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Review Article

Fragility fractures of the pelvis: An update

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ABSTRACT

Fragility fractures of the pelvis (FFP) are becoming a frequent diagnosis in clinical practice. FFP typically appear after a low-energy trauma in female patients of old age with osteoporosis. The characteristics of FFP differ from pelvic injuries after high-energy trauma. The new comprehensive FFP-classification reflects the specific morphology of the fractures and distinguishes different categories of instability. Key factors for operative treatment are the degree of instability, late presentation, and failure of conservative treatment. It is recommended to treat FFP type I and FFP type II conservatively, whereas FFP type III and FFP type IV should be treated operatively. Surgical stabilization should be as minimal-invasive as possible. Alternatives for the posterior pelvic ring are ilio-sacral screw osteosynthesis with or without cement augmentation, the trans-iliac internal fixator, the trans-sacral bar, and lumbopelvic fixation. Alternatives for the anterior pelvic ring are the retrograde transpubic screw, the internal fixator, and plate osteosynthesis. The length of hospital stay and complication ratio is higher after operative treatment, whereas mortality is lower than in the conservative group. Quality of life and mobility are reduced in all patients, independent of the classification and treatment type. The FFP-classification and the treatment recommendations provide a framework for searching for the best solution for each individual patient.

Keywords: Classification, Fracture, Fragility, Outcome, Pelvis, Treatment

INTRODUCTION

Fragility fractures of the pelvis (FFP) are a clinical entity with an increasing frequency.[1-6] A fragility fracture, as defined by the World Health Organization, is a fracture that is caused by an injury that would be insufficient to fracture normal bone; the result of reduced compressive and/or torsional strength of bone.[7] FFP are especially present in female patients of old age, suffering from osteoporosis. Growing incidence is due to high life expectancy in many countries and the ample use of computed tomography (CT) and magnetic resonance imaging (MRI). The characteristics of FFP are different from pelvic fractures in the adult population. The specific identity of FFP and the unique personality of the patients have brought up new questions on classification, treatment and outcome.[8] A large number of publications have appeared in the last decade on this subject. This manuscript covers the actual knowledge of FFP and reflects on diagnostic work-up, treatment, results, and outcome.

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SPECIFIC CHARACTERISTICS OF FFP

Literature on pelvic fractures has been dominated by high-energy pelvic trauma. These injuries are classified into anteroposterior (AP) compression, lateral compression (LC), vertical shear (VS), and complex injuries in accordance to Dalal *et al.*[9] The Tile-classification,[10] which was adopted by the Association for the Study on Internal Fixation and the Orthopaedic Trauma Association,[11] distinguishes between stable (Type A), rotationally unstable (Type B; open book and LC), and vertically unstable injuries (Type C). Mortality due to hemorrhage, infection and multiple organ failure ranges from 5% to 10% but may rise up to 30% in open pelvic disruptions.[9]

The characteristics of FFP are completely different. The clinical picture, strength of cortical and cancellous bone, and natural course are not comparable with high-energy pelvic fractures. FFP are the consequence of a low-energy trauma, typically a domestic fall from a standing position. The bone breaks in the areas of its lowest resistance, which are the areas with the most important reduction of bone mineral density (BMD). Fragility fractures cover osteoporotic fractures, insufficiency fractures, and geriatric fractures. They occur in patients with osteoporosis, long-term cortisone intake, long-term immobilized patients, or patients who underwent pelvic irradiation for a malignancy in the lower abdomen or small pelvis (prostate, uterus, ovarium, and rectum).[12,13]

The clinical picture reflects the consequences of low-energy trauma.[14] Patients present with intense pain in the groin, the pubic symphysis, the buttocks, or the lower back. There is no hemodynamic instability, as post-traumatic blood loss is minimal. Nevertheless, there may be continuing insidious bleeding in patients who take anticoagulants, which leads to hypotensive shock after hours or days. Therefore, it is recommended to monitor blood pressure and heart rate for at least 24 h after admission.[15] Due to pain, the large majority of patients are unable to sit, stand or walk. A minority presents with reduced mobility but can walk independently or with walking aids.

Wagner *et al.* developed a three-dimensional (3D) model of the sacrum of 92 Europeans of older age, and calculated BMD inside these sacra. They discovered that BMD is the lowest in the sacral ala with "alar voids" lateral to the neuroforamina and extending from S1 to S3. BMD remains the highest in the sacral bodies.[16] It explains the typical fracture morphologies in FFP with unilateral or bilateral vertical fractures in the sacral ala, sometimes connected through a horizontal fracture line at the transition of S1 to S2 or S2 to S3. In many FFP, bilateral fractures are present in the posterior pelvis, which is rather exceptional in high-energy pelvic trauma.[17] Fractures of the posterior ilium, fractures running into the ilio-sacral joint, and fractures near the pubic symphysis or pubic instabilities are seen in a minority of cases. The ligaments, which connect the pelvic bones into a ring, remain intact.[18] The bone breaks within the ring, and the pelvic ring implodes. This is in contrast to the explosion of the pelvic ring in high-energy trauma.

