Standard Approaches to the Acetabulum Part 2: Ilioinguinal Approach

Standardní přístupy k acetabulu. Část 2: ilioinguinální přístup

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INTRODUCTION

The ilioinguinal approach is one of the standard approaches in the treatment of displaced acetabular fractures used during the last decades (9).

The meta-analysis of Giannoudis et al. showed that 21.9% of acetabular fractures were historically treated using this approach (3). One of the disadvantages of this study was, that studies focussing especially on posterior wall stabilization and studies dealing with more complex fracture types treated by extended approaches were integrated. Thus, these fracture types were overrepresented. Re-analysis excluding these data lead to an increase of the rate of anterior approaches to 25.9%.

More recent data (years 2005–2007) from the German multicenter study showed that presently in almost 45% of the cases the single ilioinguinal approach was used and only 38% of patients were stabilized via the Kocher-Langenbeck approach (11).

Historically, the Smith-Peterson approach (15, 17) and the iliofemoral approach were used to treat acetabular fractures. In the 60ies, based on the work by Letournel and Judet, the ilioinguinal approach was developed for acetabular fracture fixation (9). It is an extrapelvic approach resulting in an indirect reconstruction concept of the acetabulum without direct visualization of the articular acetabulum. The ilioinguinal approach was the standard anterior approach during the last 30–40 years. An important advantage is the reduced soft tissue detachment of periarticular muscles with only a small risk of developing heterotopic bone formation.

The aim of the second part of "Standard approaches to the acetabulum" is to report on the special topics indication, positioning, exposure, incision, dissection, the anatomical basis of osteosynthesis and present results using ilioinguinal approach.

Indications

Indications for this approach have been described in detail by Letournel (8, 9). Fractures with major pathology in the area of the anterior column and wall and fractures with a transverse component can be sufficiently treated using this approach. Accordingly, the following fractures types are accepted indications for using the ilioinguinal approach:

– isolated fractures of the anterior wall,
– isolated fractures of the anterior column,
– fractures of the anterior column with a posterior hemitransverse fracture,
– both-column fractures with a single large minor displaced posterior column fragment,
– certain transverse and T-type fractures.

Contraindications

In analogy to the given indications, fractures with a main posterior pathology as well as intra-articular concomitant injuries, that cannot be addressed indirectly (e.g. posterior marginal impactions) are better indications for a posterior approach. Therefore, the following fracture types are considered contraindications for the single use of the ilioinguinal approach:

• isolated fractures of the posterior wall,
• isolated fractures of the posterior column,
• associated posterior column and posterior wall fractures,
• associated fractures with an additional displaced posterior wall fragment,
• fractures with significant posterior displacement, which cannot be reduced from anteriorly,
• fractures with posterior marginal impactions.

Exposure

The classical ilioinguinal approach allows direct visualization of the complete iliac fossa, the more or less complete area of the linea terminalis from the pubic symphysis to the SI-joint and parts of the quadrilateral surface. By palpation, the posterior column can be indirectly felt in the area of the greater sciatic notch and at the quadrilateral surface. The outer side of the iliac wing is not routinely dissected (Fig. 1). By modifying the classical approach additional portions of the pelvis can be visualized (2, 4, 6, 7, 12), (see below).

Positioning

The standard position of the patient is the supine position on a radiolucent table allowing the standard X-rays (a.p.-pelvis, Judet views, combined oblique pelvic ring and Judet views). Rotation of the patient around his long axis on the table should be possible.

