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Fractures of The Pelvis: Problems and Results of Surgical Treatment

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SUMMARY

Pelvic fractures have been the domain of conservative treatment and reduction by closed methods for a long time. In the last decades advances in classification and understanding of these often very complex fractures have been made. They are now discriminated into fractures of the apophysis, acetablar fractures and fractures of the pelvic ring. By a better understanding of the functional biomechanics and the morphological changes a number of clear and valid indications for operative procedures has been worked out. Certain pelvic ring disruptions and acetabular fractures can be stabilized after open reduction and provide better functional long time results. As the surgical approach and operative technique can be rather difficult and the concept has to be fitted to the individual case it is almost impossible to give general guidelines for the surgical management.

INTRODUCTION

The pelvis as a rigid ring is made up of ilium, public rami, acetabulum, ischium and sacrum, joined by tough fibrous tissue at the symphysis and sacroiliac joints. The static force of body weight is transmitted from the vertebra over sacrum and cranial pillars of the acetabular roof to the dorsal pillars of the hip joint. The tight junction by ligaments between iliac and symphysis joints allows a rigid—however in some way elastic and very resisitant—ring construction that can only be disrupted by extreme forces[17].

The tradional classification of pelvic fractures has been used since 100 years[15]. Although acetabular fractures frequently occur in combination with many other pelvic fractures, they require separate treatment because the prognosis for function is worse than in other pelvic fractures. Major lesions of the pelvic ring in our opinion are disruptions of the posterior or anterior pelvic ring, whereas fractures of the pelvis involving the hip joint need separate consideration. Today we see an indication for operative treatment in instable pelvic ring fractures and acetabular fractures with dislocation.

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Table 1 Classification of pelvic ring fractures according to Müller-Färber and Müller[8].

Type I:	STABLE FRACTURES OF THE PELVIS
	-unilateral anterior pelvic ring fractures
	-bilateral anterior pelvic ring fractures without dislocation
Type II:	LEISION OF THE PELVIC WITH REDUCED STABILITY
	(incomplete pelvic ring fracture with dislocation)
	-isolated ruptur of symphysis
	-unilateral anterior pelvic ring fracture with rupture of suymphysis
	-doublesided anterior pelvic ring fracture with dislocation
Type III:	INSTABLE PELVIC RING FRACTURE
	(complete unilateral or bilateral pelvic ring fracture)
	-complete disrupture of the iliosacral joint
	-presacral fracture of os ilium
	-vertical and multiple fractures of sacrum

Table 2 Classification of acetabular fractures according to Judet et al. and Letournel[3,6]

I	fracture of the dosal acetabular rim
II	Fracture of the dorsal acetabular pillar
III	fracture of the ventral acetabular pillar
IV	transversal fracture of acetabular bottom
V	transversal fracture together with fracture of the dorso-cranial acetabular rim
VI	fracture of both pillars
VII	fracture of the dorsal pillar with transversal fracture through the ventral pillar
VIII	fracture of the ventral pillar with transversal fracture through the dorsal pillar

FRACTURES OF THE PELVIC MARGIN

Fractures of the pelvic margin usually neither disturb the stability of the pelvic ring nor the function of the hip joint. Conservative treatment is the therapy of choice in these lesion in almost any case. There is no need for specific relief. Bed rest is required as long as is necessary to relieve pain.

In a farther sense avulsion fractures of points of muscle attachment from the ischial tuberosity or anterior superior or inferior iliac spine as well as adductor muscles from symphysis can be accounted to this type of injury. Treatment requires only bed rest with the hip in flexion. Only in younger patients with athletic ambition the operative reattachment of avulsed bone fractures of tendon insertions can be indicated in single cases, as the athletic ability otherwise may be reduced.

FRACTURES OF THE PELVIC RING

Pelvic ring fractures occur through direct deformation as a result of lateral or sagittal compression or through friction and rotation forces, mostly indirectly by the femoral head. A classification is senseful with a discrimination into stable and instable pelvic ring disruptions. The proposals of MÜLLER-FÄRBER and MÜLLER seem to be very useful in this context (Table 1). This classification[8], as well as recent advances in diagnosis [11] and external fixation[7,14] have led to a clear concept in surgical indications for therapy.

