Table 3 ASA grading

ASA 1	Completely fit and healthy
ASA 2	Some illness but this has no difference from normal daily activity, i.e., a nonsymptomatic condition such as hypertension
ASA 3	Symptomatic illness present, but minimal restriction on life, e.g., mild diabetes mellitus
ASA 4	Symptomatic illness causing severe restrictions, e.g., severe chronic bronchitis, unstable diabetes
ASA 5	Moribund

bed waiting for operation. This is usually not a threat to younger patients, so prioritize the old and diseased patient before the young and healthy in the operating schedules!

In Denmark and Sweden, the so-called fracture lines have recently started with fast-track handling including giving the patient oxygen as well as intravenous fluid and pain relief already in the ambulance [60, 62, 80]. The electrocardiogram is transmitted from the ambulance to the hospital and interpreted before the patient reaches the hospital. In the most advanced schemes, the patients are taken directly to the X-ray department and from there shortly to the ward before operation. On the way the ambulance personnel question the patient to have good anamnestic information for the operation. The patient should before anesthesia be graded according to the ASA system (American Society of Anesthesiologists, Table 3).

Fracture Table and Image Intensifier

The patient is moved over from bed on to a fracture table. The appropriate positioning is the responsibility of the surgeon to supervise. Ensure that the patient is secure on the narrow fracture table. The fractured leg is positioned within a traction boot, which needs to be correctly fastened, such that the leg cannot fall out. The foot must be padded to avoid pressure ulcers by the boot pressures, especially the heels are vulnerable. In addition, to enable good quality imaging in both the anteroposterior (AP) and

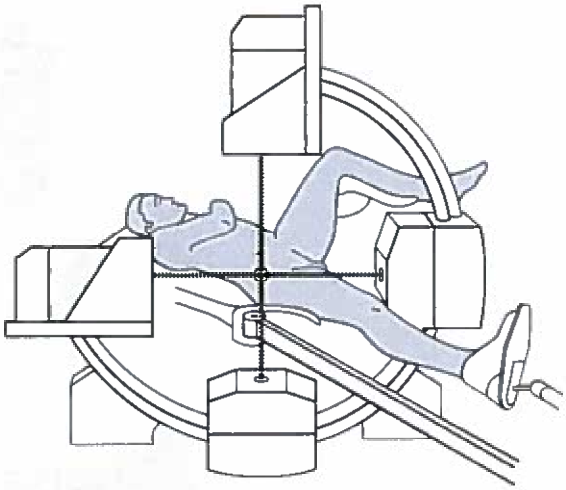

Fig. 5 Positioning of the patient on the traction table with biplanar image intensifier. The horizontal x-ray tube (*lateral view*) is to the left of the surgeon. Images are shifted with a foot pedal

lateral views to be achieved, the following points should be noted:

1. The patient is positioned such that the injured hip can be screened on the AP view without having the fracture table directly beneath the hip.
2. The uninjured leg is flexed and abducted out of the way to allow good access for the image intensifier (Fig. 5).
3. To get the clearest picture on the AP radiograph, the screen for the image intensifier should be close to the patient.
4. On the lateral view, the optimum position for the image intensifier is again with the screen as close to the patient as possible.
5. A post in the groin or a sling around the hip prevents the patient from moving when longitudinal traction is used. Both should be padded as well as the boot to avoid pressure sores.
6. Excessive movements of the injured limb should be avoided at all times as this may damage the precarious blood supply to the femoral head.

Nowadays, the image intensifier is an indispensable tool. It helps the surgeon to obtain a more accurate reduction of the fracture and placement of the internal fixation devices,

Fig. 6 Biplanar image intensifier. Note the two monitors for the lateral and frontal views

thereby optimizing the stabilization of the fracture. It has greatly reduced operating times and also allows the surgeon the opportunity for immediate evaluation of reduction and osteosynthesis placement. Biplanar image intensifier is preferred due to better precision and shorter operation times (Figs. 5 and 6). In some centers, two C arms are used at the same time to achieve the two planes, frontal and side view, but for decades a fixed biplanar imaging intensifier has been widely used in Sweden and Norway. The advantage of a biplanar imaging intensifier is that after positioning of the equipment, no further movements of the standard tubes are necessary, which avoids jeopardizing the draping and thereby the sterility. Shifting between the planes on the monitors is accomplished with a foot pedal, which considerably saves surgery time. Furthermore, the easy, rapid shifting between the positions increases the precision in the placement of the osteosynthesis material. The surgeon has the possibility to better check the activities. Thus, fewer complications are expected. Also the training of surgeons, with emphasis on details in performance has improved the results of contemporary osteosynthesis [44, 55, 56, 99, 156].