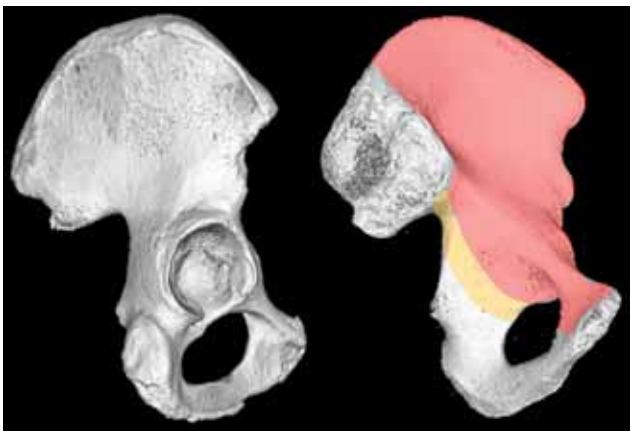

Fig. 1. The outer side of the iliac wing is not routinely dissected. By modifying the classical approach additional portions of the pelvis can be visualized.

Skin incision

The landmarks for this incision are the iliac crest, the anterior superior iliac spine (ASIS) the inguinal ligament and the pubic symphysis.

The classical skin incision starts slightly posterior of the apex of the iliac crest, then runs along the iliac crest and turns anteriorly at the ASIS in line with the inguinal ligament up to the pubic symphysis about two fingers above the symphysis. Further preparation is going down to the fascia (Fig. 2a).

Dissection

Deep dissection of the ilioinguinal approach is based on surgical development of three windows.

Dissection starts with the 1st window which is identical to the antero-lateral approach to the SI-joint. Subcutaneous dissection is performed until identification of the junction between external oblique muscle and the fascia of the gluteus maximus muscles, which is slightly lateral to the top of the iliac crest. Therefore, the facial dissection starts from lateral to avoid transmuscular dissection.

The abdominal muscles are sharply separated from the iliac crest, to get a subperiostal access to the iliac fossa (Figs 2b+c). The iliopsoas muscle is subperiosteally detached from the iliac bone up to the linea terminalis and to the SI joint (Fig. 2d). After evacuation of the