The natural course of FFP differs from pelvic fractures due to high-energy trauma. Patients with FFP may suffer additional fractures after the primary fracture, contributing to a higher degree of pelvic instability over time. In a 3-year retrospective study, Rommens *et al.* identified fracture progress (FP) in 14.2% of 148 cases, 18% of the conservative and merely 2.7% of the operative group [Figure 1a-d]. FP occurs due to repetitive low-energy trauma during mobilization after the primary fracture. FP can be prevented through surgical stabilization of the posterior pelvis, careful mobilization, and anti-osteoporosis drug therapy.[19]

The personality of FFP patients differs from that of high-energy pelvic trauma patients. FFP patients are of old age. They nearly all present with comorbidities, which augment the risks of conservative or operative treatment. Many already suffered other fragility fractures (shoulder, wrist, spine, etc.), which diminished their mobility and independence.[20] It follows that functional demands will be less pronounced than in younger patients.

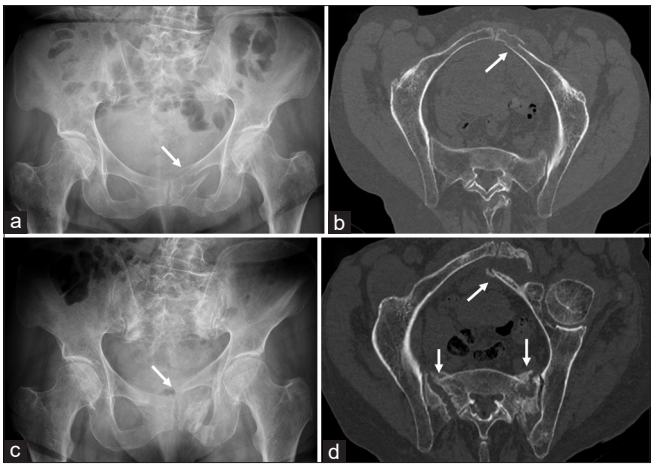

Figure 1: (a) A 83-year-old female suffers a slightly displaced left-sided pubic ramus fracture after a domestic fall. The AP pelvic radiograph shows a slightly shifted left pubic ramus fracture (arrow) but does not clearly show the posterior pelvis. (b) The oblique computed tomography (CT) reconstruction in the plane of the pelvic brim shows the slightly displaced pubic ramus fracture (arrow). There is no fracture in the posterior pelvis. (c) After 3 months of conservative treatment, the patient has continuing pain in the left groin and new pain in both buttocks. Mobility is severely restricted. The AP pelvis radiograph shows a more pronounced displacement of the left pubis ramus fracture (arrow). (d) The oblique CT- reconstruction of the pelvis in the plane of the pelvic brim shows the severe displacement of the pubic ramus fracture. In addition, complete fractures of both sacral ala are visible (arrows).

The clinical picture, the morphology, and the natural course of the fracture, on the one hand, and the personality of the old patients, on the other hand, are aspects of the specific entity of FFP. Therefore, it is logical that we needed another way to look at FFP than at high-energy pelvic trauma for what concerns treatment alternatives and treatment goals.

DIAGNOSTIC MEASURES

As a first diagnostic measure, an AP pelvic radiograph is taken. This radiograph excludes fractures of the acetabulum and classical hip fractures, the last being much more frequent than FFP. An AP and lateral view of the lumbosacral spine may also be useful in cases where low back or buttock pain is predominant to rule out osteoporotic fractures. On the AP pelvic radiograph, a fracture of the pubic ramus above the obturator foramen is most often seen. This fracture must increase our index of suspicion for a fracture at the posterior pelvic ring. Pelvic inlet and outlet radiographs may be taken, but are not compulsory. In the pelvic inlet radiograph, the direction and amount of displacement of the pubic ramus fracture are best visible. In the pelvic outlet radiograph, fractures of the sacral ala and/or fractures of the transverse process of L5 may be detected. In their retrospective analysis of 245 patients with FFP, Rommens and Hofmann found isolated pubic ramus fractures in only 17.9%.[21] More than 80% of patients with FFP suffered a posterior pelvic fracture. Conventional radiographs do not allow a thorough assessment of the posterior pelvis, and there is a risk of underestimating the severity of the lesion. For this reason alone, a pelvic CT scan is indispensable for a thorough analysis of the posterior pelvis. There may be crush lesions of the sacral ala, complete sacral fractures, fractures of the posterior ilium, or fractures running into the ilio-sacral joint. The degree of displacement is always mild to moderate. It is recommended to analyze multiplanar CT reconstructions in the coronal, sagittal, and oblique planes. A horizontal fracture of the sacrum at the transition of S1 and S2 is only visible in the sagittal reconstruction [Figure 2a-e].[22] Most importantly, posterior fractures contribute to the whole pelvic ring instability. In case of clinical suspicion but negative conventional radiographs or CT-scan, an MRI scan can be performed, if available. MRI is most sensitive for detecting bone bruises, which can be regarded as lesions of the trabecular bone.[23] Dual-energy CT scan is a good alternative to MRI for the detection of trabecular bone damage.[24]

