Classification and treatment of tibial condylar fractures. Basic principles of the treatment of closed and open diaphyseal crural fractures

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Fractures of the tibia and fibula

- **Classification:**
  - Fx. of the condyles of the tibia
  - Fx. of the shafts of the tibia and fibula
  - Fx. of the shaft of the tibia alone
  - Fx. of the fibula alone
  - Fx. and fract-dislocations about the ankle
Isolated fx of the fibula in the proximal 2/3

- Functional treatment – without any fixation
Fx of the condyles of the tibia

- AO/OTA Classification:
Classification of proximal tibial fractures by Courvoisier

Reconstruction of the joint surface - bone grafting!!!
Schatzker classification

- I. wedge or split fracture of the lateral condyle
- II. Wedge fracture with compression of the lateral condyle
- III. compression fracture of the lateral condyle
- IV. fracture of the medial condyle
- V. bicondylar split fracture with or without compression on the lateral side
- VI. Complex bicondylar fx
Schatzker I:

- **Definition**: Split fracture of the lateral tibial plateau without depression.
- **Etiology**: Often due to valgus stress. Occurs in younger patients with stronger bones, which are resistant to depression. Often due to a bumper injury.
- **Common associated injuries**: Lateral meniscal tear. The lateral meniscus may also become entrapped in the fracture and require arthroscopy.
- **Treatment**: Typically, lateral fixation.
Schatzker II:

- Most common tibial plateau fracture.
- **Definition:** Split depression of the lateral tibial plateau.
- **Etiology:** Often due to valgus or axial stress. Occurs in older patients with osteoporosis with bones that do not resist depression.
- **Common associated injuries:** Lateral meniscus, medial meniscus, and medial collateral ligament.
- **Treatment:** Typically, lateral fixation. The depressed fragments are elevated and supported with bone graft.
Schatzker III:

- **Definition:** Lateral depression
- **Etiology:** Older patients with osteoporosis. Often just due to a fall.
- **Common associated injuries:** If the depressed fragments are lateral and posterior, it is associated with joint instability.
- **Treatment:** If there is instability, the fractured fragments are elevated and supported with bone graft and lateral internal fixation.
Schatzker IV:

- **Definition:** Medial tibial plateau fracture that may be a split or split depression type fracture. May also involve the tibial spines.
- **Etiology:** Varus stress. Often severe trauma.
- **Common associated injuries:** Associated with avulsion of the intercondylar eminence, which may indicate anterior cruciate ligament injury. Lateral collateral ligament injury. Peroneal nerve injury. Popliteal artery injury.
- **Treatment:** Medial plate and screws.
Schatzker V:

- **Definition:** Split medial and lateral tibial plateau (Bicondylar). Metaphysis is still in continuity with the diaphysis.
- **Etiology:** Often pure axial stress with severe trauma.
- **Common associated injuries:** Neurovascular, ACL, and meniscal injuries.
- **Treatment:** Typically, medial and lateral internal fixation.
**Schatzker VI:**

- **Definition:** Metaphyseal fracture that separates the articular surface from the diaphysis. May involve the medial, lateral, or both articular surfaces.
- **Etiology:** High-energy trauma.
- **Common associated injuries:** Neurovascular injury and compartment syndrome. Also meniscal, ACL, and collateral ligament injuries.
- **Treatment:** Typically medial and lateral internal fixation.
Diagnostics

2 view knee X-ray

Plateau
Diagnostics

CT
Fract. of the condyles of the tibia

• Treatment: Depends on the type of the fracture as seen radiographically.
  – Non displaced fx or patients in weak general condition can be treated with conservative methods – plaster fixation
  – Operative reduction and internal fixation by screws.
  – Osteosynthesis with plates
  – External fixation
  – Bone grafting or substituting
  – Intramedullary nailing

Motion stability
Conservative treatment
Traditional operative methods
Temporary fixation of the knee

External fixator

Ring or hybrid ExFix

AO ASIF
Hybrid Fixator Technique Overview

1. Insert wires
2. Attach clamps
3. Trim wires

Note: See the AO ASIF Hybrid Fixator Technique Guide for Tibia Hybrid Frame and AO ASIF Hybrid
47-year-old female patient
Percutaneous reduction and bone grafting
Bonegrafting and result
78y male patient with impression fracture of the right lateral condyl

4 years earlier conservative treatment on the left side
Autologous cancellous bone grafting and screw fixation percutaneously.

