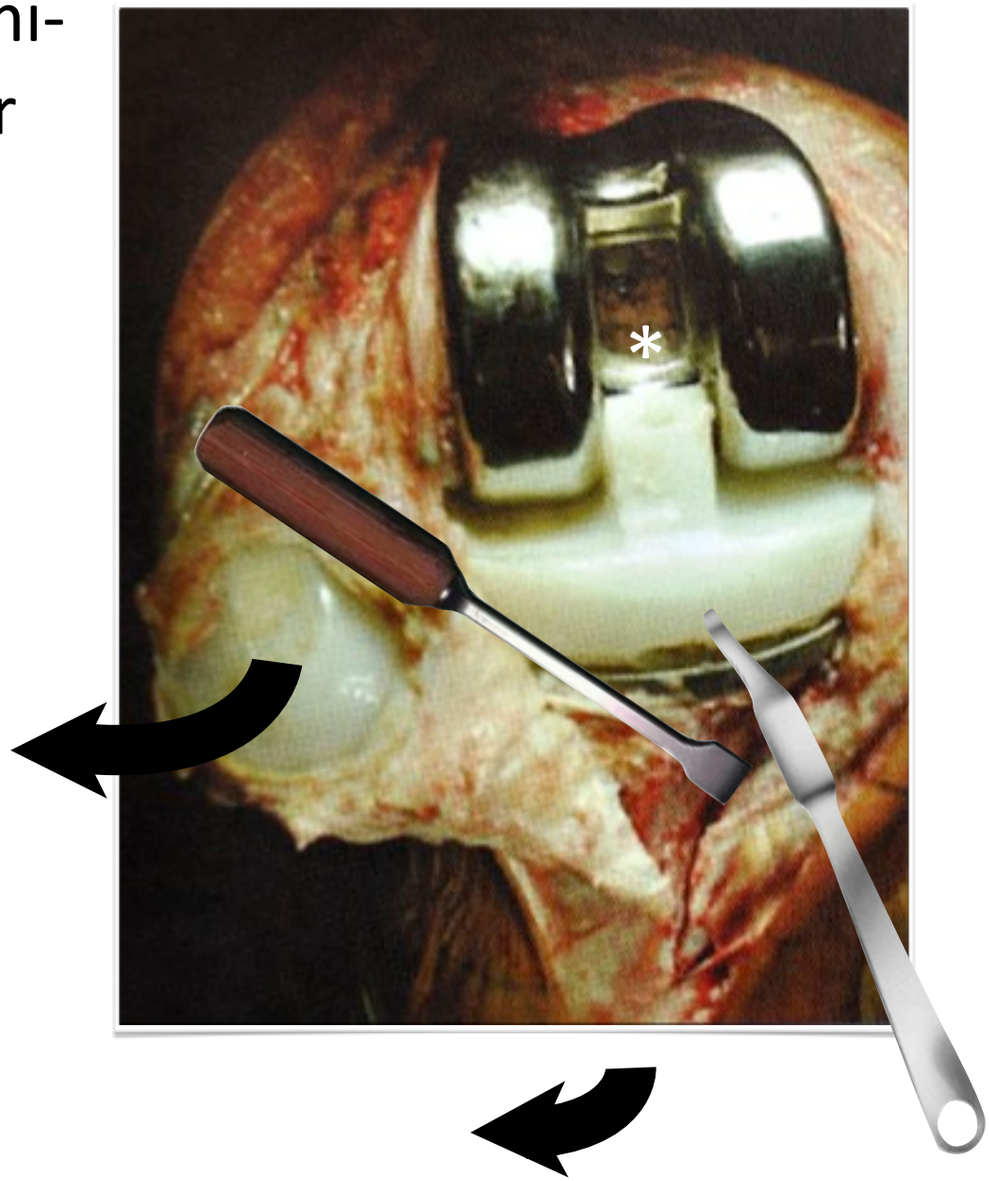


REVISION TKA APPROACHES

MEDIAL PARAPATELLAR APPROACH (MPP)

- subperiosteal elevation of deep MCL/semi-membranosus insertion to the PM corner
- release PCL, if present
- anterior subluxation of the tibia by gradual flexion/ER
- removal of the modular PE insert
- lateral subluxation of the patella
  - knee flexion ≤ 90°-100°
  - significant tension on the extensor mechanism

⇨ proceed to extensile approaches



REVISION TKA APPROACHES

QUADRICEPS SNIP

- originally described by Insall
- proximal and lateral extension of the standard MPP
  - proximal extension to the apex of the Q-tendon
  - lateral extension at a 45° angle into the vastus lateralis
- tension-reduced subluxation/eversion patella
- closure: 2-3 interrupted absorbable sutures at the site of the snip