CLASSIFICATION

A new comprehensive FFP-classification is developed, which takes the specific morphologies of these fractures into account and provides a framework for assessing pelvic instability.[21] The first criterion of the classification is the

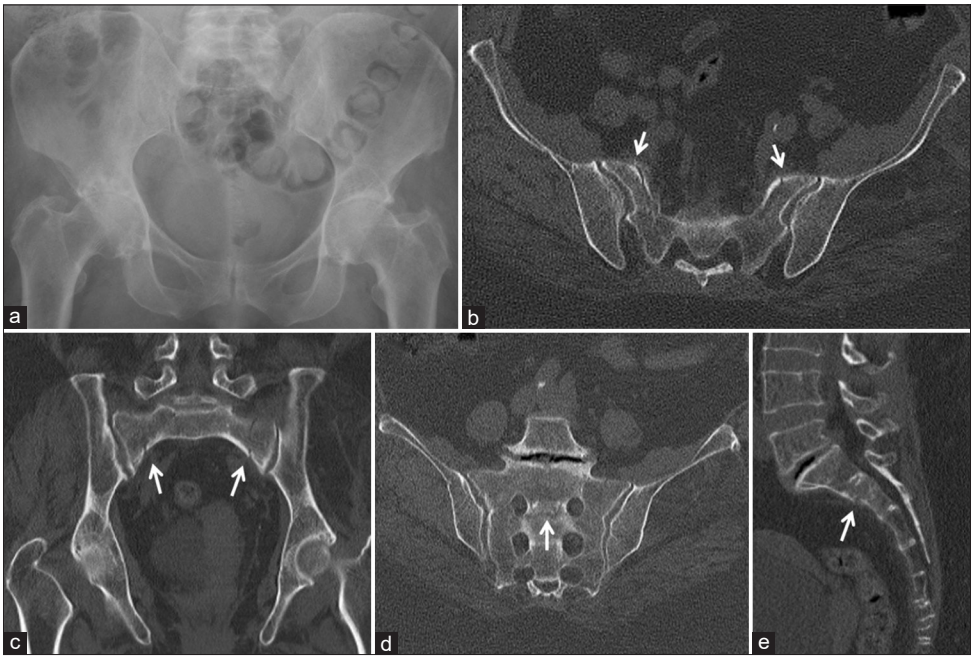

Figure 2: (a) Pelvic AP radiograph of 75-year-old-woman with intense pain in the buttocks after a domestic fall. A fracture of the anterior and posterior pelvis cannot be detected (b) axial computed tomography (CT) showing bilateral fractures of the sacral ala (arrows) (c) coronal CT-reconstruction showing complete bilateral sacral ala fractures (arrows) (d) oblique computed tomography-reconstruction showing a horizontal fracture line between the neuroforamina S1 left and right (arrow) (e) sagittal computed tomography-reconstruction showing a complete fracture between S1 and S2 (arrow).