Isolated disruptions of the anterior pelvic ring do not need an operative stabilization because of biomechanical reasons (Type I, Table 2). In severe additional injuries like lesions of the lower urinary tract or vascular lesions (Fig. 1) however a surgical stabilization of these fractures is

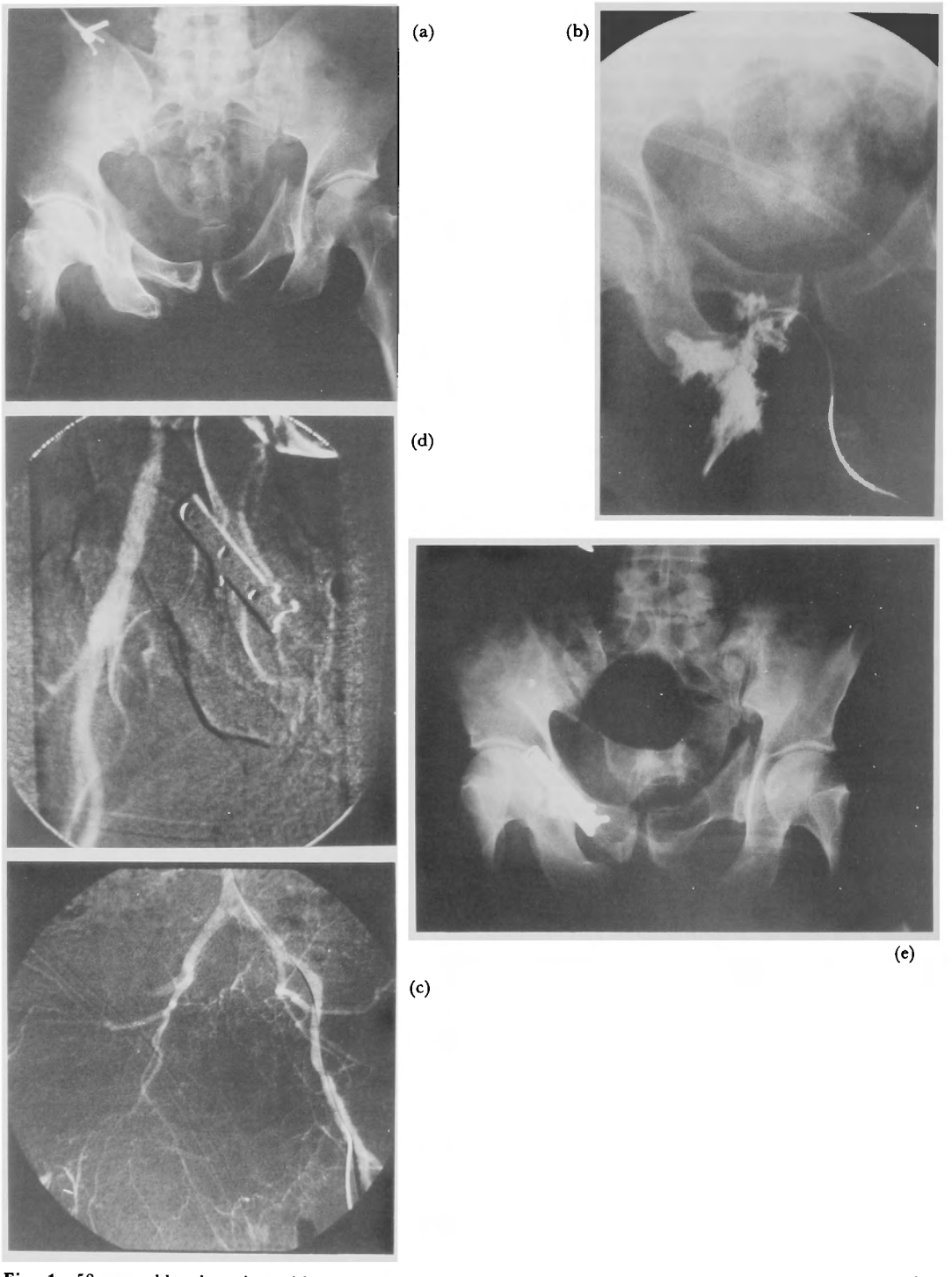


Fig. 1 52 years old male patient with overrun trauma and pelvic ring fracture (Type IIa) (1a) with disruption of the symphysis and urethra (1b) and disruption of external iliac artery (1c). Before the vascular reconstruction (1d) the os pubis is stabilized with osteosynthesis plate (1e).

