problems that have already been outlined in Chapter 6 [69]. In addition, a normal GPA value is highly variable, which makes difficult the determination of its critical value in terms of operation (Fig. 9-22). Therefore, it is not sufficient to consider the absolute GPA value, but the GPA value of the intact side should be taken into account as well.

Accuracy of measurement

It should be pointed out that the values measured mainly in mediolateral translation, angulation at the level of the scapular body, or in Y-view are influenced by three main factors.

Firstly, identification of individual metric points (Fig. 9-23) is not always easy. This concerns mainly the apex of the inferior pole of the scapula where identification is complicated by the anatomical variability in this region. Another example may be the superior pole of the scapula which is often overshadowed in 3D CT reconstructions by the surrounding processes. At the same time, these two metric points are essential for measuring the GPA value.

Another factor is the accuracy of the radiographic projection, or the position of the scapula on 3D CT reconstruction. Where a radiograph is not performed in a true anteroposterior projection, or the position of the scapula on 3D CT reconstruction is not orthograde, the measured values of angles may be influenced; just as is measurement of the CCD angle of the proximal femur in the anteroposterior view influenced by rotation in the hip joint. The effect of the position of the scapula has been clearly documented in the GPA values measured [69].

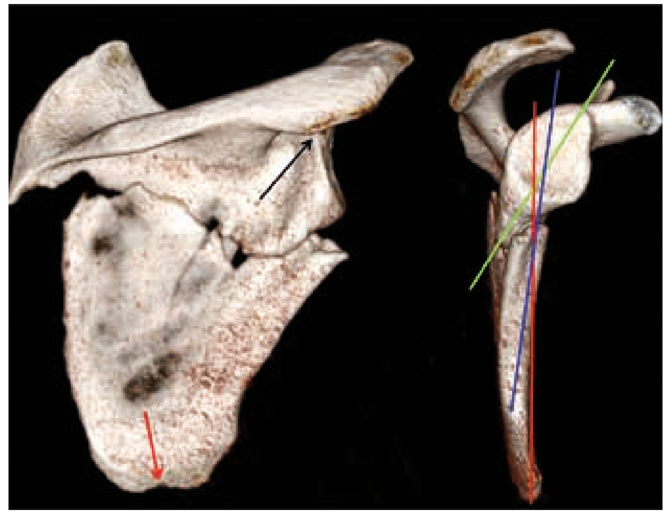

Fig. 9-23 Problematic identification of metric points. In certain scapulae it is difficult to determine exactly the tip of the inferior angle (red arrow), and/or the superior pole of the glenoid (black arrow), which is often overshadowed by scapular processes on 3D CT reconstructions. In certain cases, it is difficult to determine exactly also the axis of the distal fragment of the lateral pillar.

The third factor is that the two fragments being measured are not always displaced at a single level, but may be displaced at two or three levels. As a result, the two fragments cannot be at the same time in an optimal position in terms of measuring in the radiographic projection or 3D CT reconstruction. This naturally influences the values measured.

RELATIVE RADIOLOGICAL INDICATION CRITERIA FOR OPERATIVE TREATMENT OF SCAPULAR FRACTURES

Intraarticular fracture

- Step-off or gap of fragments – 4 mm
- Articular surface involvement – 25%

Extraarticular scapular body and neck fracture

- Angulation of lateral pillar fragments in Y-view – 40 degrees
- Angulation of lateral pillar fragments in Neer I projection – 30 degrees
- Mediolateral translation of lateral pillar fragments at the level of the scapular body – 20 mm
- Overlap of lateral pillar fragments in Neer I or II projections – 25 mm
- Glenopolar angle in Neer projection < 20 degrees, > 60 degrees

Process fractures – injuries to SSSC

- Minimally double lesion with a minimal displacement of 10 mm each
  Coracoid base + acromion/ scapular spine
  Coracoid + AC dislocation

Fig. 9-24 Indication criteria for operative treatment

10

SURGICAL APPROACHES

Due to the complex anatomical shape of the scapula, its specific location on the rib cage and the wide spectrum of its injuries, there is no single surgical approach that affords access to all fractures of this bone. The choice of the surgical approach is based primarily on the type of fracture and the surgeon's experience. The dissection technique depends also on the injury-operation interval. Radiographic examination alone is not sufficient to determine the surgical approach. Currently, the method providing an exact picture of the anatomy of the fracture, allowing planning of an optimal surgical approach, is 3D CT reconstruction of the injured scapula.

Surgical approaches to the shoulder have undergone a long historical evolution, the milestones of which included the publications by Kocher of 1907 [24], Dupont-Evrard of 1932 [7], Rowe of 1943 [34], Nicola of 1945 [27] and Abbott of 1949 [1]. Based on these publications, and in association with the development of operative treatment of scapular fractures, there gradually began to appear new approaches devised to manage individual types of injury.

Currently, four basic approaches, in various modifications, are used, namely the Judet posterior, the posterosuperior, the anterior deltopectoral and the Dupont-Evrard posterolateral, approaches.

JUDET POSTERIOR APPROACH

This approach was described by Robert Judet [21] in 1964 to treat scapular neck and body fractures. In clinical practice it was popularized in the 1970s, primarily by AO surgeons [14, 16, 25, 37]. In the English literature it appeared some two decades later, and it is still commonly in use [6, 8, 13, 15, 19, 26, 28, 30-32, 35, 38, 39]. The approach, used nowadays with various modifications, provides an excellent exposure of the entire infraspinous fossa, the lateral and medial borders of the scapula, the scapular spine, the anatomical and surgical necks, and the posterior and inferior rims of the glenoid.

ORIGINAL JUDET DESCRIPTION

The original description was published in French [21] and for this reason a number of authors have presented it inaccurately. In his study, Judet started with a defense of operative treatment. In his view, internal fixation significantly accelerated restoration of shoulder function. In harmony with his French predecessors [7], he called the lateral border of the scapula a pillar ("*pilier*"). The exact description reads as follows:

"The patient is placed in a prone position; the reference structures are the acromion and the scapular spine. The upper extremity hangs loosely, preferably in 90-degree abduction. An L-shaped incision angles sharply at the medial border of the scapula and extends as far as the posterior border of the scapular spine. Medially, it ends just above the inferior angle of the scapula; laterally it extends as far as the acromial angle. The skin and subcutaneous tissue, including the aponeurosis of the infraspinatus, are incised close to the medial border of the scapula down to the bone.

The posterior deltoid is detached from the scapular spine. The resulting block of soft tissues is thus formed by skin, partly by the aponeurosis and partly by muscles. Its base is formed by the posterior surface of the pillar, its free medial border is formed by the infraspinatus and its proximal part by the infraspinatus and the deltoid. If it is necessary to expose the superior pole of the glenoid, the acromion must be osteotomized in the upper part of the lateral edge of the scapular spine, perpendicular to the scapula."

As an example, Judet described one case of an infraspinous fracture of the body treated with a plate placed on the lateral pillar, without presenting other cases.

MODIFIED JUDET APPROACH

The Judet approach has been modified over time by his successors, as experience showed that mobilization of the flap in a single, compact layer was not optimal. Therefore, some authors changed the technique of dissection of individual soft--tissue layers, while others also modified the shape of the skin incision [6, 8, 13, 15, 19, 26, 28, 30-32, 35, 38, 39].

Hardegger et al. [14], in 1984, were the first to publish a phased dissection of soft tissues, i.e., gradual retraction of individual layers (skin, deltoid, infraspinatus) and the use of the interval between the infraspinatus and the teres minor. Subsequently, they were followed by other authors, some of whom also supported their recommendations with detailed anatomical studies [4, 13, 15, 28, 30, 31, 35, 39].

The first to describe the change in direction of the skin incision, i.e., along the scapular spine and the lateral border of the scapula with the apex of the flap towards the lateral angle of the scapula, were Ebraheim et al. [8] in 1997, who were followed by van Nort et al. [38] and recently by Manohara and Kumar [26], and by Porcellini et al. [32]. Obremskey et al. [30] saw no benefit from this change for a number of perfectly acceptable and logical reasons.

MODIFIED JUDET APPROACH USED BY THE AUTHORS

As compared to the original Judet approach, with retraction of soft tissues in a single layer, a phased process allows dissection only to the minimally required extent and, thereby, spares individual muscles, the infraspinatus in particular [2, 3].

Indications: The Judet approach is indicated for fractures of the scapular body and neck, the inferior glenoid, the entire glenoid, and any combination thereof.

Patient positioning: The patient is placed in a semiprone position on the intact side, with supports in the region of the lumbar spine and the chest. As scapular fractures are associated in a majority of cases with rib fractures, maximal caution is required during patient positioning. Subsequently, reference structures are marked on the skin, i.e., the contours of the scapular body, the scapular spine and the acromion (Fig. 10-1).

Preparation of the surgical site and draping: The skin of the whole forequarter is carefully disinfected, including the ipsilateral clavicle, the adjacent part of the neck and the entire upper extremity on the injured side. The extremity must be draped free to allow for its manipulation during surgery.