degree of instability. Four types with increasing degrees of instability are identified. The second criterion, which provides the subtypes, is the localization of the fractures. FFP type I is an isolated anterior pelvic fracture. FFP type IA is a unilateral and FFP type IB is a bilateral pubic ramus fracture. FFP type II is characterized by a non-displaced posterior fracture. FFP type IIA is a non-displaced posterior fracture without a pubic ramus fracture. FFP type IIB is a crush lesion in the sacral ala combined with a pubic ramus fracture, FFP type IIC is a complete sacral, ilio-sacral, or posterior ilium fracture combined with a pubic ramus fracture. FFP type III is a displaced unilateral posterior fracture, FFP type IIIA at the posterior ilium, FFP type IIIB at the ilio-sacral joint and FFP type IIIC at the sacral ala. FFP type IV is characterized by a bilateral displaced posterior lesion. FFP type IVA has bilateral fractures at the posterior ilium, FFP type IVB at the sacral ala and FFP type IVC at different localizations of the posterior pelvis. In FFP type IVB, the sacral ala fractures can be connected with a horizontal fracture line at the transition of S1 to S2 or S2 to S3. The fracture lines create an H-form. The sacral bodies of S1 or S1 and S2 remain connected with the lumbar spine, but are separated from the pelvic ring, resulting in a spinopelvic dissociation [Figure 3]. This classification has been validated by Pieroh *et al.* and by Berger-Groch *et al.*[25,26] They found substantial reliability, but the limitation of the classification being the difficulty in distinguishing between non-displaced and displaced fractures. In their original publication, Rommens *et al.* found FFP type I in only 17.9%, FFP type II in 51.8%, FFP type III in 11.0%, and FFP type IV in 19.2% out of a series of 245 patients (198 females and 47 males) with an average age of 79.2 years.[21,24] This data supports the use of CT as a diagnostic tool in all patients with FFP to correctly assess the degree of instability, which is predominantly determined by the posterior pelvic fracture.[27]

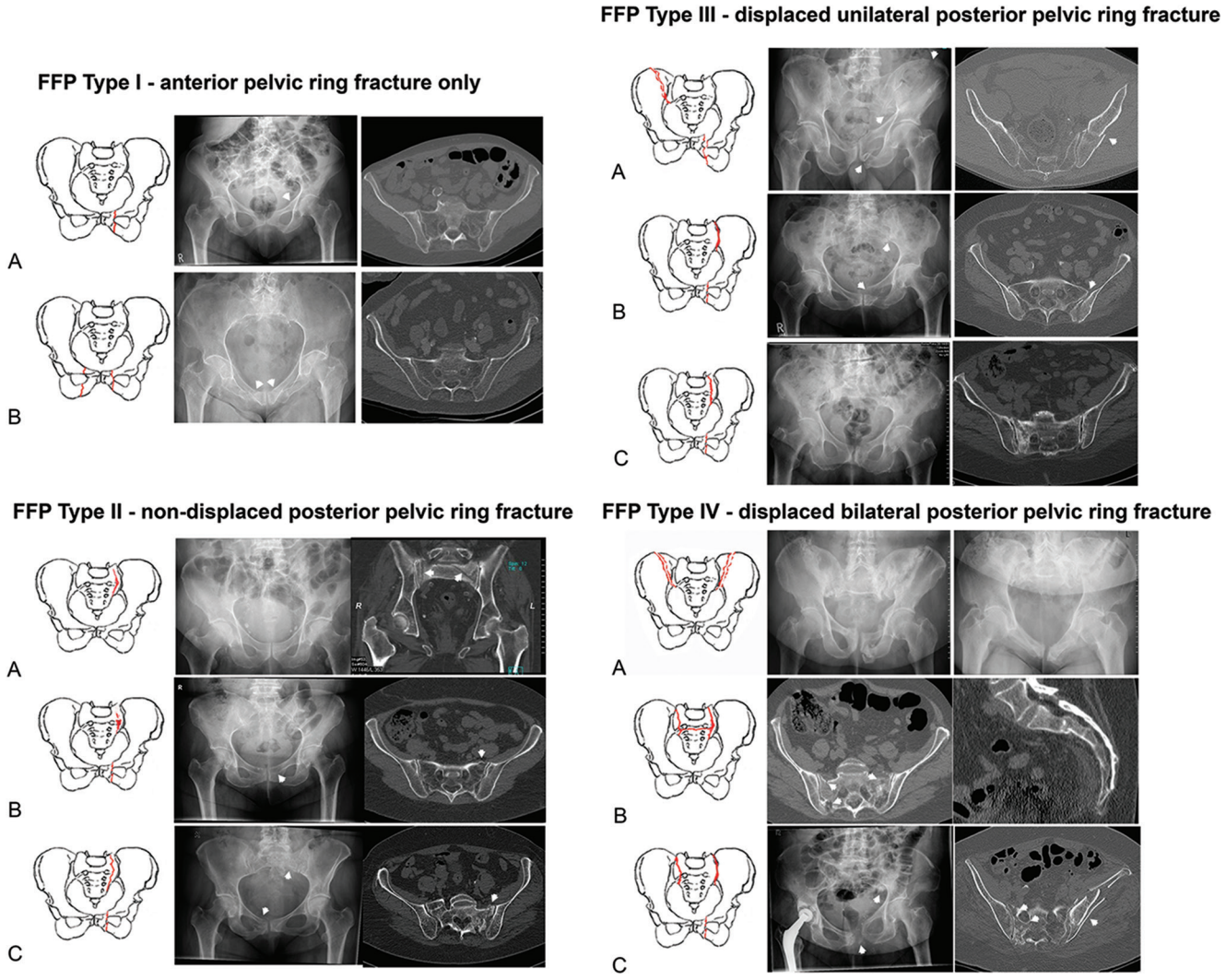

Figure 3: Comprehensive classification of fragility fractures of the pelvis (FFP) of Rommens and Hofmann.[21]