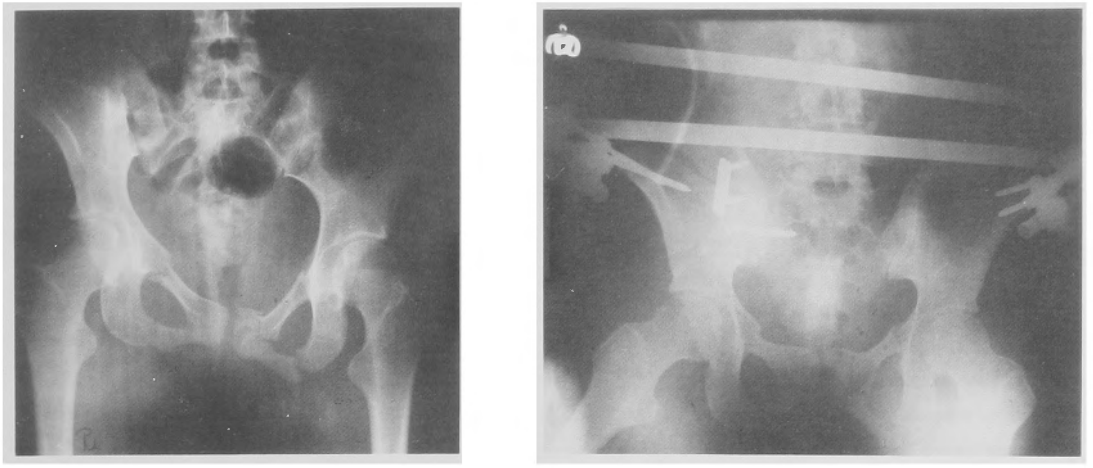


Fig. 2 17 years old female patient with pelvic ring fracture Type III with partial disrupture of the iliosacral joiont and fracture of os ilium. Stabilization of the iliosacral join through screw osteosynthesis and fixature externe.

necessary after the operative treatment of these above mentioned injuries to avoid further disruption and further additional injuries.

If the injuring force is extremely high the posterior pelvic ring is damaged. This is always associated with the disruption of the anterior pelvic ring. In the simplest case we only see a ruptur of the anterior iilosacral ligaments opening the two pelvic halfs like the leafs of a door (Table 1, Type II).

By using the operative outer ventral fixation of the pelvis the lesion will heal in almost all cases with good results. A conservative treatment with longitudinal traction and a pelvic sling should no longer be considered as therapeutic measure in patients with polytranuma.

Often there are additional injuries of the lower urinary tract. If these injuries are operated upon, we prefer the stabilization in the same session using a osteosynthesis plate readapting the symphysis. In each other case we stabilize the anterior pelvic ring with an external fixateur, which minimizes the danger of infection. Usually we prefer the trapezoid-like- mounting (Fig. 2)[8].

Complete posterior pelvic ring fractures (Type III, Table 1) lead to major dislocations. The lateral part of the pelvis is tracted cranially with the hip joint in these cases. These dislocations are more excessive in complete ligamentous lesions of the ilioscral joint than in merely osseous lesions (for instance: fractures through the lateral mass of sacrum or os ilium), because the later ones tend to hook themselves into one another.

Conservative treadment with pelvic sling and additional supracondylous extension is no longer acceptable today. In addition the reposition results are often very unsatisfieing. For a better judgement of deformations of the pelvic ring and dislocations of the iliosacral joint as well as for control purposes after reposition we demand X-ray examinations in the technique described by Pennal et al. [11].

The fixation of the anterior ring alone is not sufficient in these complete pelvic ring destructions. Because of the enormous friction forces towards the two halfs of pelvis the application of a fixateur externe alone is not sufficient enough. Open reduction of these fractures is recommended for sufficient stabilization ad reposition results. The disruptured iliosacral joint can be refixed by long spongiosa screws being brought into the lateral mass of sacrum through the os ilium like an ar-

throdesis (Fig. 2). However in addition the anterior pelvic ring has to be braced with a fixateur externe constrcution.

Thus pelvic ring fractures of Type I can be fully stressed immediately after the accident. Type II injuries need a healing period of 6 weeks and Type III injuries of 12 weeks after full load can be carried out. If the reposition is sufficient prognosis is good in these cases.

FRACTURES OF THE ACETABULUM

Fractures of the hip joint area need a separate consideration because they impair not only the stability of the pelvic ring but also the hip joint function. The hip joint was the last big joint beeing operatively reconstructed as the access to these structures is rather difficult. The complex threedimensional construction of the pelvis and the difficulties in stabilization procedures allowed only conservative treatment of fractures and luxations in the past [1,2]. However after the publications of JUDET and LETOURNEL[3,5,6] valid and senseful operative indications have been worked out in the last years[4,13].

