

# Surgical Techniques

## DHS – Dynamic Hip Screw

Mr. Michael Petrie MBChB Sheffield, MRCS Edinburgh

### Positioning

- Patient supine
- Radiolucent, padded counter-traction post between legs
- Uninjured leg flexed & abducted at hip in Well leg holder (pad peroneal nerve) or wide abduction held in boot/foot plate
- Injured leg held in boot/foot plate
- Allows use of C-arm image intensifier between patients legs (AP & Lat), whilst remaining on non-sterile side
- Vertical, transparent, 'isolation' drape
- Verify adequacy of XRays before surgical prep

### Reduction

- Extremity secured as above
- Longitudinal traction on Abducted and Externally rotated leg
- Maintain traction whilst Adducting and Internally Rotating leg
- Generally intertrochanteric fractures are reduced in neutral/slight internal rotation
- Traction**, most important element
- Adjust to maintain reduction, too much traction → valgus over-reduction
- Check reduction with image intensifier (AP and Lat) – special attention paid to postero-medial cortical contact
- Estimate **Anteversion** of femoral neck

### Draping

- Prepare skin over hip after soap scrub and usual antiseptic prep
- Square off lateral aspect of hip; iliac crest → distal thigh with towels & drapes
- Vertical drape, allows C-arm to be used without being individually draped
- Transparent, plastic, adherent, 'isolation' drape applied to skin at proposed incision site (use of C-arm easier, surgeon direct positioning throughout)

### Exposure

- Approach proximal femur laterally, Greater trochanter → distally
- Length of incision dependent on length of implant
- Coagulate perforating branches of profunda femoris when elevating vastus lateralis off lateral intermuscular septum (linea alba)

### Insertion of Guide Pin

- Level of insertion varies with angle of plate used, use proximal aspect of osseous insertion of gluteus maximus and tip of lesser trochanter, approx 2cm below vastus lateralis ridge, helps identify level of entry of 135deg angle plate
- The > the angle plate – for each 5deg increase in angle move 5mm distally
- Attach threaded guide pin 3.2mm to power
- Place appropriate fixed angle guide midway on lateral aspect so guide pin

- enters at designated level
- ☒ Ensure guide is flush and parallel to lateral cortex to ensure accurate angle
- ☒ Aim guide pin towards **apex** of femoral head (point where line parallel to and in centre of femoral neck intersects with subchondral bone)
- ☒ Confirm central position (AP & Lat)
- ☒ Avoid peripheral placement in either direction as only with pin central can lag screw be advanced safely to within 10mm of joint without risking penetration
- ☒ After confirming appropriate tip position of guide pin, verify appropriate plate angle with adjustable angle guide
- ☒ Central and deep placement allows secure purchase in best available bone and maximal collapse of screw without thread impinging on barrel, two factors that decrease risk of mechanical failure of fixation
- ☒ Evaluate using fluoroscopy images to identify position of pin relative to apex of femoral head (AP & Lat)
- ☒ **Tip-apex distance** < 25mm (after correction of magnification)
- ☒ If position peripheral/shallow → redirect
- ☒ After guide pin positioned satisfactorily determine appropriate lag screw length and remaining distance (135deg angle plate in average adult, approx length 95mm)
- ☒ Use guide pin placement instrument to insert second pin (3.2mm) parallel to guide pin, 13mm proximal to primary guide. Provides temporary stability for unstable fracture, in which reduction can be lost if guide pin backs out after reaming and for basicervical femoral neck fracture in which head could rotate during screw insertion
- ☒ Instrument also accommodates 2.4mm pin if 6.5mm cannulated screw used for definitive rotational stability

### Reaming Femur

- ☒ Occasionally guide pin pulls out of position when reamer removed. To minimise → avoid reaming over tip threaded portion of pin
- ☒ When guide pin inserted and measured, insert further 5mm into subchondral bone. Ream according to exact measurement of lag screw length, choose a lag screw that matches length measurement
- ☒ Set power combination reamer to lag screw length indicated by measuring gauge and ream until distal aspect of positive stop reaches lateral cortex. Ream coaxially to guide pin to avoid binding guide pin and use 'spot' image intensifier to ensure pin not advancing into pelvis or withdrawn at conclusion of reaming.
- ☒ If pin inadvertently withdrawn, reverse guide pin placement instrument and reinsert
- ☒ If desired confirm proper plate angle using trial plates and trial handle (especially if pin inserted freehand)