RECOMMENDATIONS FOR TREATMENT

The leading symptom of FFP is immobilizing pain. Consequently, treatment focuses on a rapid decrease of the pain level, enabling recovery of mobility and independence. Patients with FFP are of old age and always present with one or several comorbidities. Such patients are at higher risk for general complications during the hospital stay and surgical complications when treated operatively. Therefore, management should be as less invasive as possible.[28] The comprehensive FFP-classification is combined with recommendations for treatment, which are presented in an algorithm.[21]

FFP type I and FFP type II are managed conservatively. Pain therapy is combined with early out-of-bed mobilization as tolerated by the patient. Within days, at the latest, within one week, the patient should be able to walk on the floor with the help of a physiotherapist and a walking frame. When mobilization is not possible because of continuing or increasing pain, a re-evaluation with conventional radiographs and CT is recommended. A switch from conservative to operative therapy is discussed with the patient.

FFP type III and FFP type IV are treated by surgical means. Through stabilization, the motion of the fracture fragments during loading is eliminated. Pain is reduced and out-of-bed mobilization is made possible earlier.

MINIMAL-INVASIVE SURGICAL TECHNIQUES

Any surgical procedure should be minimal-invasive to avoid larger incisions, significant amounts of blood loss, and longer operation times. Several alternatives are available.[28,29] Some techniques merely stabilize a unilateral fracture area, while others stabilize or bridge the posterior pelvis from the ilium to the ilium. The last techniques are used in the case of bilateral fractures or as a preventive stabilization for the non-fractured side.

Sacroplasty is a technique in which a small amount of bone cement is injected into the fracture site at the sacral ala.[30] Hardware is not inserted. Patients with non-displaced sacral fractures sustained rapid and substantial pain relief in a series of 68 patients published by Andresen *et al.*[31] In a multicenter study by Kortman *et al.* with 243 patients, symptomatic cement leakage was only seen in 0.4%,[32] whereas it was seen in 27% in the smaller series of Bastian *et al.*[33] In complete and displaced sacral fractures, sacroplasty is not recommended.

Ilio-sacral screw osteosynthesis is well known for the treatment of high-energy pelvic fractures. It can be used successfully in patients with FFP.[34] It is recommended to use two screws in S1 or one screw in S1 and another in S2. Nevertheless, there is a higher risk of cutting-out because of the lower BMD of the sacrum in older patients.[35] Because the highest BMD is found in the sacral body, the thread of the screw(s) should at least reach until the midline of the sacrum. In the case of bilateral sacral fractures, ilio-sacral screw osteosynthesis is not adequate due to the limited space for the insertion of multiple screws. To augment holding power and reduce cutting-out, ilio-sacral screws can be augmented with bone cement, which is injected through the canal of the screw and applied at its tip.[36] Biomechanical tests have proven enhanced stability.[37]

Trans-sacral bar osteosynthesis is a valuable alternative to ilio-sacral screw osteosynthesis. A 5 mm or 6 mm threaded bar is inserted from ilium to ilium through the sacral corridor of S1. Washers and nuts are placed on both sides of the bar to lock its position and create slight compression.[38] Before inserting the bar, a thorough analysis of the morphology of the upper sacrum is needed. A corridor of sufficient dimension is not available in all patients to safely insert a trans-sacral implant.[39] In a series of 85 patients published by Wagner *et al.*, an operative revision was necessary for 15.3%.[40] Trans-sacral bar osteosynthesis can be combined with unilateral or bilateral ilio-sacral screw osteosynthesis, which reduces the rotation of the broken sacrum around the bar on load [Figure 4a-d].[41] Trans-sacral screw osteosynthesis also has the advantage of stabilizing both sides of the posterior pelvis. It can be used in bilateral fractures. If

