The Hip Joint
Fracture Management

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Campbell's Operative Orthopaedics (11th edition), Canale, Beaty (Ch 52, pg 3237)

Hip Fracture

Incidence: >280,000/year in the US
30% Mortality at one year
(Mortality returns to age-adjusted mortality after 1 year)
Femoral neck and intertrochanteric fracture of equivocal incidence
90% > 65years
Female:Male 3:1

Risk Factors: White race
Neurological impairment
Malnutrition
Impaired vision
Malignancy
Decreased physical activity
(Osteoporosis, although present in at risk age, not shown to be more prevalent in age-matched controls)

Subtrochanteric 10-15% of Hip fractures
Bimodal distribution 20-40 years (high energy trauma)
>60 years (falls account for 90%)

Prognosis

Intertrochanteric: Usually unite with correct reduction and fixation
Late complications are rare
Wide area of bone, most of which is cancellous with a good blood supply

Intracapsular: Constricted area, comparatively little cancellous bone and thin/absent periosteum.
Blood supply to distal fragment usually sufficient, however, impaired or absent to proximal part (femoral head) → Osteonecrosis/avascular necosis and later degenerative non-union.

Subtrochanteric: Varies from vascular cancellous bone at intertrochanteric line → decreasingly vascular diaphyseal, cortical bone distally (femoral shaft).
Increased rates of non-union or implant fatigue failure due to increased mechanical stress applied.

Diagnostic Uncertainty:
MRI – 100% Sensitivity with equivocal x-rays (Quinn et al)
Bone Scan – 93% even <24hours (Holder et al)

Operative Timing: Patients often have extensive co-morbidities

Often 12-24 hours delay for assessments and treatment advantageous and well supported;
>3/7 delay → 2x ↑ Mortality at 1 year (Zuckerman et al)
>2/7 delay → 15% ↑Immediate mortality compared <2/7 (McGuire)

Traction: Unhelpful in reducing pain
No improvement in ease of fracture reduction
May further decrease blood supply to femoral head pre-op

Aim of Treatment: Return to pre-fracture level of function without long-term disability and avoiding medical complications.

Positive predictors: (Koval et al)
- Age <85
- < 3 co-morbidities
- Pre-fracture independence
- Ambulation with therapy on discharge

(Fracture classification not predictor of mortality or ambulatory ability)

ORIF

AIM: To obtain a rigid and stable fixation, to permit ambulation and WB Day 1.

Early mobilisation: Decreases;
- pulmonary complications
- Venothromboembolism
- Pressure sores
- General de-conditioning

To re-establish bony continuity so the bone assumes a significant proportion of the load, Prosthesis inserted so ocnstruct of bone and metal is rigid.

If fracture well reduced and internally fixed – almost immediate weight bearing can be initiated.
It has been found that patients voluntarily limit loading until fracture healing begins (Koval et al.)
However, some surgeons advocate touch/weight of leg WB until xray signs of healing is evident.

Non-Operative Rx:
Reserved for non-ambulatory patients pre-fracture with only very mild pain.
Mortality approx 35%

Intertrochanteric Fracture

Incidence:
- >200,000/year in the US
- Mortality 15-30%,
- Increases with age, majority > 70years

Boyd-Griffin Classification

1. Greater → Lesser Trochanter.
   Reduction simple, maintained easily, results often satisfactory
2. Comminuted fracture, mainly intertrochanteric. Multiple fractures of cortex.
   Reduction is more difficult, comminution varies from mild → extreme
3. Subtrochanteric fracture with at least one fracture line passing across proximal femur just distal/at lesser trochanter. Varying degrees of comminution.
   Reduction difficult with increased rate of complications

4. Fracture at trochanteric region and proximal shaft in at least 2 planes, usually primarily sagittal. Requires ORIF with a 2 plane reduction.

Type 3 and 4 – most difficult to manage, approx. 1/3 of all fractures

Evans Classification

Type 1: Fracture line upwards and outwards from lesser trochanter

Type 2: Fracture line reverse obliquity (outwards and downwards) with medial displacement of femoral shaft (due to action of adductor muscles)

AO Classification

$A1_{1-3}$ Uncomminuted

$A2_{1-3}$ Increasingly comminuted

$A3_{1-3}$ Subtrochanteric extension with reverse obliquity

$A1_1 – A2_1$ Stable

$A2_2 – A3_3$ Unstable

Operative Management - AIM: strong, stable fixation

Variables;

1. **Bone quality** (majority pt's osteopenic therefore, less than desirable – Implant is placed within head and neck where bone quality is best)
2. **Fragment geometry**
3. **Reduction** (Variables 3-5 – Surgeon controlled)
4. **Implant design**
5. **Implant placement**

(Ward 1838) described the internal trabecular system

- Trabeculae orientated along lines of stress
- Thicker trabeculae; Calcar → weight bearing dome
- Smaller trabeculae; Inferior foval area → Superior femoral neck → greater trochanter and lateral cortex
- Calcar; dense vertical plane of bone
  Posterior-medial femoral shaft – lat greater trochanter
  Reinforces femoral neck posterior-inferiorly
  Thickest medially → thins laterally

Optimal position for **compression screw** is central or slightly Inferior and Posterior
Anterior superior femoral head/neck is poorest quality bone.

Tip-Apex Distance (Baemgaertner et al.)
Sum of distances; apex of femoral head → tip lag screw (AP & Lateral view) = T-A Distance (corrected for magnifiifcation)
Sum must be </= **25mm** to prevent failures by '**cutting out'** of lag screw.
(Adams et al.) T-A Distance – Crucial for IM nail & Compression screw fixation to prevent cut out and loss of reduction.

$X_{AP} + X_{LAT}$ </= 25mm

Fracture Geometry
Pre-operatively, it has to be established by XRay whether Fracture is Stable or Unstable based on fracture geometry.

Reduction - to restore Cortical contact medially and posteriorly
Lesser Trochanter status important for stability evaluation
If displaced with a large fragment, indicates a significant cortical deficit posterior-medially, therefore, potentially unstable.
If seen, consider changing decision from plate to IM device.

Reduction – Open vs. Closed
Aim; Stable reduction (whether anatomic or non-anatomic)
Majority undergo a closed reduction to achieve anatomic reduction with posteriomedial apposition.
Fluroscopy; Used under AP and Lateral views to evaluate reduction.
Especially amount of Posteriomedial Cortical contact
To be internally fixed
In comminuted fractures the distal shaft sags posteriorly, may require open reduction to restore anatomic position and may need to be maintained in this position during fixation.
Compression Hip Screw Prophylactic Abx (Fluclox & Gent/1st Gen Ceph (pre- & for 24h post) – check local hospital guidelines)
Reduce Infection (3-5% → <1%) Gustilo et al
Prophylactic Anticoagulation (LMWH/Warfarin)
(Risk – bleeding/post-op haematoma)
Physio - Successful restoration of mobility to pre-fracture ambulation & overall funct.
(Koval et al) 41% → Normal pre-fracture ambulation
(Positive predictors – Age<85, <3 co-morbidities)
40% → Community/Household ambulators
Aim: Ambulation Day 1 post-op
Weight bearing as tolerated/full weight bearing.