High-risk structures: During dissection, there is a risk of damage to both the scapular circumflex artery in the upper half of the interval between the infraspinatus and the teres minor muscles, as it passes around the lateral border of the scapular body, and to the suprascapular nerve and artery at their exit from the spinoglenoid notch.

Dissection phases: The dissection has three basic phases. The first phase consists of a boomerang skin incision passing from the acromial angle along the scapular spine to the spinomedial angle and along the medial border of the scapula, and raising a skin flap. In the next phase, the posterior border of the deltoid is identified, its posterior part detached from the scapular spine and turned back laterodistally. In the final phase, the infraspinatus is mobilized and retracted proximally. In each of the phases it is possible to open the interval between the infraspinatus and the teres minor and to expose the lateral border of the scapular body (Fig. 10-2).

Skin incision and subcutaneous dissection: A boomerang, or an L-shaped, skin incision extends from the posterior edge of the acromial angle along the scapular spine to the spinomedial angle, where it turns and continues along the medial border of the scapula to the inferior angle of the scapula (Fig. 10-3). Subcutaneous tissue is incised down to the common fascia of the deltoid and the infraspinatus. In this phase, that fascia should remain intact. In the next step, a skin flap is raised, preferably with scissors, retracted laterodistally and held in this position by two sutures.

Dissection of the posterior border of the deltoid: Another important step is identification of the posterior border of the deltoid. This is not always easy as the spinal portion of the deltoid and the medial portion of the infraspinatus are covered by a common fascia passing from the medial part of the infraspinatus to the posterior edge of the deltoid. Identification of the posterior deltoid border may be facilitated by palpation of the triangular tuberosity, to which the posterior border of the muscle attaches. Another option is tracing of the course of the attachment fibers of the ascending part of the trapezius, which continue into the posterior edge of the deltoid (Fig. 10-4).

After identification of the posterior border of the deltoid, the common fascia is split by a T-shaped incision, with one limb of the incision following the posterior edge of the deltoid and the other, incising the fascia of the infraspinatus, running perpendicular to it. Prior to performing this part of the incision, the fascia is digitally released from the infraspinatus belly to the maximal extent possible (Fig. 10-5). This T-shaped incision exposes adequately both the posterior edge of the deltoid and the medial half of the infraspinatus (Fig. 10-6).

Release of the spinal origin of the deltoid: Prior to releasing the spinal origin of the deltoid from the scapular spine, the anterior surface of the deltoid covering the infraspinatus, is separated from the latter muscle. At the site of their attachment to the scapular spine, the two muscles share their fibers and

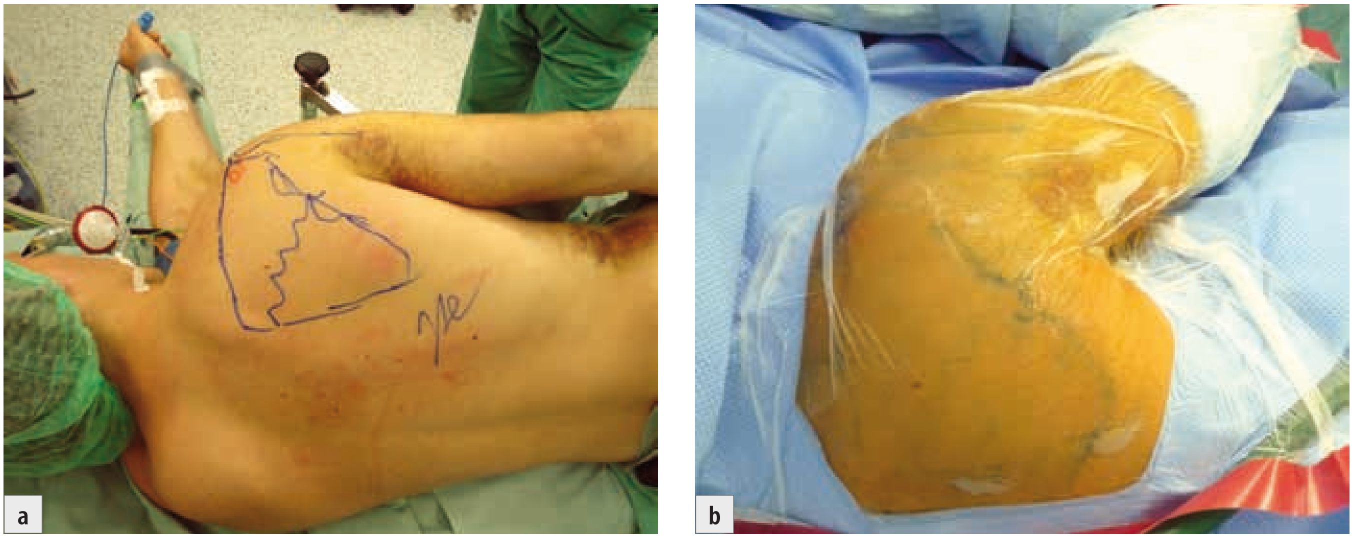

Fig. 10-1 Patient positioning in the Judet approach: **a)** a semiprone position; **b)** free draping allows for adequate manipulation of the injured extremity.

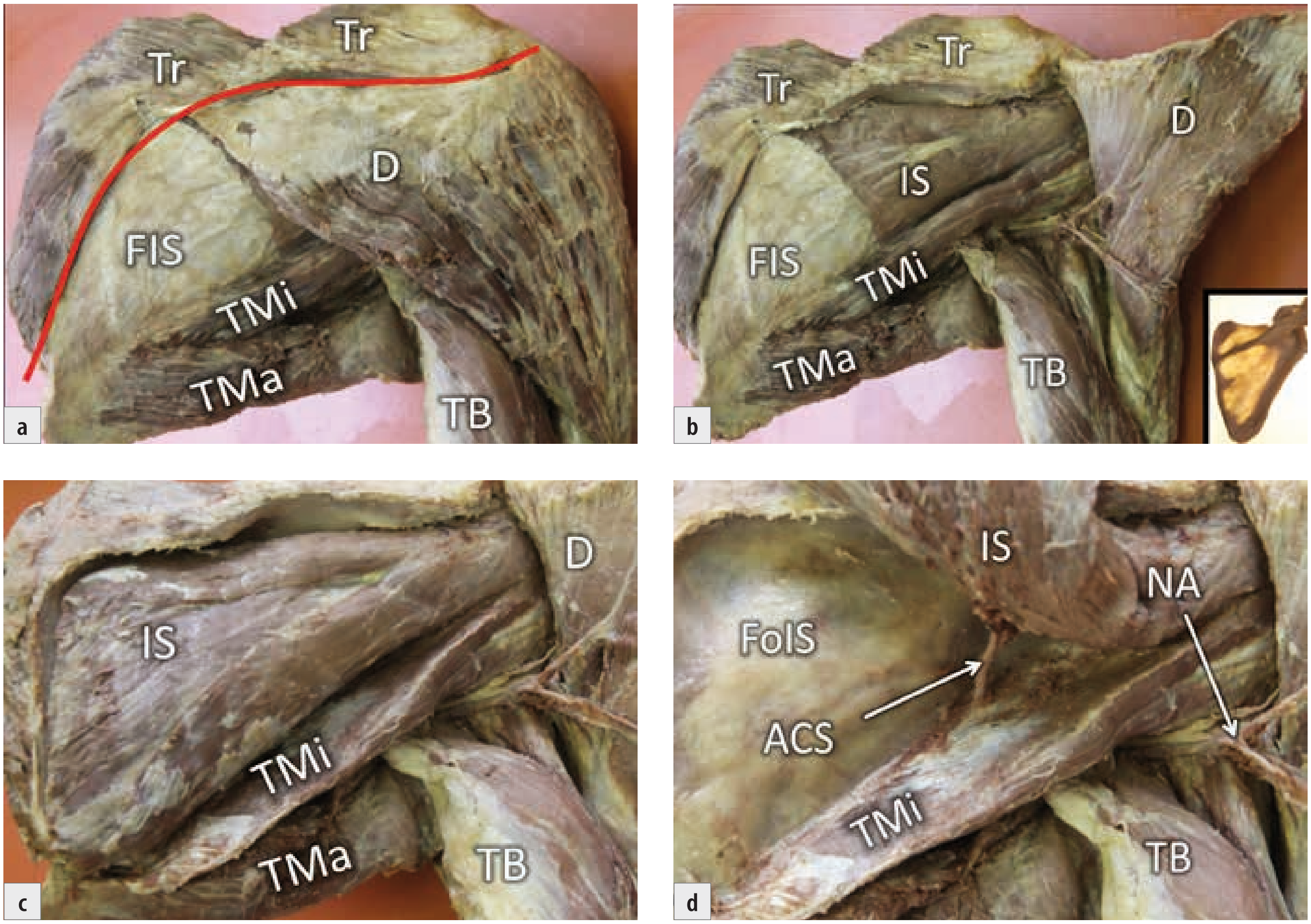

Fig. 10-2 Individual phases of the modified Judet approach on an anatomical specimen: **a)** the shape of skin incision; **b)** reflection of the deltoid; **c)** identification of the interval between the infraspinatus and the teres minor; **d)** retraction of the infraspinatus. ACS – scapular circumflex artery, D – deltoid, FIS – fascia of the infraspinatus, FoIS – infraspinous fossa, IS – infraspinatus, NA – axillary nerve, TB – long head of the triceps brachii, TMa – teres major, TMi – teres minor, Tr – trapezius.