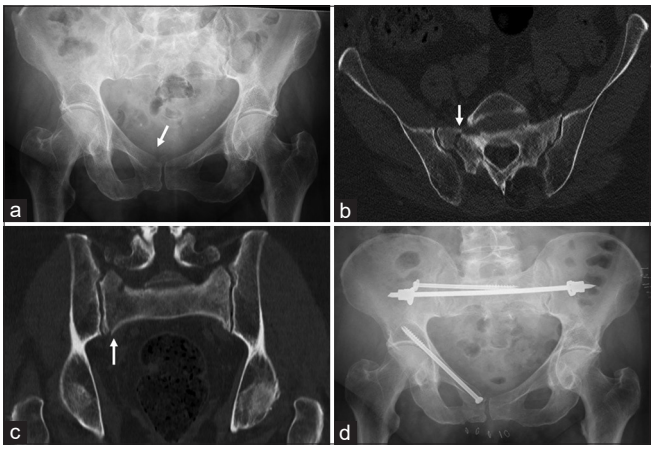

Figure 4: (a) A 79-year-old female suffers a ramus superior and inferior fracture at the right side after a fall at home (arrow). There is no clear fracture of the posterior pelvis in the pelvic AP radiograph. (b) Axial computed tomography (CT)-cuts through the sacrum reveal a complete fracture on the right (arrow) and a crush zone on the left. (c) Coronal CT reconstruction reveals a complete fracture of the right lateral mass of the sacrum (arrow). There also is an irregularity of the anterior cortex of the left sacral ala. (d) After unsuccessful conservative treatment, a posterior and anterior minimal-invasive stabilization is carried out. A trans-sacral bar and right ilio-sacral screw and a retrograde transpubic screw on the right side are inserted.

used in unilateral fractures, it can be regarded as a preventive stabilization of the contralateral non-broken side.

The trans-iliac internal fixator is a construct, which connects the posterior ilium on both sides (pedicle screws from the posterior superior iliac spine toward the ilium body) with a transverse bar situated behind the sacrum. It is especially used in patients without a safe trans-sacral corridor in S1, but is a good alternative to trans-sacral bar osteosynthesis in all patients with sacral fractures.[42,43] As in trans-sacral bar osteosynthesis, it stabilizes both sides. It also can be combined with ilio-sacral screw osteosynthesis [Figure 5a-d].

Lumbopelvic fixation is another technique, which can be performed in a minimal-invasive way. It is often used to stabilize FFP type IVB (H-type sacral fractures). The construct connects the lumbar spine (pedicle screws in L5 or L4) with the posterior ilium (pedicle screws from the posterior superior iliac spine towards the ilium body). Both sides of the construct are connected with each other with a transverse bar. The construct prevents intrusion of the broken sacrum into the small pelvis.[44,45] The motion segment between L5 and S1 (resp. L4 and S1) is suspended. Lumbopelvic fixation can be combined with ilio-sacral screw osteosynthesis, creating triangular osteosynthesis.[46]

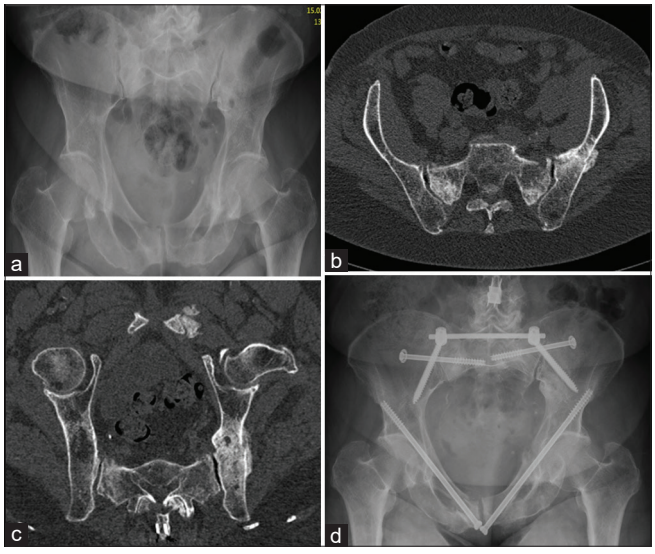

Figure 5: (a) A 73- year-old female has a history of continuous pain after a fall six months ago. Treatment with pain therapy and mobilization has been unsuccessful. On the pelvic inlet view, callus formation without healing of the left superior and inferior pubic ramus fractures is visible. (b) Axial CT-reconstruction. A healed left ilium fracture is visible. Left and right sacral ala are fractured. (c) Oblique CT-reconstruction. There is a bilateral instability of the anterior pelvic ring. The sacral corridor is too small for a safe trans-sacral bar placement. (d) Postoperative pelvic inlet view. The posterior sacral ala fractures were fixed with a trans-iliac internal fixator and two ilio-sacral screws. The pubic ramus fractures were transfixed with two retrograde transpubic screws.