Acetabular fractures are caused by force transmitted in the longitudinal axis of the femur to the acetebalum. They can be associated with lesions of the femoral head or of the neck of the femur. The force is transduced mainly along the dorsal and cranial pillars rather than the ventral pillar. These biomechanical aspects have to be considered in the management of those fractures. The simple discrimination into ventral and dorsal hip luxation fractures used in the past was sufficient only for conservative therapy measures[16].

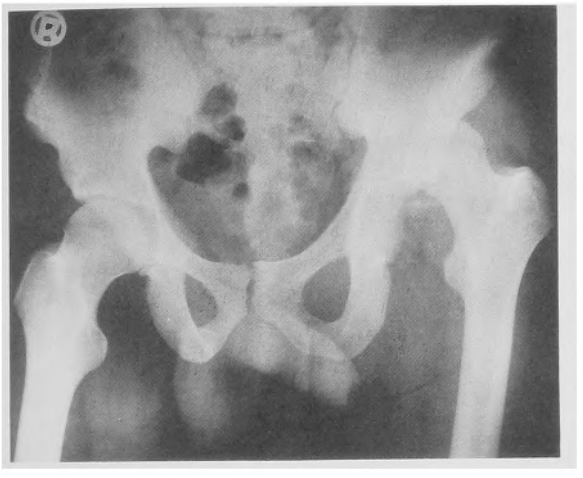
Diagnostics

The most common classification of the different types of acetabular fractures is the one published by JUDET and LETOURNEL (Table 2). It respects the biomechanical aspects as well as the operative techniques. However the exact amount of the fracture can sometimes only be found during the operation. Socalled Ala- and Obturator X-ray-exatminations of the hip are often proposed for better exposure of the ventral pillars of hip roof and dorsal joint margin. We prefer computertomography, which reveals the whole amount of joint involvment and can show additional pelvic injuries.

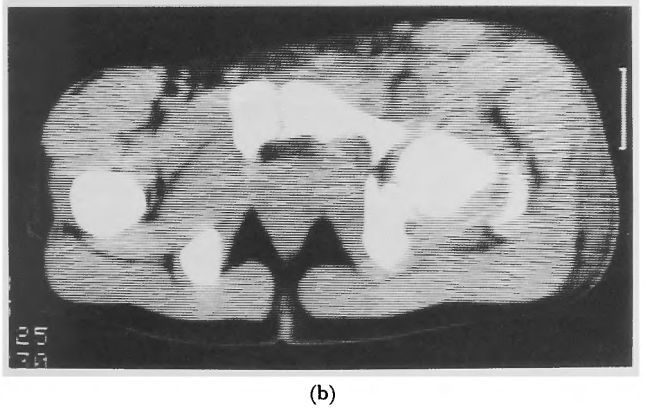
Operdtive treatment

Reduction of acetabular fractures is one of the most complex surgical maneuvers in trauma surgery. Therefore general recommendations for routine procedures cannot be given. The most common acetabular fracture is the avulsion of the dorsal acetabular margin[16]. The femoral head is chiseled off by force in the longitudinal axis of the femur in flexion. There is almost a luxation of some amount.

In rim fractures with posterior dislocation the blood supply to the femoral head is disrupted, and aseptic necrosis occur in approximately 50 percent of the patients. This fracture should be treated as an emergency. Reduction should be prompt. Should reduction not be done easily with gentle upword traction with the hip flexed, the femoral head may be trapped by a band of posterior capsule or by piriformis tendon. Open reduction is then necessary, and internal fixation of the rim fragment



(a)