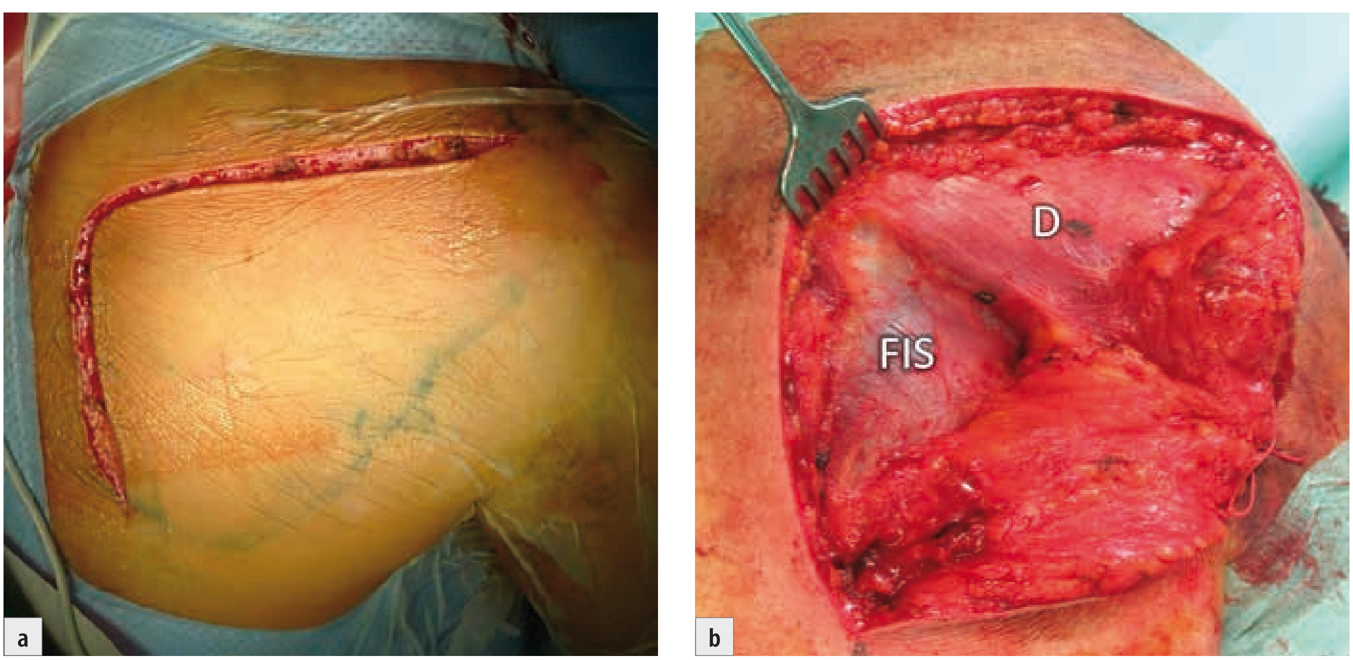

Fig. 10-3 Judet approach – skin incision and raising of the skin flap: **a)** L-shaped skin incision; **b)** reflected skin flap. D – deltoid, FIS – fascia of the infraspinatus passing laterally to the deltoid.

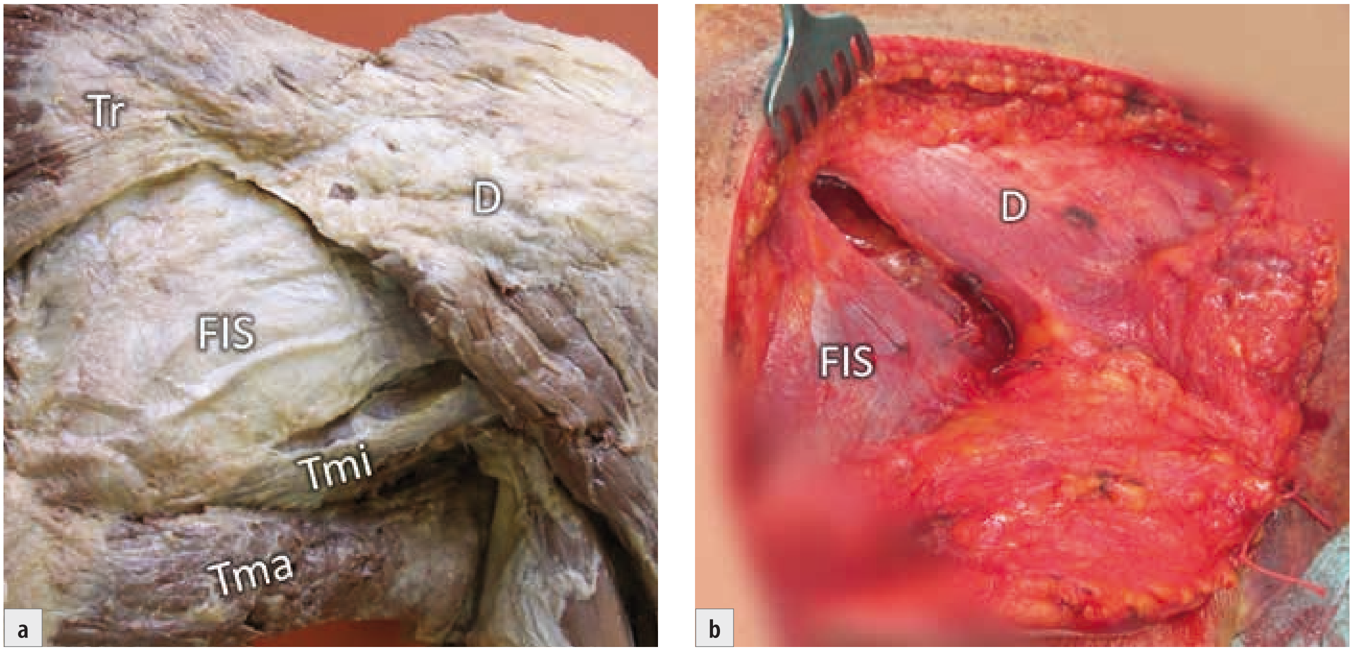

Fig. 10-4 Identification of the posterior border of the deltoid: **a)** anatomical specimen; **b)** intraoperative photograph. **D** – deltoid, **FIS** – fascia of the infraspinatus, **Tma** – teres major, **Tmi** – teres minor, **Tr** – trapezius.

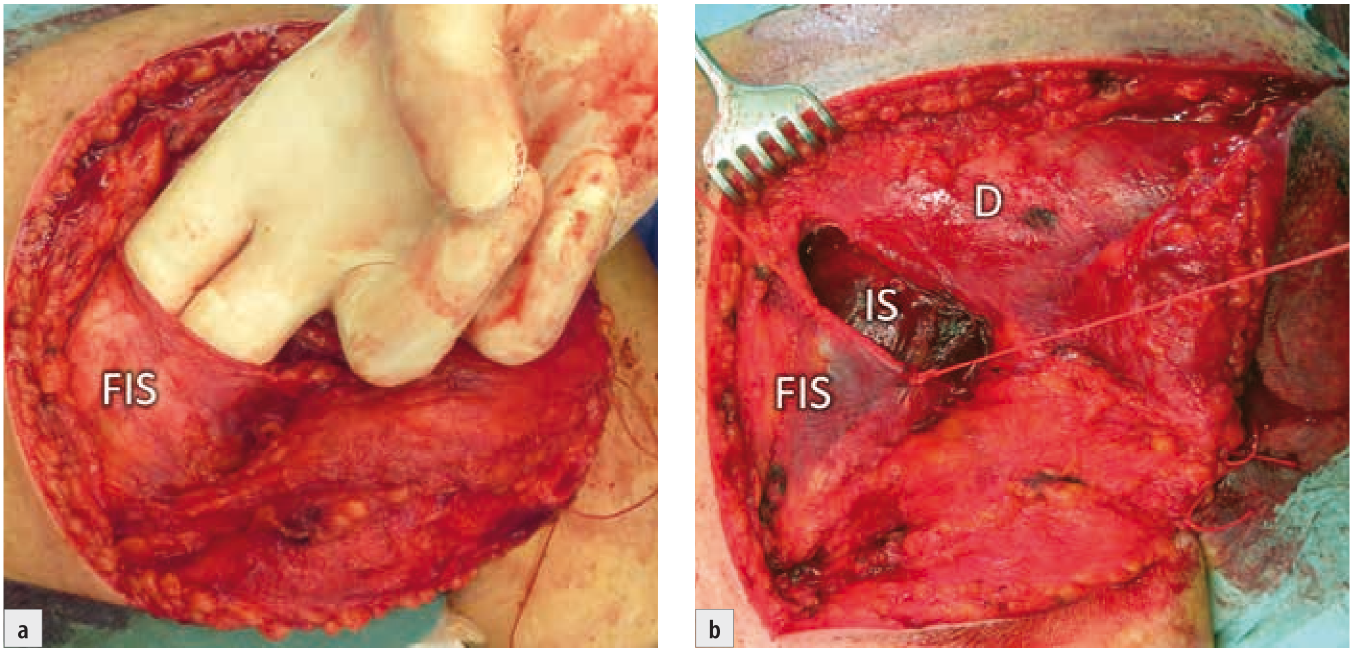

Fig. 10-5 Release of the fascia of the infraspinatus: **a)** digital dissection; **b)** insertion of sutures. **D** – deltoid, **FIS** – fascia of the infraspinatus, **IS** – infraspinatus.

their separation may therefore be difficult. Subsequently, the spinal portion of the deltoid is released from the scapular spine in a mediolateral direction, as far as the acromial angle.