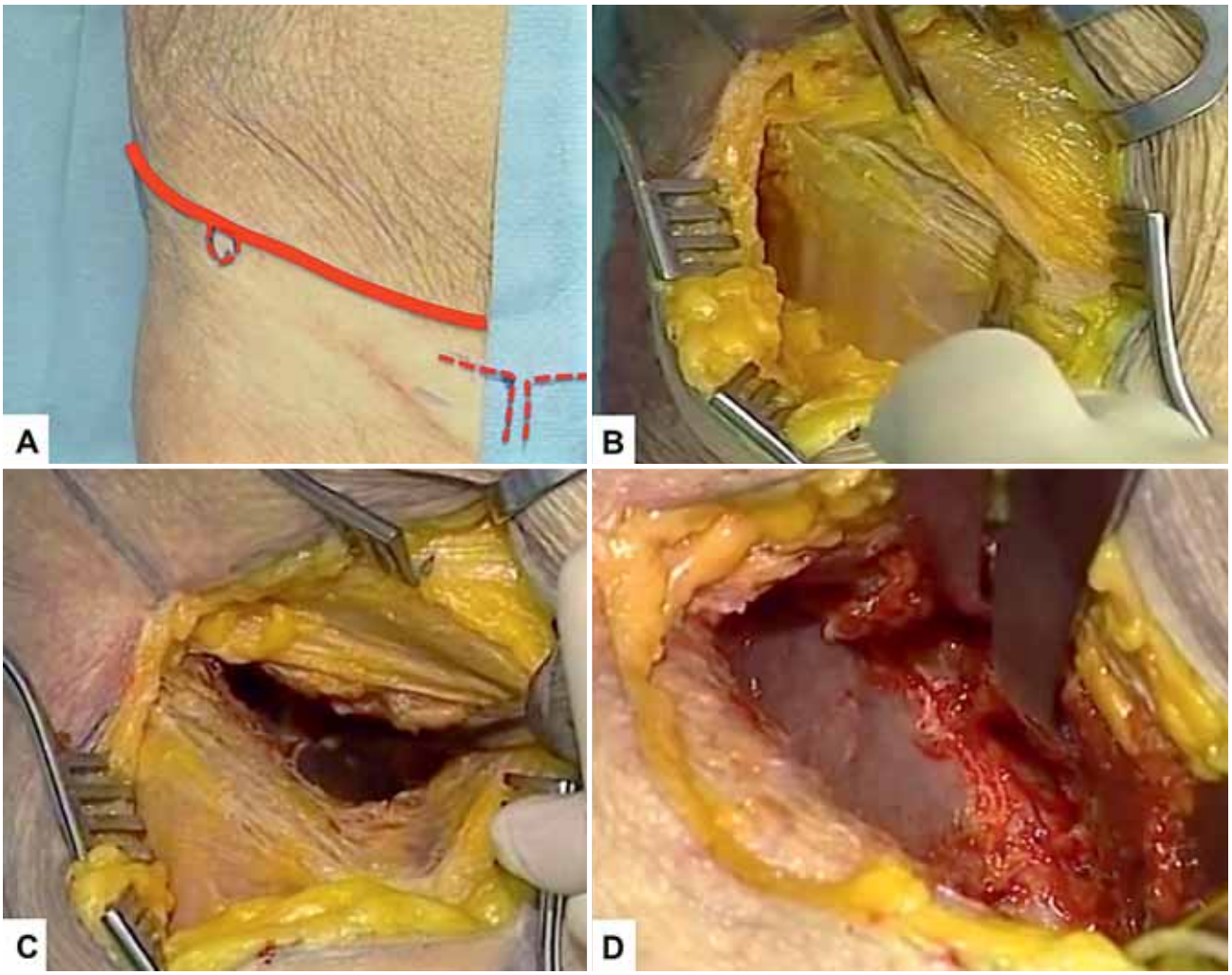

Fig. 2. A – the classical skin incision, B, C – subperiostal access to the iliac fossa, D – detaching of the iliopsoas muscle.

Fig. 3. First window..

fracture hematoma, dissection can be extended subperiostally to the lateral shoulder of the sacrum thereby protecting the lumbosacral trunc. The iliopsoas muscle and the abdominal organs are held medially using long Langenbeck retractors. Blunt Hohmann retractors can then be inserted medial to the linea terminalis and anterior to the SI-joint to get digital access to the anterior SI-joint and parts of the posterior column. Sharp Hohmann retractors or K-wires can be inserted subperiostally on the sacral shoulder for visualization of the SI-joint, if necessary. Before performing further anterior dissection (2nd and 3rd window), a tamponade of the iliac fossa is done with an abdominal cloth.

Clinically, the 1st window is necessary to address fracture lines reaching the iliac fossa and the iliac crest to perform stabilization of these fractures, mostly high extending anterior column fractures, according to the "proximal-to-distal-rule" (Fig. 3).

The main principle of dissecting the 2nd window of the ilioinguinal approach is opening the floor of the inguinal canal and its anterior and posterior wall.

Subcutaneous dissection is performed until identification of the abdominal external oblique muscle (Fig. 4a).

The incision of the fascia of the external oblique muscle (anterior wall) is performed parallel to the inguinal ligament while sparing the superficial inguinal ring (Fig. 4b). Blunt dissection of the soft tissues from the inguinal ligament allows identification of the spermatic cord/teres uteri ligament together with the inguinal nerve. These latter structures are secured by mobilization and holding with a vessel loop (Fig. 4c).

Opening the floor and posterior wall of the inguinal canal is performed by incising the fascia of the transversus abdominus muscle and after identification of the inguinal ligament, dissection of the ligament is performed leaving a small portion of the inguinal ligament intact to allow easier reattachment (Fig. 4d).