REVISION TKA APPROACHES

QUADRICEPS SNIP

ADVANTAGES/RESULTS

- easy to perform
- avoids lateral superior genicular artery (vascular supply to the patella)
- can be combined with lateral retinacular releases
- can be combined with TTO
- can be extended to a Q-turndown procedure

REVISION TKA APPROACHES

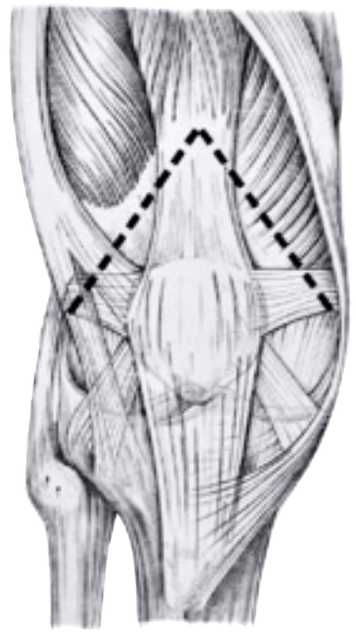
QUADRICEPS SNIP

ADVANTAGES/RESULTS

- slightly better functional outcome than other extensile exposures
- MPP/Q-snip: no difference KSS
- no extensor weakness/no extensor lag
- no modification of the postop. rehab. protocol (standard physical therapy protocol)
- lowest complication rate (delayed # Q-tendon)

REVISION TKA APPROACHES

V-Y QUADRICEPSPLASTY (V-Y TURNDOWN)



- first described by Coonse & Adams (1943)
- modified by Insall (1984), Scott & Siliski (1985)
  - redirection of the MPP laterally & distally at 45° from the apex of the Q-tendon, through the lateral retinaculum, towards the proximal lateral tibia (spares inferior lateral genicular artery)

REVISION TKA APPROACHES

V-Y QUADRICEPSPLASTY (V-Y TURNDOWN)

- reflection of the extensor mechanism/patella distally
- V-Y lengthening during closure, if desirable
- release lateral retinaculum is left open
- closure in 90°
  - with multiple nonabsorbable sutures
  - with acceptable tension on the sutures

REVISION TKA APPROACHES

V-Y QUADRICEPSPLASTY (V-Y TURNDOWN)

ADVANTAGES

- allows excellent exposure
- allows lengthening of the Q-tendon
- preserves patellar tendon/tibial tubercle

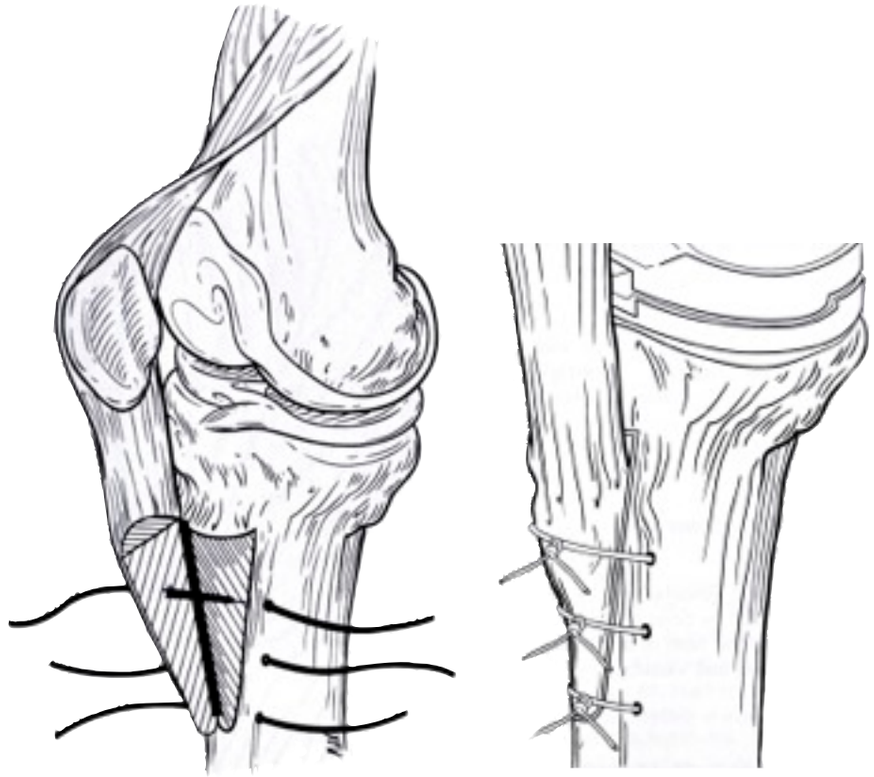
DISADVANTAGES

- postop. extensor lag up to 10°
- modified postop. rehab. protocol
  - no active extension/deep flexion 6 weeks
  - extension-brace 6 weeks
- possible devascularisation patella/extensor mechanism