### Tapping femoral head

- ☒ Generally screws inserted into osteoporotic bone do not require tapping
- ☒ Younger patients/abnormally sclerotic bone, tapping is indicated to avoid excessive torque on insertion wrench and to decrease risk of mal-rotation of the femoral head fragment during final seating of screw
- ☒ Attach quick-connect T-handle to lag screw tap, set to appropriate length

- ☒ Insert tap to reamed position and slide the cortex guide up to lateral cortex of the femur. Tap until advancing portion of positive stop rests against cortex guide

### Selection of Lag Screw

- ☒ Fully inserted lag screw that equals length determined by direct measuring guide allows 5mm compensation when compression screw is used or 5mm fracture collapse before shaft of screw begins backing out of barrel
- ☒ If >5mm compression desired (or significant telescoping of implant expected) use a shorter lag screw. 5mm shorter allows 5mm extra compression

### Insertion of Plate/Lag Screw

- ☒ Assemble appropriate Classic plate and lag screw onto Classic insertion wrench
- ☒ Screw lag screw retaining rod onto distal end of lag screw until firm connection
- ☒ Slip AMBI/Classic centring sleeve onto Classic insertion wrench
- ☒ Place entire assembly over guide pin to reamed hole
- ☒ Advance lag screw to proximal femur to pre-determined level and verify position with image intensifier
- ☒ 180deg turn represents 1.5mm advancement of lag screw
- ☒ Verify position and depth of screw using image intensifier (AP + Lat)
- ☒ When complete, handle of insertion wrench must be perpendicular to axis of femoral shaft to allow proper keying of lag screw to plate barrel
- ☒ Remove centring sleeve, advance side plate onto lag screw shaft.
- ☒ Use plate tamper to seat plate fully
- ☒ Unscrew lag screw retaining rod, remove insertion wrench from back of lag screw, remove threaded guide pin with 3.2mm tip

### Attachment of Plate

- ☒ Use plate clamp to secure plate to shaft. Consider releasing traction and manually impacting fracture fragments, especially if well-aligned and stable
- ☒ Ensures some intermittent loading of medial cortex. Readjust plate clamp
- ☒ Use 3.4mm twist drill through green (neutral) end of combination drill guide to drill bone screw holes
- ☒ Determine appropriate cortical screw length with length gauge
- ☒ Insert screw using self-holding hex screwdriver (attaches to power source)
- ☒ Use hex-screwdriver for final manual tightening
- ☒ A 4.5mm bone tap is available, only for extremely hard cortical bone
- ☒ When all screws inserted and tightened and all traction released, fracture compressed with compression screw, usually 19mm screw
- ☒ **Caution**, compression screw exerts powerful force, must be correlated with bone quality)
- ☒ Observe lag screw position (fluoroscopy) to ensure does not pull out as compression applied
- ☒ If does, change to 'super-lag'/cement augmentation
- ☒ The oval auto-compression holes of plate allow for 2mm of longitudinal shaft compression for subtrochanteric fractures/osteotomies
- ☒ To achieve compression, place eccentric 'gold' end of combination drill guide in 1<sup>st</sup> compression slot distal to fracture, arrow pointing towards fracture, drill

- through 3.5mm twist drill
- ☒ Place 4.5mm self-tapping cortical screw in slot, screw engages through distal part of slot, away from fracture. As screw is seated it abuts inclined distal aspect of slot, forcing plate and attached proximal fragment slightly distally until resisted by fracture compression (produces 1mm compression)
  - ☒ For additional 1mm compression – repeat in next distal slot (to allow slightly loosen eccentric screw after 2<sup>nd</sup> abuts slot before finally seating)
  - ☒ Seat and retighten
  - ☒ Drill remaining holes with green (neutral) end of combination guide
  - ☒ Plates with  $\geq 8$  holes, allow further compression in very distal hole (approx 5.5mm)

### **Fixation of Lesser Trochanter and Posterio-medial fragments**

- ☒ Geometry of most proximal slot allows insertion of 6.5mm cancellous/ universally cannulated screw for fixation of lesser trochanter/large posterio-medial fragments
- ☒ Slot allows 45deg of proximal and 26deg distal angulation in coronal plane and 14deg of anterior/posterior angulation in sagittal plane
- ☒ Insert 2.4mm guide pin into fragment
- ☒ Implant appropriate 6.5mm screw

### **Mobilise Day 1, fully weight bearing**