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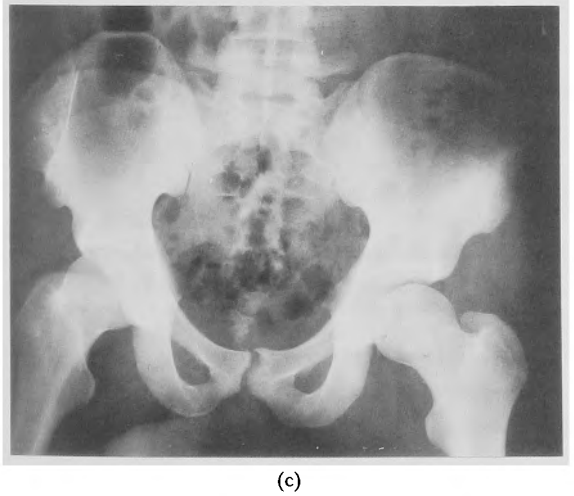
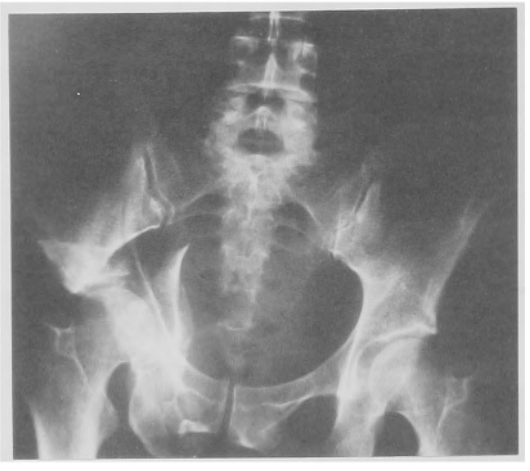


(c)

(d)

Fig. 3 Luxation fracture of the left hip joint with avulsion of the dorsal acetabular roof (3a) in a 23 year old male patient. Immediate closed reduction with interposition of the fragment into the joint (3b, c). (3d) X-ray after operative correction.



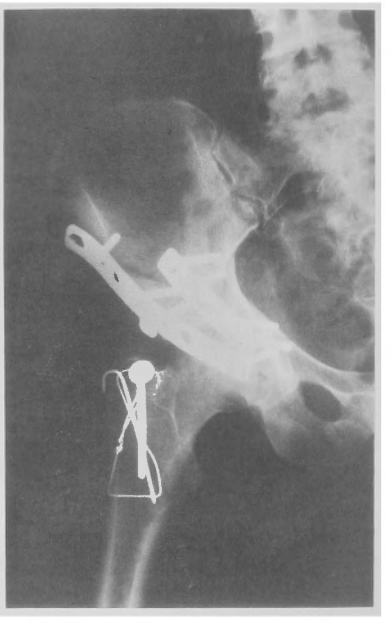


Fig. 4 32 year old patient with avulsion of the dorsal and ventral acetabular roof (4a). Dorsal acess and reconstruction with two osteosynthesis plates after removement of the major trochanter (4b).

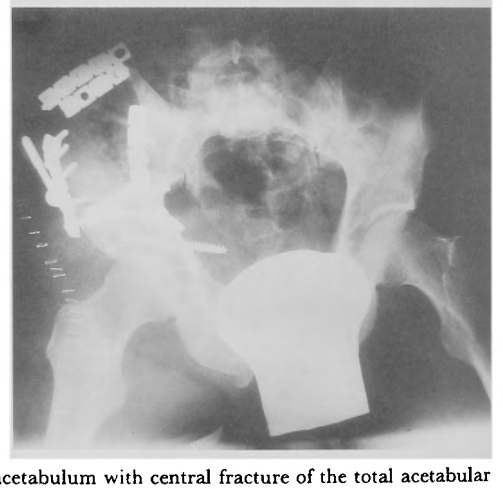


Fig. 5 34 year old male patient with severe damage of the acetabulum with central fracture of the total acetabular roof and right pelvic bones (5a). Exposition of the hip joint from the outside and inside via ilio- inguinal access. Iliac muscle was detached from the inside and medial and minimal adductor muscle had to be detached from the outside. Stabilization with singular traction screws and reconstruction plates (5b).

should be done. The closed reduction can cause an interposition of the fragment into the joint leading to great pain. In such cases an operative reduction has to be performed as soon as possible (Fig. 3).

The way of operative approach depends on the type of fracture[2,9]. If a rim fragment is avulsed dorsocranially a posterior approach is necessary. Usually this way allows stabilization of a dorsal pillar fracture or transverse fractures also.

In all cases of avulsion of a dorsocranial rim fragment we see an absolute indication for fixation with traction screws (Fig.4). Conservative treatment using a femur distraction will only lead to a good functional sucess in the very rare fractures without dislocation. To avoid posttraumatic arthresis the hip joint must be reconstructed without any steps. An impression of the acetabular fracture margin which is rather frequent has to be perceived and should be treated by filling up the defect with autologous spongious bone transplants.

In cases of total demolition of the dorsal acetabular roof fragments are tightended with osteosynthesis plates, because only bigger pieces can be refixed with traction srews. Traumatic arthrosis frequently occurs after this injury, but the patient may have many years of uscful function before this complication ensues. If the cranial acetabular roof is destroyed the dorsal standard approach has to be extended. The greater trochanter has to be chiseled off and the insertions of the medial and minimal gluteus muscle are tipped up. Thus the cranial acetabular roof can be surveyed better and iatrogenic injuries to the superior gluteal nerve may be avoided (Fig. 4).