REVISION TKA APPROACHES

TIBIAL TUBERCLE OSTEOTOMY (TTO)

- first described by Dolin (1983)
- modified by Whiteside
  - osteotomy
    - length: 5-8 cm
    - width: 2-3 cm
    - thickness: 0,5-1 cm
  - medial to lateral
  - oscillating saw, than completed with osteotome
  - lateral periosteum/soft tissue pedicle: intact



REVISION TKA APPROACHES

TIBIAL TUBERCLE OSTEOTOMY (TTO)

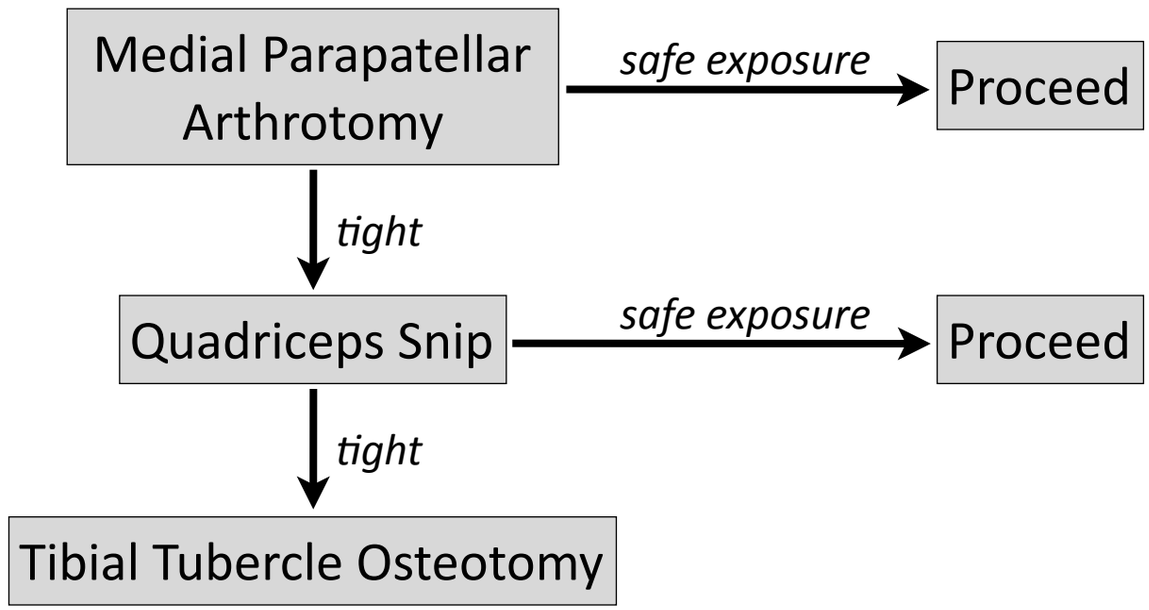
- step-cut osteotomy proximally
- fixation with 3 wires
  - medial to lateral
  - through medullary canal behind stem
  - most proximal wire through TT itself at 45° (prevents prox. migration)
- use of long tibial stem (bypasses osteotomy by ≥ 2 cortical ∅)

REVISION TKA APPROACHES

TIBIAL TUBERCLE OSTEOTOMY (TTO)

INDICATIONS

- well fixed cemented tibial stem
- knee ≤ 75° of flexion
- patella baja
- planned reconstruction with allograft/megaprosthesis
- failure to obtain adequate exposure with Q-snip



REVISION TKA APPROACHES

TIBIAL TUBERCLE OSTEOTOMY (TTO)

RESULTS

- less extensor lag, but worse KSS than other extensile exposures
  - more trouble with stairs/kneeling
  - worse ROM
- slight modification of the postop. rehab. protocol
  - immediate full-weight bearing
  - unrestricted ROM exercises
  - no resisted extensor strengthening exercises 6 weeks

REVISION TKA APPROACHES

TIBIAL TUBERCLE OSTEOTOMY (TTO)

COMPLICATIONS

- loss of fixation (superior migration fragment)
- # of the osteotomy fragment
- prominent hardware under the skin
- distal wound healing problems

Thank you for your attention!

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