Now the muscular and vascular lacunae are presented. At the most lateral part of this part of incision, the lateral cutaneous femoral nerve can be identified in the fatty tissue, typically medial to the anterior superior iliac spine, and looped. At the medial border of the muscular lacuna the arcus iliopectineus is identified. Directly lateral of the arcus iliopectineus, the femoral nerve can be visualized. In approximately 30° hip joint flexion, tension of the iliopsoas muscle and the femoral nerve is released and the arcus iliopectineus is easier visible.

Medial to the arcus iliopectineus, the iliac external vessels can be palpated and the vascular lacuna is opened by superficial incision. Blunt medial mobilization of the vessels is performed to identify the medial margin of the arcus iliopectineus, followed by dissection until getting bone contact at the iliopectineal eminence (Fig. 4e).

By inserting two small Langenbeck retractors, the arcus iliopectineus is fully exposed. With a scissor the arcus is then cut up to the iliopectineal eminence. The posterior fascia of the iliopsoas muscle is often already, at least partially, disrupted. Thus, further dissection of this fascia is not necessary. Sharp incision of the iliopectineal fascia on the superior ramus and the anterior acetabular wall is performed with a scalpel to reach the quadrilateral surface. With retraction of the iliopsoas laterally and the vessels medially, exposure to the superior and medial parts of the quadrilateral surface and antero-superior parts of the acetabulum is achieved (Fig. 4f).

Overall, the 2nd window allows reduction of fractures of the quadrilateral surface and intermediate anterior column fracture lines. Reduction of the main anterior column displacement with the possibility of "pushing-down" this fracture part is then possible. The main dissection of the 2nd window is extrapelvic.

Finally, if necessary, the 3rd window medial to the vessels is opened. The interval between the lateral border of the rectus abdominis muscle and the vessels is bluntly dissected. Notching the rectus abdominis muscle is usually not necessary.

The 3rd window is useful to fix the often used inguinal plate lateral to the pubic symphysis.

Extended exposures

Some modifications of the ilioinguinal approach allow extended dissection and visualization of parts of the iliac bone, the superior pubic ramus and the anterior hip joint. A total of three relevant extensions are reported in the literature (4, 6, 7).

Lateral extension

Gorczyca et al. and Weber et al. reported a lateral extension to visualize parts of the outer ilium (4, 18). A limited dissection of parts of the glutaeus medius et minimus muscles is performed on the outer side of the ilium. This allows a more simple reduction of high extending anterior column fractures by insertion long reduction forceps or it allows a periacetabular cerclage osteosynthesis in high extending fractures of the posterior column. With a more extended dissection it is possible to even stabilize fractures in the area of the acetabular roof by dorso-medial lag screws.

Pohlemann et al. developed a cannulated instrument, based on a Cobb-raspatory, for cerclages osteosynthesis

to minimize the risk of damage to the gluteal neurovascular bundle (13).

Anterior extension

In order to enable visualization of the entire anterior wall with additional possibility of intra-articular reduction control the group of Ganz et al. reported an anterior modification of the ilioinguinal approach (7).

Anterior dissection is performed according to the Smith-Petersen approach (17) using a more L-shaped incision. After osteotomy of the anterior superior iliac spine, the rectus femoris muscle is detached at its pars directa at the anterior inferior iliac spine and retracted inferiorly and medially. Thus the hip joint capsule can be fully exposed from anterior and the joint can be opened, if necessary. Typical fractures types for this modification are intermediate anterior column fractures and fractures of the anterior or antero-superior wall.

A similar modification was also reported by Pape et al. (12).