This manoeuvre can be facilitated by inserting sutures into the edge of the deltoid and detachment of the distracted muscle from the scapular spine using electrocautery. A small bleeding artery can typically be found at the level of the spinoglenoid notch, arising here from the suprascapular artery stem. The muscle is released as far as the acromial angle and then retracted laterodistally. In this way, the whole posterior surface of the infraspinatus is exposed (**Fig. 10-7**).

Intermuscular windows: Two intermuscular windows – the lateral and the medial, can be created on the posterior surface of the scapula (**Fig. 10-8**).

The lateral window lies in the interval between the infraspinatus and the teres minor, i.e., at the muscle innervation interface (**Fig. 10-9**). In 90% of cases, the two muscles are separated by a fascial septum and each muscle has its own compartment. In the remaining 10%, the fascia is common and the septum is absent: in such cases identification of the interval is more difficult. Medial retraction of the infraspinatus exposes the scapular circumflex vessels perforating the teres minor, as a rule

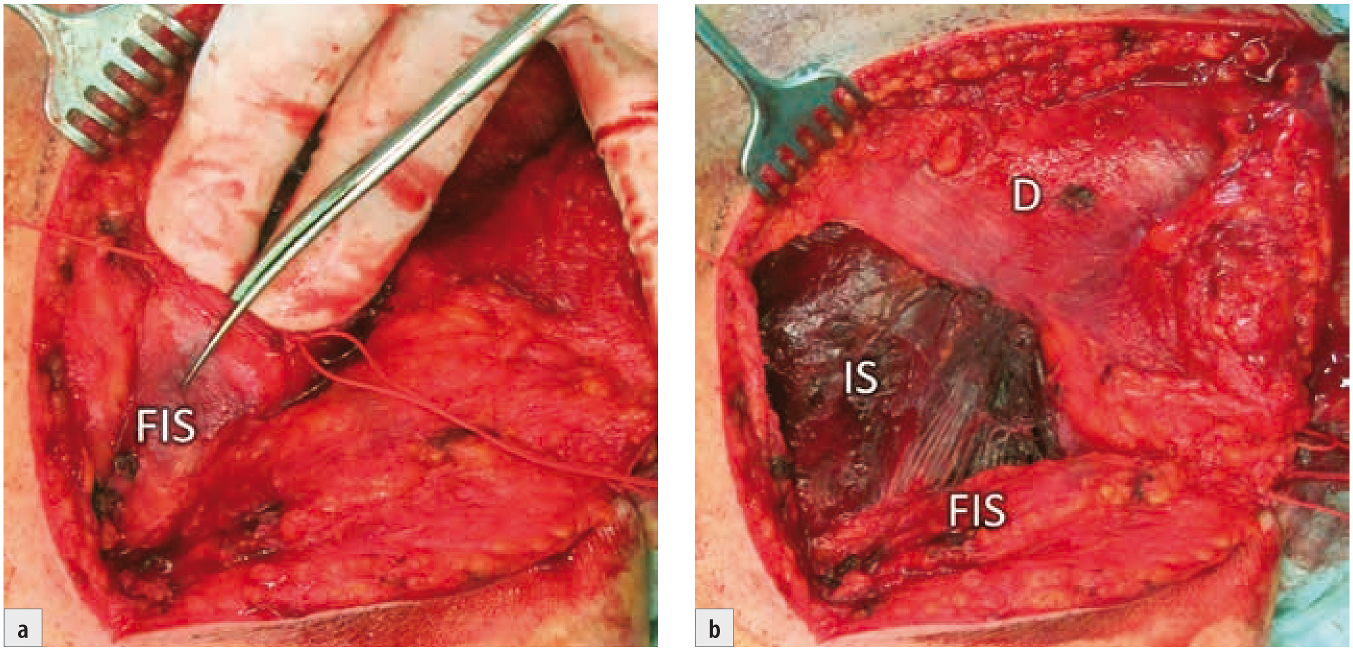

Fig. 10-6 Reflection of the fascia of the infraspinatus: **a)** T-shaped incision of the fascia; **b)** opening of the fascia. **D** – deltoid, **FIS** – fascia of the infraspinatus, **IS** – infraspinatus.

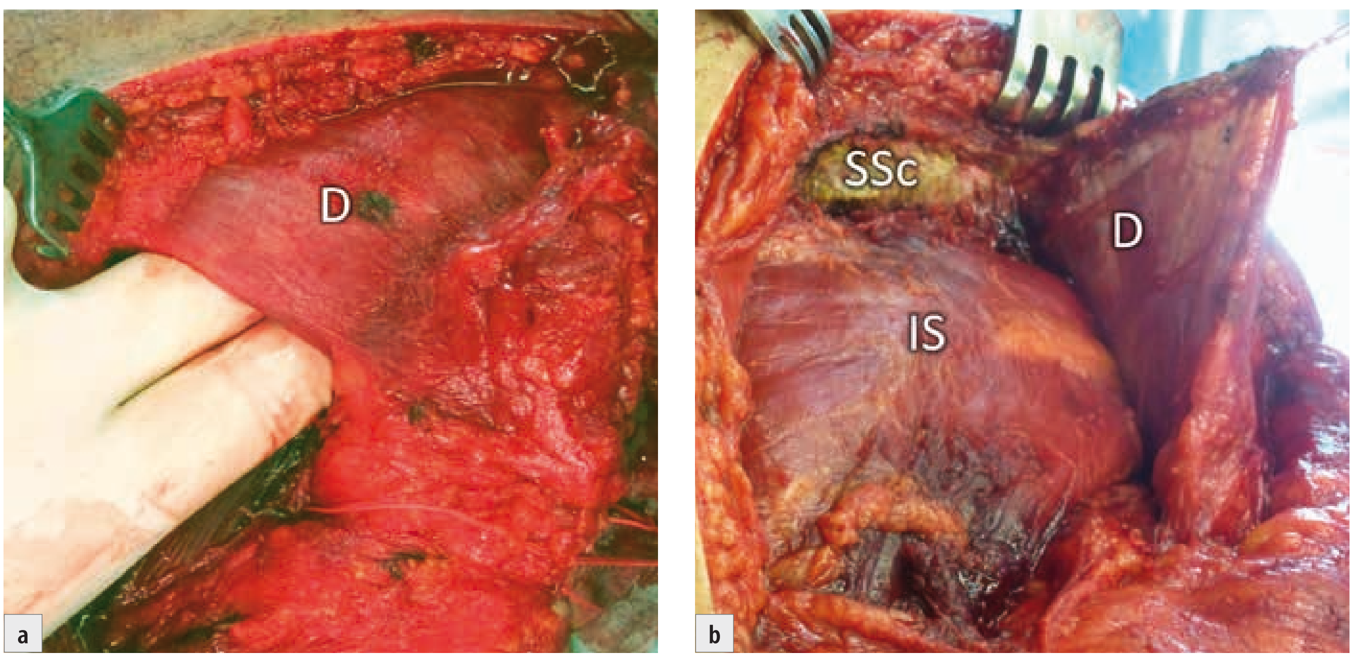

Fig. 10-7 Reflection of the deltoid: **a)** detachment of the deltoid from the infraspinatus; **b)** reflection of the muscle laterally. **D** – deltoid, **IS** – infraspinatus, **SSc** – scapular spine.

3 to 4 cm distal to the lower rim of the glenoid, and passing around the lateral border of the scapula to its posterior surface (**Fig. 10-10**). Unless injured at the time of fracture, these vessels must be ligated and divided, in order to expose the posterior surface of the lateral pillar.

The medial window, between the superomedial border of the infraspinatus and the trapezius, is used when it is necessary to reduce and fix a fracture in the spinomedial angle, but retraction of the infraspinatus is not desirable.