A specific technique for FFP type IIIA and FFP type IVA (fragility fractures through the ilium) is iliac intramedullary stabilization. One or two large fragment screws are inserted from the anterior inferior iliac spine toward the posterior superior iliac spine, crossing the slightly displaced ilium fracture. Open reduction and internal fixation of the ilium fracture with plate and screws are avoided.[47,48]

It is not yet proven if an internal fixation of the anterior pelvic ring is necessary for all patients with FFP. The anterior pelvis is usually broken at the pubic ramus above the obturator foramen. In a minority of cases, the pubic bone near the symphysis is broken. Rarely there is instability in the pubic symphysis without a fracture. Several minimal-invasive techniques are available for the fixation of the anterior pelvis.

The retrograde transpubic screw osteosynthesis uses the anterior column corridor for retrograde screw insertion.[49] The screw passes the acetabular cavity and perforates the lateral cortex of the ilium above the hip joint [Figures 4d and 5d]. The morphology of the anterior column corridor does not always allow the insertion of a straight screw.[50] If it is impossible to pass the joint, a shorter screw is chosen. The screw splints the fracture and diminishes motion in the fracture site when walking. The technique is safe, when applied correctly. Oikonomidis *et al.* published a series of 32 patients, which were treated for pubic ramus fractures with a photodynamic bone stabilization system. In contrast with the retrograde screw, the implant follows the curve of the anterior column corridor. After 7 months, pubic ramus fractures were healed in 96% of the 25 surviving patients.[51]

The anterior internal fixator is available in different designs. It connects the anterior inferior iliac spine of both sides (pedicle screw in the direction of the ilium body) with a curved bar that is inserted subcutaneously.[52] Another design enables additional fixation of the pubic bone with the fixator.[53] Special care must be taken for the correct insertion of the transverse bar. If placed too deep, it presses directly on the iliopsoas muscle, the femoral nerve, or even the femoral vessels.[54] The ilio-pubic plate-bar-implant connects the anterior iliac crest (short plate and screws) with the pubic bone (short plate and screws). The implant consists of short plates at the margins and a curved bar in the middle part. The implant is inserted subcutaneously from the iliac crest to the pubic bone.[55] The implant only bridges one side of the anterior pelvis. In the case of bilateral fractures, two implants are needed.

Single or double-plate osteosynthesis is not a minimal-invasive procedure. It is restricted to major instabilities of the anterior pelvis [Figure 6a-d]. Double-plate creates higher stability than single-plate osteosynthesis. In a retrospective study, plate and screw loosening of the superior plate was seen in 45% of cases, whereas loosening of the second anterior plate was never seen.[56]

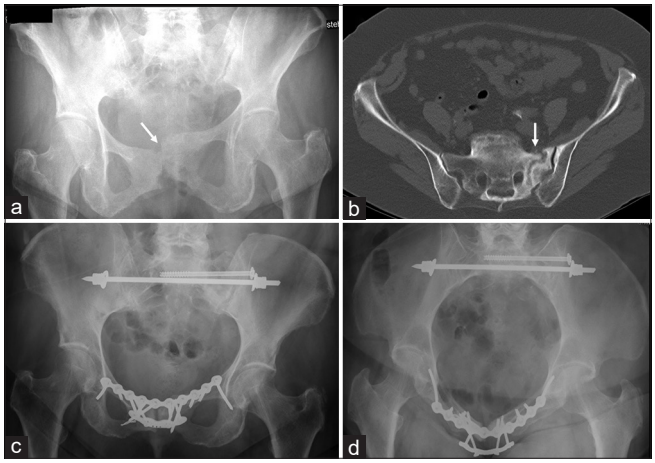

Figure 6: (a) A 72-year-old female suffers long-lasting deep left lumbar pain and at the symphyseal region. The pelvic AP radiograph reveals a step-off at the pubic symphysis (arrow) as sign of instability. (b) Axial CT - reconstruction shows a complete fracture of the left sacral ala with signs of sclerosis at the fracture margins (arrow). (c) Post-operative pelvic AP view. A sacral bar has been placed through the body of S1. On the left side, an additional sacroiliac screw has been inserted. The instability of the symphysis pubis has been fixed with a double-plate osteosynthesis. (d) Post-operative pelvic inlet view.