Medial extension

A medial extension is possible via an extended dissection of the 3rd window like in the intrapelvic approach

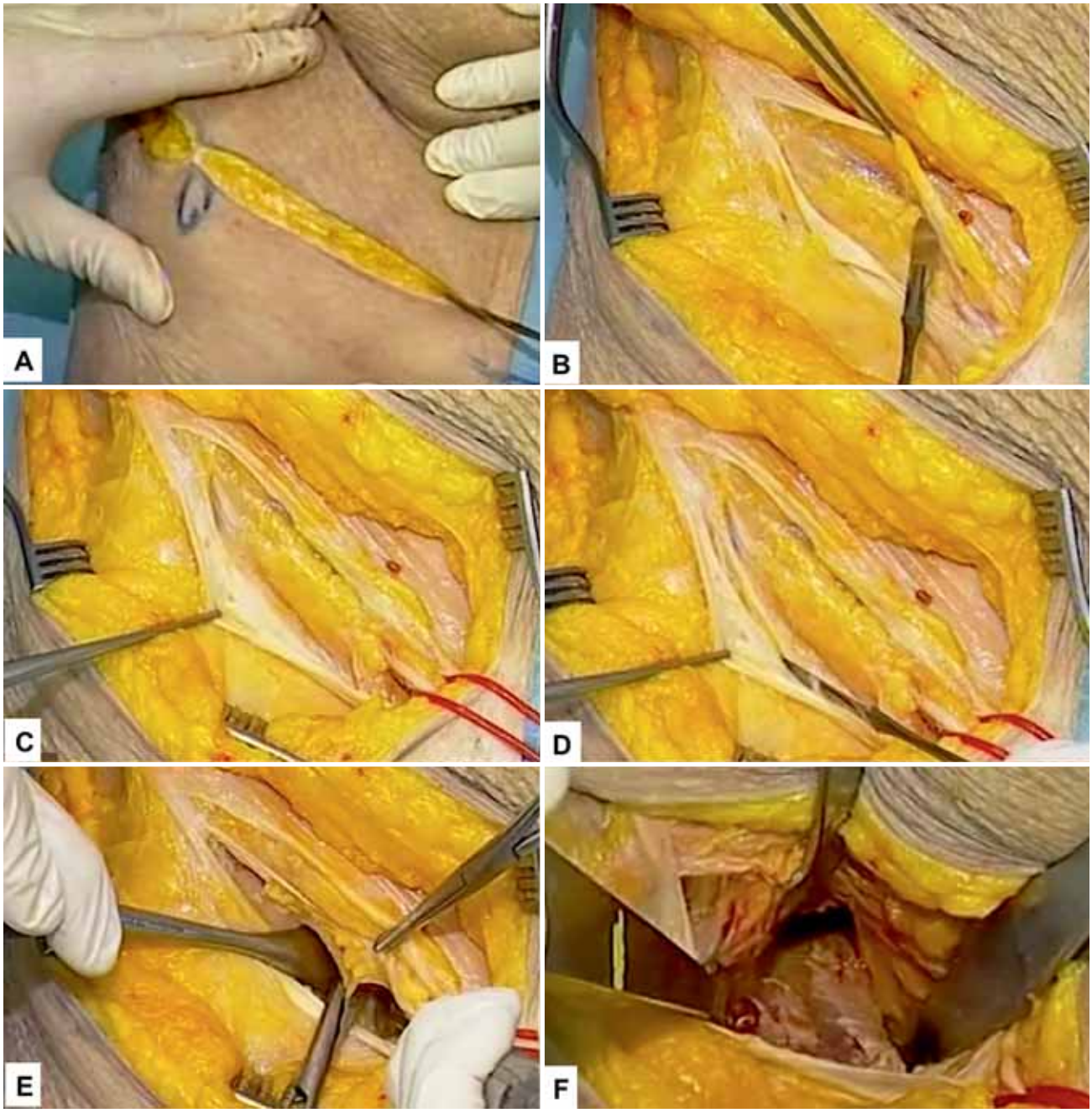

Fig. 4. A – subcutaneous dissection is performed until identification of the abdominal external oblique muscle, B – the incision of the fascia of the external oblique muscle (anterior wall), C – blunt dissection of the soft tissues from the inguinal ligament, D – opening the floor and posterior wall of the inguinal canal, E – dissection until getting bone contact at the iliopectineal eminence, F – achieving of the antero-superior parts of the acetabulum.