Operation Choice

Specific methods have evolved to be found most suitable to treat various forms of hip fractures. Methods combining biomechanical stability, mini-traumatic approach, and feasibility in handling and learning have survived the development evolution, provided they have proven not to disturb the bone healing process which is dependent on good blood circulation to the bone fragments as well as macro-stability during the callus formation process. For the arthroplasties, the stability of fixation as well as the operating time has been decisive. Here, also the costs of the implant have been an issue. The most-used operation choices for various types of hip fracture are shown in Table 4 and the probable outcome in Table 5.

The osteosynthesis of cervical fractures with pins or screws as well as the osteosynthesis for trochanteric and subtrochanteric fractures with screw-plate and intramedullary nail will be described in detail in this chapter. For arthroplasty, the basic knowledge of how to perform an arthroplasty is described in chapter ▶ Total Hip Arthroplasty - Current Approaches.

Table 4 Operations usually performed for various types of hip fractures

Fracture type	Operation type
Undisplaced cervical	Osteosynthesis with pins or screws
Displaced cervical	Arthroplasty (if older patient, osteosynthesis in the younger)
	Hemi unipolar
	Hemi bipolar
	Total hip arthroplasty (THA)
Baso-cervical	Screw-plate
Trochanteric two fragment	Screw-plate
Trochanteric multifragment	Screw-plate
	Short intramedullary nail
Subtrochanteric	Intramedullary nail
	Screw-plate, biaxial

Table 5 Probable outcome after osteosynthesis for the different fracture types

Fracture type	Healing	Stability
Undisplaced cervical	+	+
Displaced cervical	–/+	+/–
Baso-cervical	+/-	+
Trochanteric two fragment	+	+
Trochanteric multifragments	+	+/–
Subtrochanteric	+	–/+

In this hip fractures chapter will be described specific technical points for arthroplasty in elderly patients with a fresh hip fracture.

Cervical Hip Fractures

Closed Reduction

The surgeon should supervise the transfer of the patient to the fracture table to guard against undue and excessive movements of the fractured hip. The blood circulation to the femoral head via the capsular vessels along the femoral neck is vulnerable. Sudden forceful movements of the hip during the reduction or excessive traction causing fracture diastasis might impair the circulation. Reduction is usually done by applying traction to the outstretched leg, followed by internal rotation. This maneuver should all the time be checked in both AP and in lateral views using the X-ray image intensifier. Preferably, a biplanar image intensifier with the two planes available alternately at the same time should be used. Then, the shifting of view is easily done by a foot pedal instead of shifting the position of the whole apparatus. There is then also less risk of desterilizing the draping. Pulsing of the X-rays diminishes radiation exposure to the patient and the surgeon. The reduction manoeuvre is started by using the fracture table to apply gentle longitudinal traction to the leg while checking mostly in the AP view. Traction is continued until the medial parts of the femoral neck (the calcar region) are approximated with contact between the bone ends. Next, the lateral view is most important, and the foot is rotated inwards until the dorsal angulation in the femoral neck fracture has been eliminated. This part of the maneuver can be looked upon as similar to closing a book. The goal is to restore the alignment of the femoral neck such that in the side view a straight line can be drawn to bisect the femoral head, trochanteric region, and shaft. Little residual angulation should be allowed (Figs. 7 and 8). Small corrections with ab-adduction and sometimes elevation of the leg may also be needed to obtain an anatomical reduction. It may be necessary to fully internally rotate the foot; failure to apply full internal rotation is the commonest reason for an inadequate reduction. Over-reduction of the fracture is usually impossible due to the intact soft-tissue hinge of the posterior femoral neck. The reduction alignment in the side view should be 180°, with the femoral head, neck, trochanteric region, and shaft in a straight line. In the frontal view, the optimal reduction is anatomical or with a slight valgus angle. The smooth curvatures of the femoral neck, shown in the frontal and side view, should be restored. After reduction, some slackening of the traction allows impaction to occur and reduces the risk of the femoral head rotating during surgery.

Osteosynthesis

Operation with internal fixation of femoral neck fractures with a flanged nail was introduced by Smith-Petersen [150] who used open reduction.