RESULTS OF TREATMENT

There is increasing evidence about the outcome of conservative and different types of operative treatment for FFP. Rommens *et al.* looked at the natural course of 138 patients with FFP type I (isolated anterior pelvic ring fracture).[57] Only two of them were treated operatively at a later stage because of painful non-union. One-year mortality was 16.7%. The rate of surviving patients living at home with or without assistance dropped from 80.5% to 65.3%. The European Quality of Life Score and the Parker Mobility Score were far below the average of the reference population.[58,59]

Hopf *et al.* published a series of 30 patients, who underwent percutaneous ilio-sacral screw osteosynthesis. Pain intensity declined from 6.9 to 1.8 in the visual analog score.[34] There was only one screw malposition and one screw loosening (3.3%). They recommended the technique as safe and efficient.[34] On the contrary, in a series of 50 patients, who underwent the same technique, a symptomatic screw loosening was seen in 9 patients (18%) and the revision rate was 20%.[35] König *et al.* published a literature review on cement-augmented ilio-sacral screw osteosynthesis. They found only 2.45% cement leakage in 122 procedures and found the technique safe and usable.[61]

Schmitz *et al.* described a series of 25 patients, who underwent cement-augmented transiliac internal fixation. There were surgical site complications in 16%. They assessed the technique and implant as suitable.[43] Wagner *et al.* published a series of 85 patients treated with trans-sacral bar osteosynthesis. The 1-year mortality rate was 9.6%. After a follow-up period of more than 3 years, 85% of patients lived at home and 82% walked independently with or without a walking aid. The authors concluded that the technique is reliable and efficient.[40] Shetty *et al.* obtained 92.5% excellent and good results in 27 patients treated with lumbopelvic stabilization.[44] Nakayama *et al.* presented a series of 14 patients with FFP type IIIA, who were treated with interdigitating percutaneous screw fixation. The technique was effective in relieving pain and enabling early mobilization.[48]

Publications on stabilization techniques of the anterior pelvic ring are also available. Rommens *et al.* published a series of 76 retrograde transpubic screw insertions in 65 patients with FFP. There were no surgical complications. Slight screw loosening did not affect bone healing.[49] Kumbhare *et al.* performed a systematic review of publications on the INFIX technique. Out of 619 procedures, they found heterotopic ossification in 24.7%, neuropraxia in 25.3%, and femoral nerve palsy in 1.6%.[62] Herteleer *et al.* compared single with double plate osteosynthesis of the anterior pelvic ring in 48 patients with FFP. There was a screw loosening in 45% of the superior plate but no screw loosening in the anterior plate. A surgical revision was necessary for 16.7% of patients with single, but no revision was needed in patients with double-plate osteosynthesis.[56]

Percutaneous procedures should be preferred above open procedures. Rommens *et al.* showed that patients with open procedures suffered significantly more surgical complications than patients with percutaneous procedures.[63] The length of hospital stay and the total number of in-hospital complications are higher in patients, who undergo operative interventions, when compared with patients, who are treated conservatively.[64]

OUTCOME

Patients with an FFP suffer intense pain, loss of mobility, and independence. Quality of life and mobility are diminished, independent of FFP-classification, and type of treatment. Nevertheless, there is no difference found in mobility and independence between operatively and conservatively treated patients in several studies.[65,66] In the series of Schmitz *et al.*, quality of life and mobility were even higher in the conservative group.[67] On the contrary, large case series indicate that mortality is lower in operatively treated patients.[64,65] Nuber *et al.* compared operative and conservative treatment according to the therapeutic algorithm presented by Rommens *et al.*[21] in a prospective cohort study of 154 patients. Strict compliance with the algorithm led to significantly lower mortality within one year in the operative group. The worst outcome and the

highest mortality were observed in patients who refused the recommendation of operative stabilization.[68] In their prospective study on 110 patients, Rommens *et al.* worked out that the degree of pelvic instability, late presentation, and failure of conservative treatment were key factors for the indication of operative treatment.[66] The last studies endorse the original recommendations for surgical treatment published by Rommens and Hofmann in 2013.[21,69]

CONCLUSION

Fragility FFP are a new entity with an increasing frequency. The characteristics of FFP cannot be compared with those of pelvic fractures in high-energy trauma. The FFP-classification provides a framework for the assessment of the instability of the pelvic ring. The degree of instability, delayed presentation and failure of conservative treatment are key factors for the indication of operative treatment. Surgical treatment should be as less invasive as possible. Operative procedures produce higher in-hospital complications and longer hospital stay. A reduction in quality of life and mobility is seen in all patients. Mortality is higher than in the reference population but can significantly be reduced with surgical treatment. Further studies are needed to determine the best time and type of operative treatment.

AUTHORS' CONTRIBUTIONS

PMR: Conceptualization, literature search, writing original draft, and supervision. AH: Design, literature search, manuscript editing. The authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

DECLARATION OF PATIENT CONSENT

All the clinical data presented here having patient information was duly informed to the patients who have given their individual consent for the same in the respective references.

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CONFLICTS OF INTEREST

There are no conflicting relationships or activities.

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