Release and reflection of the infraspinatus: The muscle is first released along its circumference medially, distally and laterally. Due to innervation and blood supply of the infraspinatus, the muscle can be safely reflected only proximolaterally, although some authors describe other techniques (**Figs. 10-11**, **10-12**). Therefore, the muscle is reflected from the inferior angle towards the scapular spine. The released part of the muscle is carefully reflected towards the spinoglenoid notch. During reflection from the lateral border of the scapular

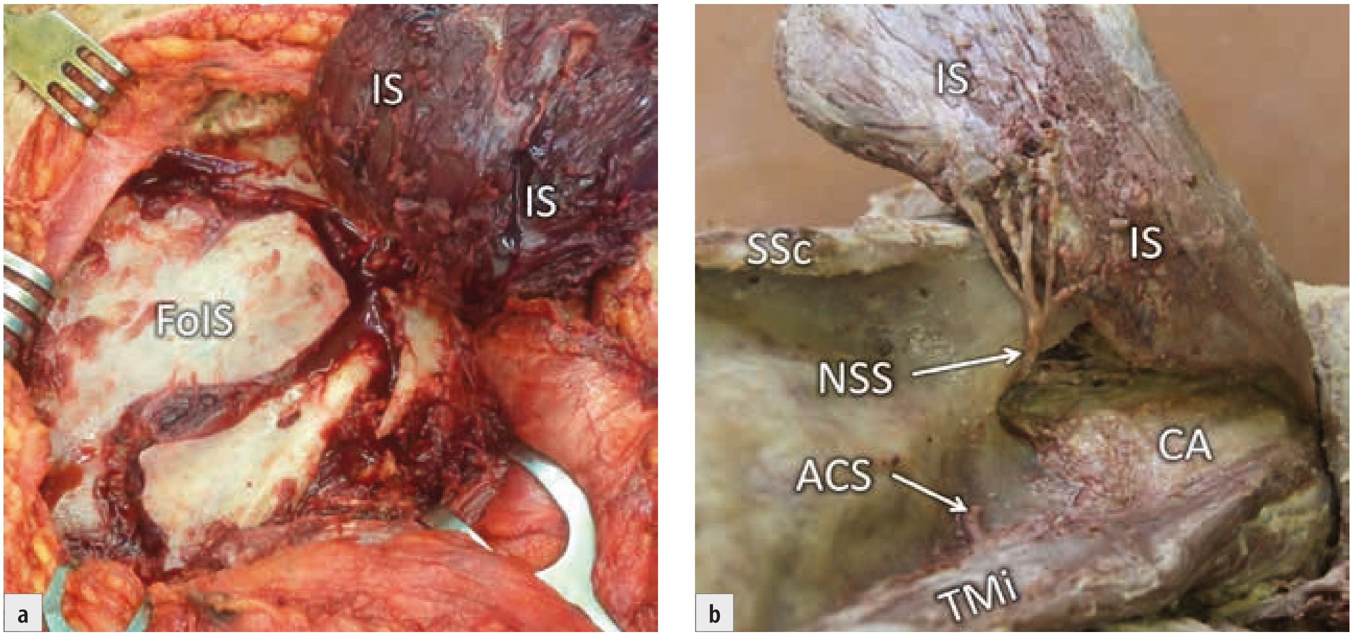

Fig. 10-13 Retraction of the infraspinatus: **a)** intraoperative photograph; **b)** anatomical specimen. **ACS** – scapular circumflex artery, **CA** – glenohumeral joint capsule, **FoIS** – infraspinous fossa, **IS** – infraspinatus, **NSS** – suprascapular nerve, **SSc** – scapular spine, **TMi** – teres minor.

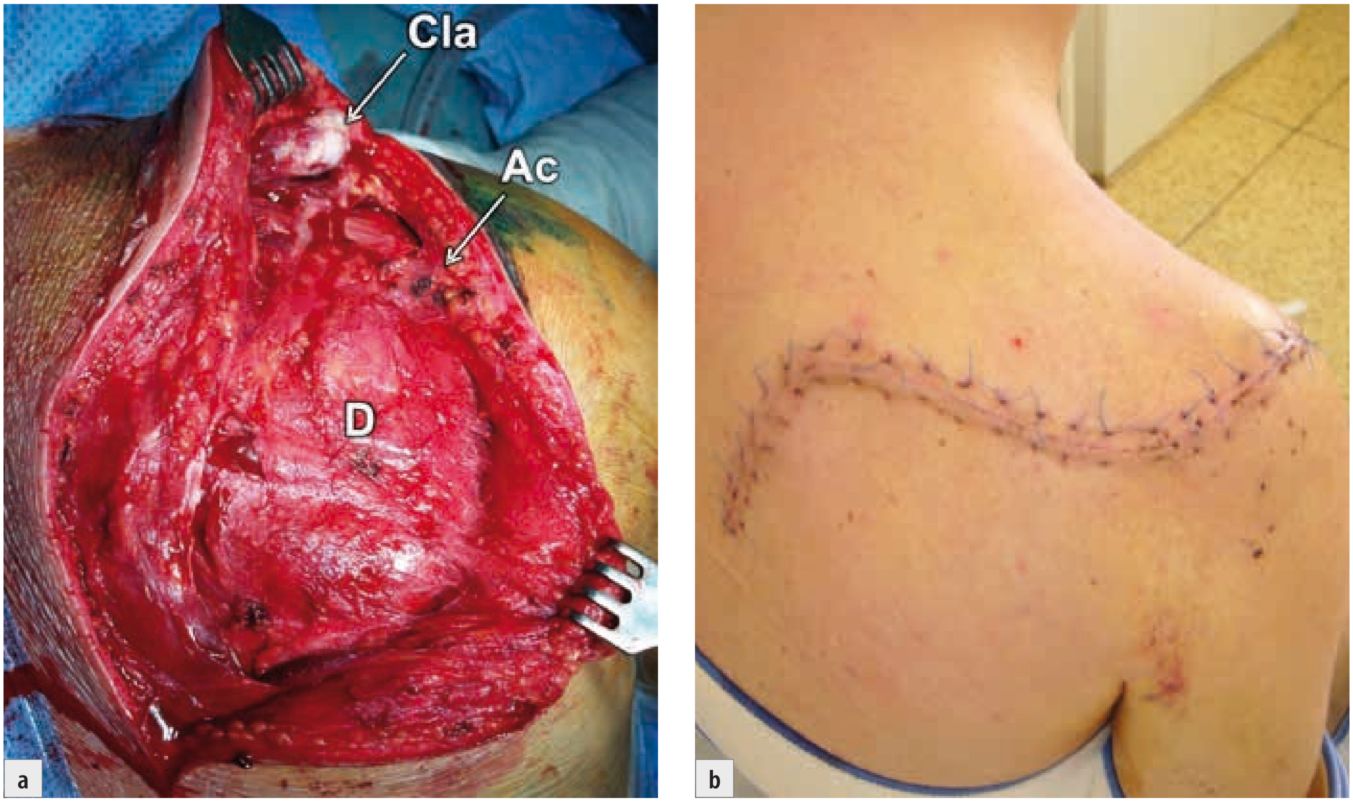

Fig. 10-14 Extended Judet approach for associated AC dislocation: **a)** intraoperative photograph; **b)** skin incision. **Ac** – acromion, **Cla** – clavicle, **D** – deltoid.

For this reason, a modified Judet approach may be used in three options, depending on the fracture pattern and injury--operation interval.

In the first option, after raising of a skin flap, we make only a T-shaped incision of the infraspinatus fascia and subsequently we open a lateral intermuscular window. In this way, the lateral border of the scapular body is exposed without the necessity to release the deltoid (**Fig. 10-17**). This approach is suitable mainly for two-part fractures of the infraspinous part of the scapular body with a sufficiently long proximal fragment (**Fig. 10-18**).

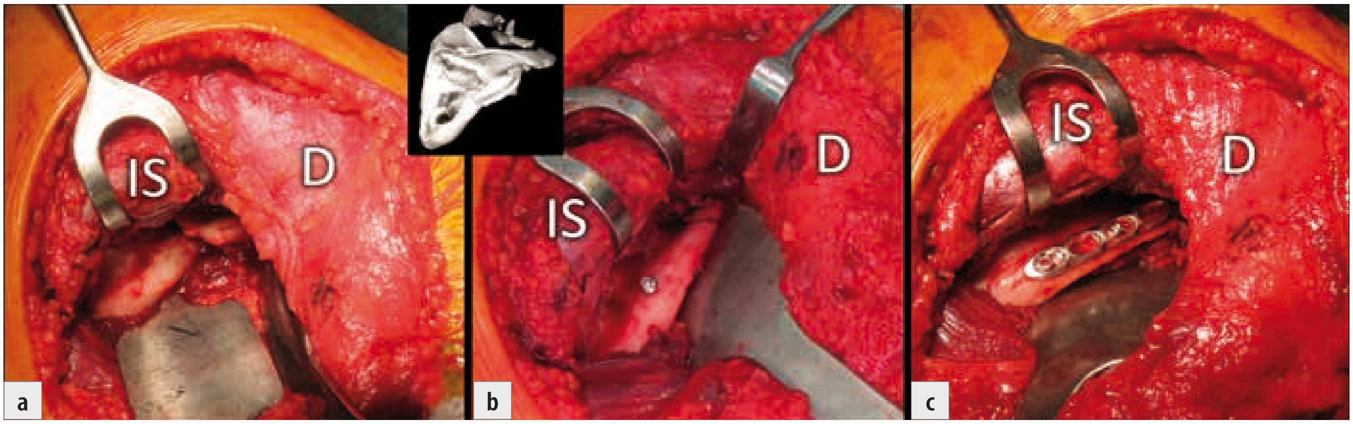

Fig. 10-17 Modified Judet approach without mobilization of the deltoid and the infraspinatus: **a)** exposure of the lateral pillar in a two-part infraspinous fracture of the scapular body; **b)** reduction of fragments; **c)** internal fixation of the lateral pillar using a 2.7-mm plate. D – deltoid, IS – infraspinatus.