(2, 5) or performing an extended Pfannenstil approach. Karunakar et al. described the combination of the ilioinguinal and intrapelvic approach with the advantage of better visualization of the medial wall "below" the linea terminalis (6).

Therefore, the complete ipsilateral rectus belly is mobilized and plates can be placed from the inner side of the pelvis against the central displacement. This modification overlaps to the dissection of the intrapelvic approach.

Results

Approach-related results in the literature are rare, and have the disadvantage of an inhomogeneous patient population.

For the ilioinguinal approach Letournel (8, 9), Matta (10) and Rommens (14) reported some approach-specific results.

Letournel reported on various complications after using the ilioinguinal approach (9).

The lateral femoral cutaneous nerve was permanently damaged in about 22.5%, while other nerve damage were observed in only 2.7%. Iatrogenic injuries of the internal iliac vein were observed in three cases, significant postoperative hematoma in 4.5% of cases. Deep infections were seen in eight out of 158 cases (5%).

Matta used the ilioinguinal approach in 119 patients (32%) with displaced acetabular fractures (10). Indications for the were fractures of the anterior column and wall, fractures of the anterior column with a posterior hemitransverse fracture, both column fractures as well as some transverse and T-type fractures.

The average operative time was 3.7 hours (1–12 hours), the mean blood loss was 1500 ml (400–6000 ml).

The postoperative result was anatomic in 74% (0–1 mm), in 16% near anatomic (2–3 mm) and in 10% bad with a remaining displacement (gap/step) of more than 3 mm.

Two nerve damages, two wound hematomas, three extra-articular infections, three pulmonary embolisms and one iatrogenic injury of the femoral artery were seen. In one case with an intraarticular fragment a revision was necessary.

Rommens reported on 61 patients with predominantly anterior acetabular fracture pathology in two thirds of the patients (14). Approach-related complications occurred with three iatrogenic vascular injuries (external iliac vein), four motor iatrogenic nerve damage and 16 sensory nerve damages of the lateral cutaneous femoral nerve. Thromboses were seen in one case in the external iliac artery and in another case in the deep pelvic vein. In one case, a deep wound hematoma had to be revised. No infections occurred. Two patients showed insufficient reduction.

From these three papers, some data are available regarding complications. The lateral cutaneous femoral nerve is in danger in approximately 23.3% of cases, other nerves (probably the femoral nerve) in 3%. Postoperative hematoma can be expected in 3%, postoperative infection (superficial + deep) in 3,3% and iatrogenic vascular injury in 2.1%.

Analyses regarding the quality of reduction were reported by two groups. Briffa et al. report on 68 patients (44%) (1). 77.9% showed anatomical joint reconstruction (0–1 mm) and 11.8% near anatomic reconstruction (2–3 mm) whereas 10.3% had a persistent displacement of >3 mm. Tannast et al. reported, based on the data of Matta, on 323 patients (40%) (16). The average blood loss was 1000 ml and the average operating time was 180 minutes. 70% showed anatomical joint reconstruction (0–1 mm) and 23% near anatomic reconstruction (2–3 mm) whereas 5% had a persistent displacement of >3 mm.

Combining these data from Briffa et al. and Tannast et al. the quality of reduction can be expected in different fracture types as being anatomic in 72.6%, near anatomic in 21.4% and non-anatomic in 6% (1, 16).

CONCLUSION

The ilioinguinal approach is still a standard approach in treating acetabular fractures with anterior column involvement. The basic concept of creating three windows allows addressing the typical fracture lines in anterior column and wall fractures and associated acetabular fracture types with anterior column involvement including fractures with a transverse fracture line. The principle of dissection is extrapelvic. An anatomic joint reconstruction can be expected in 72.6%, considering the heterogenous group of patients with different fracture types. The overall complication rate is low, the relevant complication is traction injury to the lateral cutaneous femoral nerve.

Literature

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