After 3 months, function 0-120 degree.
Femoral and tibial LISS
Preop.

LISS - Less Invasive stabilization system

4 week

Absolute stability in the joint - relative stability in the metaphyseal area
Small anterolateral approach
Preparing a tunnel for the plate
Implantation of the LISS plate
Percutaneous screw insertion
In bicondylar fx sometimes double plating is required
Fractures of the shafts of the tibia and fibula

- **Mechanism:**
  - Angulatory force: tend to be transverse or short oblique type, the fract. of tibia and fibula are at about the same level.
  - Rotational force: spiral type, at a different level in the two bones.
Fractures of the shafts of the tibia and fibula

• Classification
Treatment of tibial shaft fx

Children
- Conservative – with plaster
- Minimal invasive surgery – TEN/ESIN

Adults
- Mainly IM nailing
- Reamed in closed fx
- Unreamed in polytrauma and open fx
- ExFix in grade III open fx
Fractures of the shafts of the tibia and fibula

• Treatment: Standard method of conservative treatment:
  - To reduce the fract. (when necessary) by closed manipulation and to immobilise the limb in a full-lengths plaster with the knee slightly flexed and ankle at a right angle, or 3 weeks of calcaneal continuous traction and than plastering. If the fract. seems stable walking should be encouraged after 3 weeks. The duration of plaster fixation is about 3 months.
Conservative treatment
Conservative treatment with plaster
Fractures of the shafts of the tibia and fibula

- Operative treatment:
  - Plates ans screws: rarely used
  - Götze cerclage as an adaptive OS also rarely performed
  - Angle stable plates for articular fractures /LISS/
Fractures of the shafts of the tibia and fibula

• Operative treatment:
  – Intramedullary nail: often a satisfactory method. Closed reduction and nailing.
    • Reamed or unreamed technique.
    • Statically and dinamically locked.
In shaft fractures anatomical reduction and absolute stability is not required.

Functional reduction - length, axis and rotation + relative stability
The distal fibular fx require stabilization
The 2 ways of blood supply of long bones:

- endosteal vascularisation
- periosteal circulation
Unreamed technique
Unreamed technique
Proximal interlocking
Distal interlocking
Result

Poller screw
Evolution of the Tibia Nails

UTN / CTN
Universal

Extended indications

More interlocking options
Reaming

- Enlargement of the intramedullary canal by a special flexible drill

  - Advantages:
    - The larger nail the higher stability
    - Bigger bone-implant interface
    - The drilling debris facilitates bone healing

  - Disadvantages:
    - Damage of the intraosseal circulation
      - Mechanical
      - Temperature
      - Pressure
    - Risk of contamination
Fractures of the shaft of the tibia and fibula

• Operative treatment:
  – Treatment by external fixation/mostly for open fract. and for fract. that are already infected.
  – Segmented comminuted fx
Gustilo-Anderson III/B open fracture

- External fixator
- The bone covered by sural flap
Pinless fixator

Tibial shaft fracture in a polytrauma patient with severe head trauma
Initial stabilization with the Pinless Fixator
Change to intramedullary nailing after 5 days

CASE 3
Fractures of the shafts of the tibia and fibula

- Complications:
  - Infections
  - Delayed union or non-union
  - Mal-union
  - Impairment of vascular supply
  - Injury to a major nerve
Distal tibial fx
Distal tibial fx
The end