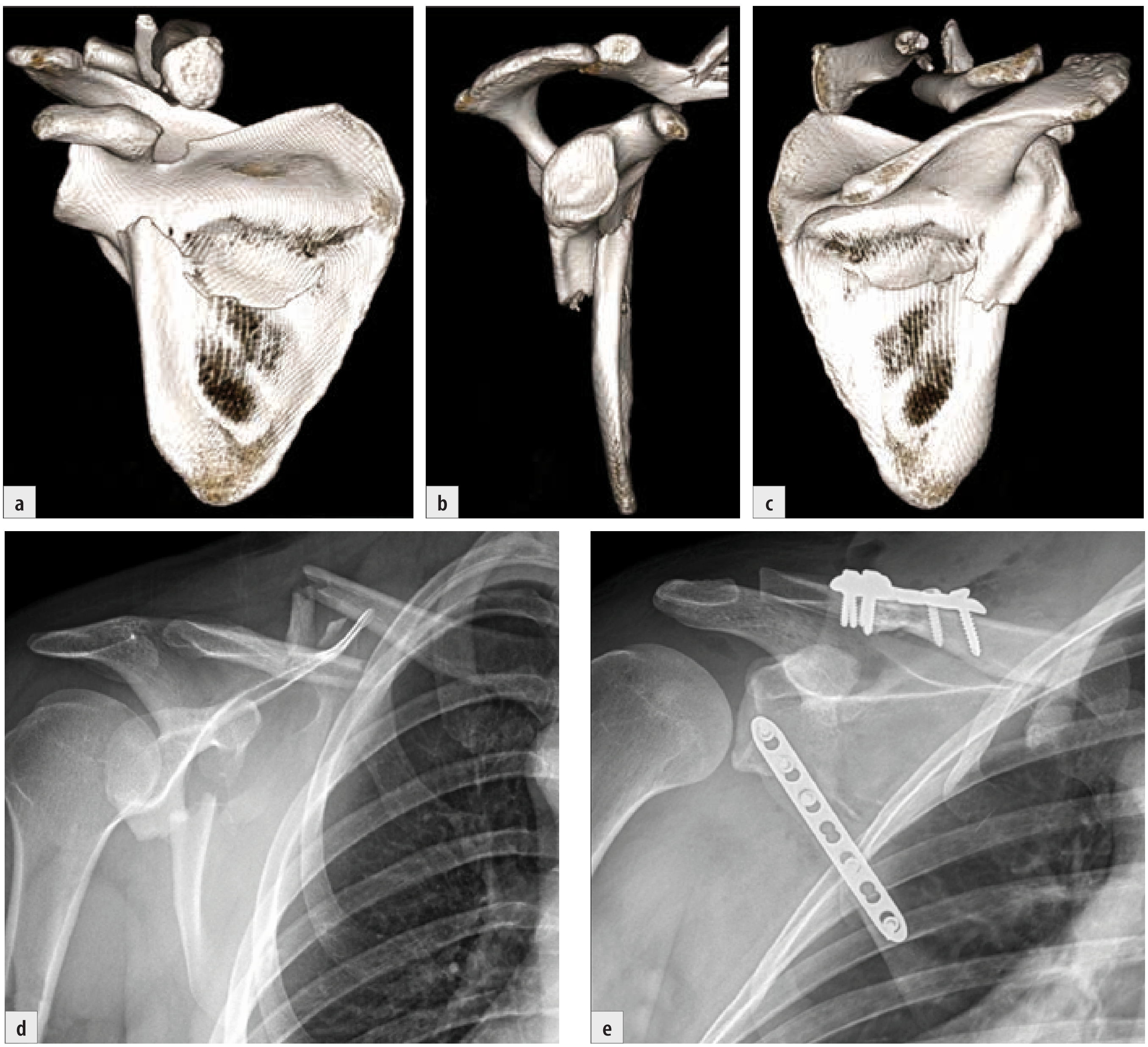

Fig. 10-18 Two-part infraspinous fracture of the scapular body combined with a clavicular shaft fracture, a case from Fig. 10-17: **a-c)** 3D CT reconstruction, **d)** post-injury radiograph, **e)** postoperative radiograph.

11

OPERATIVE TREATMENT

In the past, few authors have given detailed descriptions of operative techniques for treating scapular fractures, primarily from the AO school [6, 12, 30, 31, 40, 42, 48, 66]. However, lately there have already been numerous studies that focus on the operative techniques in detail, specify indication criteria and evaluation of outcomes of operative treatment of these fractures [1, 2, 4, 5, 7-11, 13, 16-24, 29, 32-38, 41-47, 49, 51, 60, 61, 63, 64, 70, 71].

BASIC PREREQUISITES

The basic prerequisite for successful operative treatment is to follow a sequence of necessary steps, starting with a detailed radiological examination and ending with postoperative rehabilitation. This requires an individualized approach to each particular fracture and the availability of adequate equipment and surgical skills (**Table 11-1**).

PREOPERATIVE RADIOGRAPHIC EXAMINATION

Essential for establishing a correct indication and a well-conducted operation is a detailed definition of the fracture anatomy [3, 10]. Such knowledge can reliably be obtained only by standardized 3D CT reconstructions, with the subtraction of surrounding bones, serving as a basis for determining the pattern of the fracture, its displacement, an optimal therapeutic procedure and, in case of operative treatment, also the surgical approach to provide the required exposure.

INDICATIONS FOR OPERATIVE TREATMENT

Indication criteria were discussed in detail in Chapter 9. It should be noted that the mentioned radiological criteria are only a part of the decision-making process (**Fig. 11-1**). Of decisive importance is the patient's general and local condition, and their functional demands and expectations. Of no less importance are the knowledge, experience and skills of the attending surgeon [13].

PREPARATION OF THE PATIENT, AND OPERATING RESOURCES

Prior to operation, patients should be duly informed about the necessity and goals of the operative procedure, its potential complications, postoperative rehabilitation and the expected duration of treatment. It is beneficial to use a radiolucent table, which allows adjusting the patient's position according to the chosen surgical approach. However, radiolucency is not always a necessary precondition as the use of an image intensifier is helpful only in certain fracture patterns. Endotracheal anesthesia is necessary in view of the patient's positioning, and, in case of a presumed longer procedure, the patient should have a urinary catheter inserted.

The patient's position on the operating table must be stable, especially if a change in orientation of the operating table is required during operation. Care should be taken to avoid pressure sores, mainly with the use of the Judet approach with the patient in a semi-prone position (**Fig. 11-2**).

Complying informed patient
Preoperative plan based on 3D CT reconstructions
Surgical approach
Patient's position
Reduction and internal fixation plan
Basic equipment of operating theater
Positioning operating table
Positioning and anti-sore aids
Image intensifier
Patient's preparation
General anesthesia with intubation
Bladder catheterization
Patient's stable positioning with sore prevention
Draping allowing free motion of the operated on limb
Instruments and implants
Basic instruments for bone surgery
Implant set 2.7-mm or 3.5-mm
K-wires, tension band wire
Drilling machine
Scapula model
Postoperative physiotherapy
Shoulder continuous passive motion machine
Skilled physiotherapist

Table 11-1 Basic prerequisites of a successful operative treatment.

EQUIPMENT AND CHOICE OF IMPLANTS

In addition to basic surgical tools for internal fixation, it is beneficial also to have available other instruments, such as Hohmann-Müller retractors of different types and sizes, raspatories, bone curettes of different sizes, small reduction forceps and bone drills.

As a rule, internal fixation of scapular fractures does not require special implants. Reduction and temporary fixation is performed with the use of 0.5-2mm K-wires, and final internal fixation with implants from the 2.7-mm, or 3.5-mm, instrumentation set, including the appropriate cortical screws, 2.7-mm or 3.5-mm reconstruction plates, 2.7-mm or 3.5-mm semitubular plates, and T- or L-shaped plates. Locking plates are required only in exceptional cases.

We currently prefer 2.7-mm implants that better fit the shape of the scapula, whilst providing sufficient stability, without projecting excessively from the bone surface. Only exceptionally are 3.5-mm implants required in more robust patients, or in case of greater comminution of one of the pillars [10].

Sometimes, we use smaller, 2.4-mm or 2.0-mm screws to fix small fragments of the articular surface, or intermediate fragments of the lateral pillar. Cannulated screws (3.5-mm or 4.0-mm) are useful for internal fixation of the coracoid process.

Anatomically-shaped plates contoured to the circumference of the biomechanical triangle, which are recommended by some authors [25, 26, 69], cannot be used in all patients, due to the considerable variability of the shape and size of the scapular body. Several reports have been published on the use of a modified AO calcaneal plate [57], or a distal humeral Y-plate [39], a “3D printed” and Y-plate [59] in a comminuted scapular body fracture, and an AO 2.7-mm mesh plate [36], as well as a plate for a lateral clavicular fracture [35, 36] in a multi--fragmentary fracture of the acromion.

STRATEGY

Assessment of the fracture and the choice of the surgical approach are followed by planning the actual reconstruction. This applies particularly to complex fractures. In terms of internal fixation it has to be taken into account that the scapula has an irregular distribution of its bony mass, with only certain areas offering sufficient anchorage for implants. These include mainly the lateral pillar of the scapular body, the scapular spine, the scapular neck and glenoid, the acromion, and the inferior angle (Fig. 11-3).

FRACTURES OF THE SCAPULAR BODY

In fractures of the scapular body, it is essential to restore the integrity of the biomechanical triangle, primarily the lateral pillar and, when necessary, the spinal pillar. The first step in infraspinous fractures is always reconstruction of the lateral

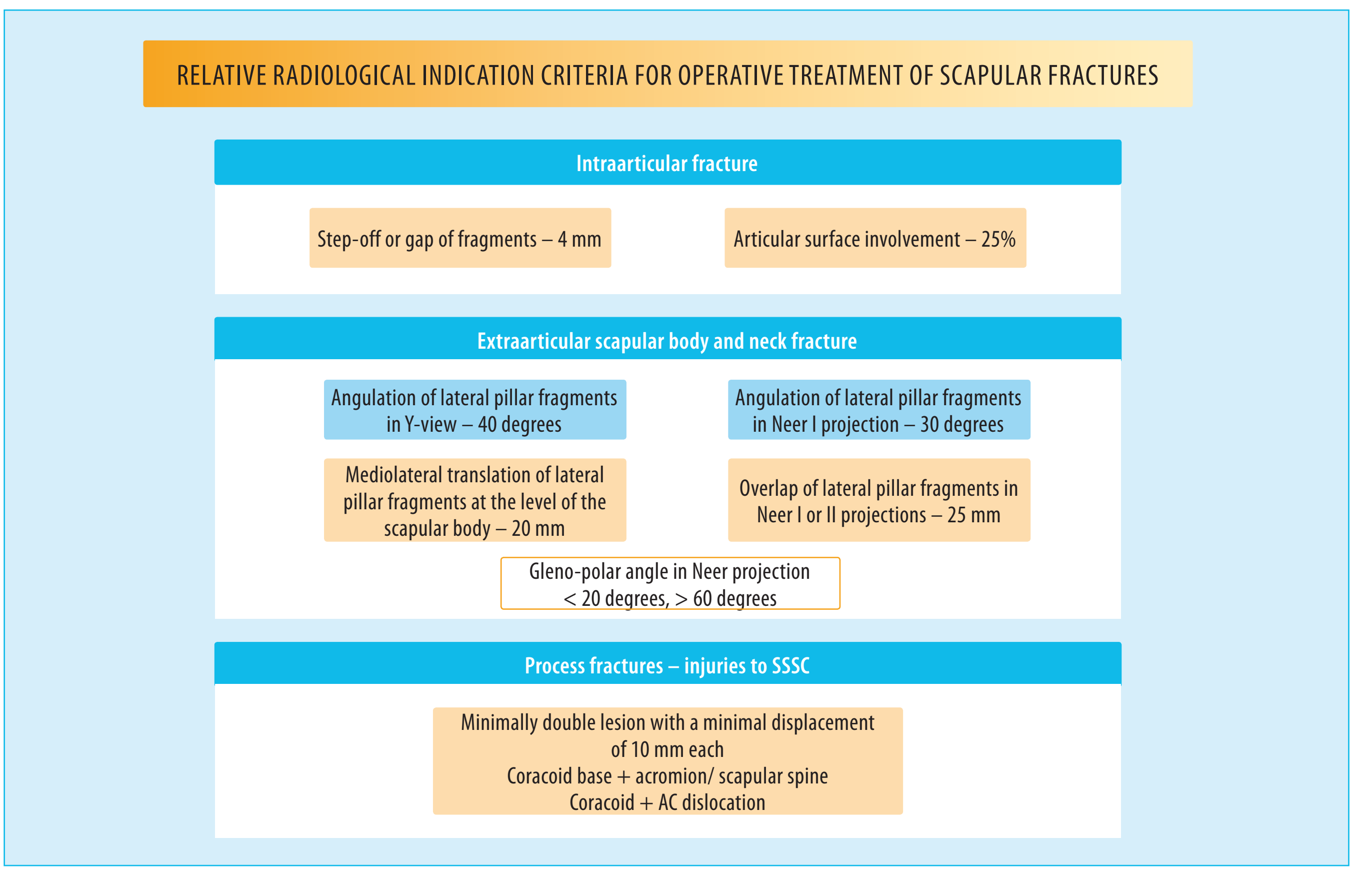

Fig. 11-1 Indication criteria for operative treatment

REDUCTION AND FIXATION TECHNIQUE

The technique of reduction and fixation depends predominantly on the fracture pattern. It is, therefore, essential to respect specific features of each fracture and to adjust the operative technique accordingly.

The scapula heals with rapid callus formation. As a majority of scapular fractures are operated on with a delay of several days to weeks, it is necessary to clear the fracture surfaces of callus prior to reduction, mainly in glenoid and lateral, or spinal, pillar fragments.

Reduction of fragments can be performed manually, using the respective instruments (reduction forceps), or by means of implants temporarily inserted into the fragments as joysticks. For fixing small fragments, one or two K-wires are used; larger fragments are held with 2.5-mm, or 3.5-mm, screws, exceptionally with an additional small plate.

But for a few exceptions, we do not use a standard image intensifier to check reduction in open procedures, as is recommended by some authors [20-22]. In our view, intraoperative radiology cannot compensate for a properly performed approach that provides good visualization of the fracture site, and the choice of a safe direction of individual screws, including careful and repeated measurement of their length. We have encountered only one case of intraarticular penetration of screws, namely in one of the first of our 150 operations performed so far.

Based on our long-term experience, we currently prefer a "minimalistic" type of internal fixation and, unlike many other authors [20-22], we avoid the use of an excessive number of plates.

Multiple plates require a more extensive dissection, which can often further compromise the fracture stability [21, 22]. We have also reduced indications for internal fixation in the spinomedial angle [7, 10]. Our treatment outcomes have proved that with a proper indication and technique, healing of fractures in an anatomical position can be achieved, in a majority of cases, using standard 2.7-mm implants, without the use of locking screws [8, 11]. We have not, so far, encountered any case of secondary postoperative displacement of fragments. If there occurred breakage of a plate, it was always attributable to non-compliant full load-bearing in the first weeks postoperatively. In spite of this, the fractures healed without displacement [10]. Our "minimalistic" strategy has also been confirmed by recent studies [1].

FRACTURES OF THE LATERAL PILLAR

The lateral pillar is a key structure in the treatment of fractures of the scapular body and neck. Stable fixation of fractures of the lateral pillar is essential and should be performed as the first step. A rare exception may be some fractures of both pillars of the scapular body, where internal fixation of the spinal pillar, i.e., the scapular spine, is the first step.

Reduction

Most infraspinous fractures of the scapular body are associated with contraction of the scapular musculature, especially the infraspinatus and the subscapularis, causing overlap of the two main fragments of the lateral pillar, resulting in its shortening.

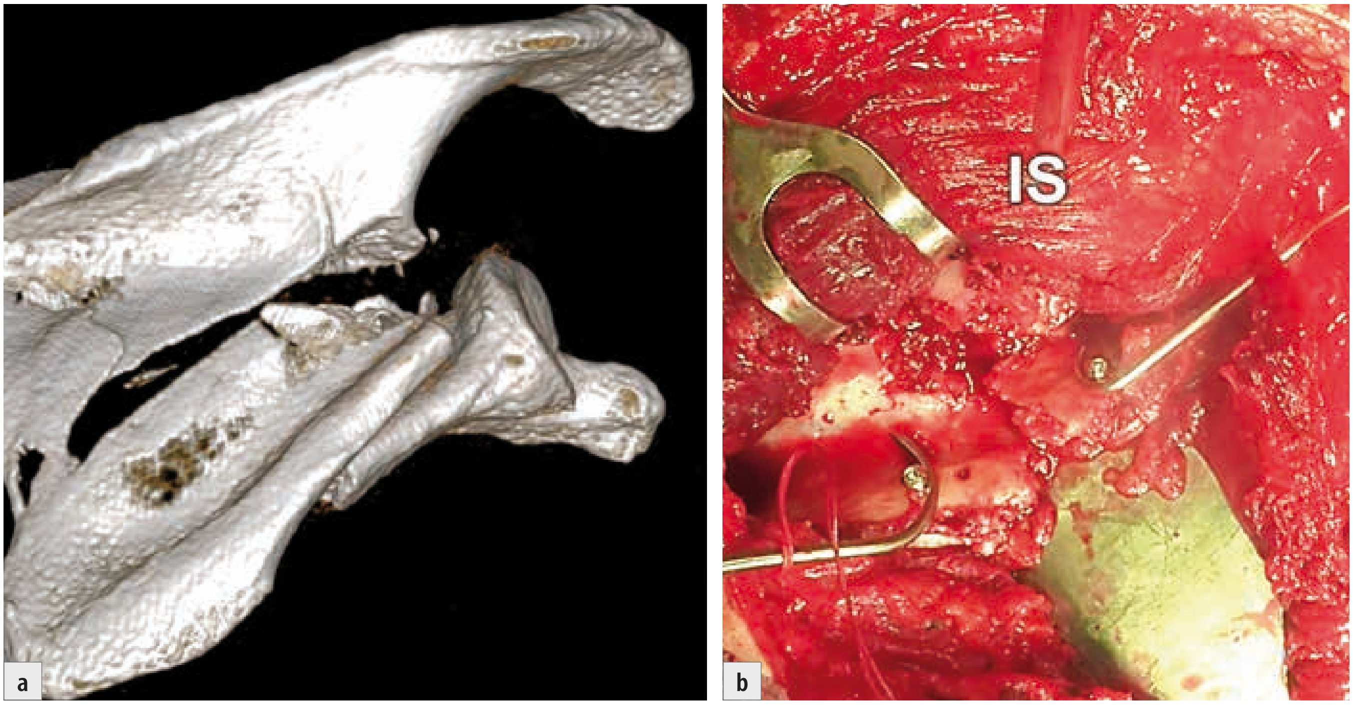

Fig. 11-4 Reduction by pulling bone hooks via screws: **a)** overlap of fragments of the lateral pillar and its marked shortening; **b)** reduction by pulling bone hooks via screws inserted into the two fragments. **IS** – infraspinatus.

With delayed treatment, reduction is hindered by the rapid formation of the callus.

Reduction may be achieved by various techniques. Cole [16, 17, 22] recommends two Schanz screws driven into each of the main fragments and their distraction by means of a small external fixator. This, however, may complicate visualization and manipulation in the surgical wound. It is also possible to use a laminar spreader, where care should be taken to avoid damage to the bone at the site of its contact with the spreader jaws.

We prefer reduction using two bone hooks, which has proven very effective. A 3.5-mm, or 2.7-mm, cortical screw is driven into each fragment close to the fracture line and slightly obliquely from it, to prevent slipping of the hooks from screws during distraction. Distraction of the fragments and their reduction are achieved by pulling on the screws using the hooks (Fig. 11-4). The locations of the holes chosen should allow their subsequent use for plate attachment.

The screw couple can be also used for reduction by means of bone forceps. Each screw serves as a support for their jaws, when bringing the fragments closer together, or for their compression (Fig. 11-5). This technique is suitable in longer fragments of the lateral pillar that bear part of the articular surface of the glenoid.

Maintaining reduction depends on the shape of the fracture surfaces of the lateral pillar [7], occurring in several basic types (Fig. 11-6):

- a transverse simple fracture, stable after reduction (**type 1a**);
- an oblique simple fracture, unstable after reduction (**type 1b**);
- a fracture with an intermediate fragment from the pillar, unstable after reduction (**type 2a**);
- a fracture with separation of intermediate fragment(s), with a full-width defect of the pillar (**type 2b**).

An unstable reduction can be maintained in several ways, including conversion to a stable type by reduction and fixation

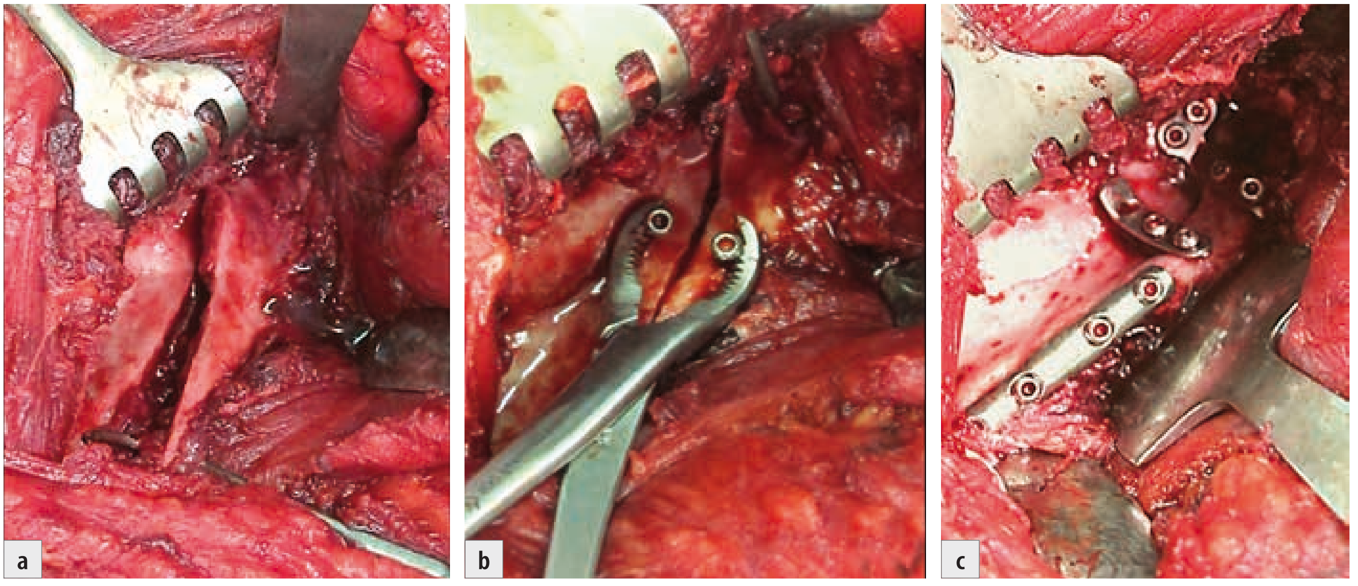

Fig. 11-5 Reduction with the use of screws and bone forceps in a fracture of the surgical neck of the right scapula, treated via the Judet approach: **a)** prior to reduction, the fracture line in the lateral pillar is open; **b)** compression of the fracture line using two screws and bone reduction forceps; **c)** completion of internal fixation.

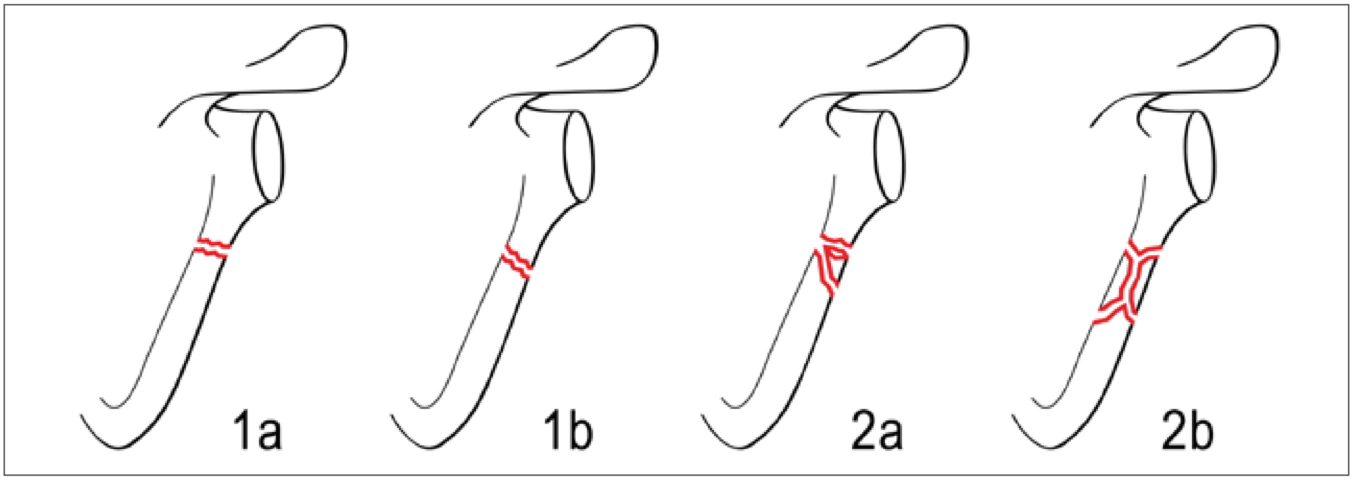

Fig. 11-6 Classification of lateral pillar fractures. For description see the text.