Sometimes we need more complex operative approaches in other types of fractures. These are for instance the methods of SMITH/PETERSON or JUDET/LETOURENEL[2,9], in which the hip joint is exposed from the inner side of the pelvis. In some cases the hip joint has to be exposed from the outside and the inner side (Fig. 5). Reduction of pillar- and transverse fractures still remains difficult. Stabilization of these fractures is achieved through compression-plate-osteosynthesis or traction srews[4,6,13]. There is no general guide line for the management of complex acetabular fractures which may need a combined dorsal and ventral operative approach. These fractures should be treated only by the experienced specialist.

Postoperative Care

A movement with full body weight should not be performed by the patients before 12 weeks after the operation of an acetabular fracture. Greater demolitions and persistant defects demand even longer periods of relief. However therapeutical physical mobility exercises should be started as early as possible.

The open redution of acetabular fractures has led to better functional results. The risk of traumatic arthrosis is still very high in fractures with many fragments and in fractures with delayed operations, because often it is not possible to reconstruct the hip withou any steps in these cases.

PELVIC FRACTURES IN POLYTARAUMA

Pelvic fractures in patients with polytrauma need a special consideration. On the one hand extensive operative procedures for complex acetabular fractures with a prolonged operation time and additional blood loss may be disadvantageous for the patient. On the other hand pelvic ring fractures often lead to a severe bleeding themselves, which can only be stopped by an operative stabilization of the pelvic ring. In the own experience the stressing reconstructions of the acetabulum were not performed immediately. Sometimes a difficult general condition of the patient allowed operative reonstruction of the pelvis only several weeks after the injury. An exact reposition of the fragment could not always be achieved after that time.

In opposition to these circumstances the stabilization of the pelvic ring to seize the retroperitoneal beleeding with an external fixation is not very stressing and can be done easily.

Table 3 Pelvic ring fractures in the Department of Surgery, Bonn University between 1979 and 1988.

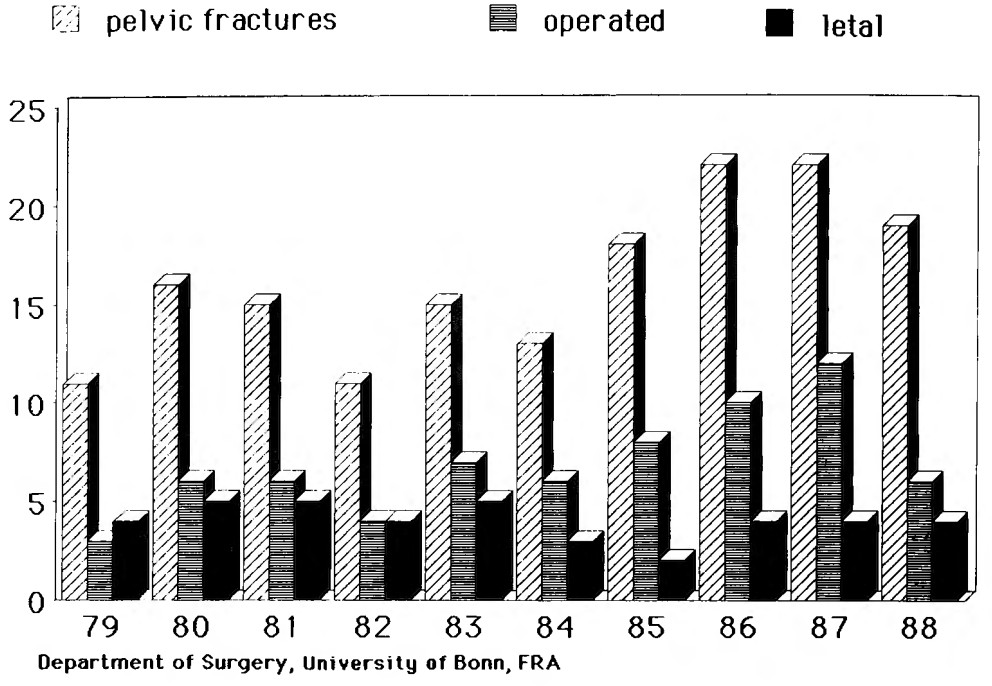
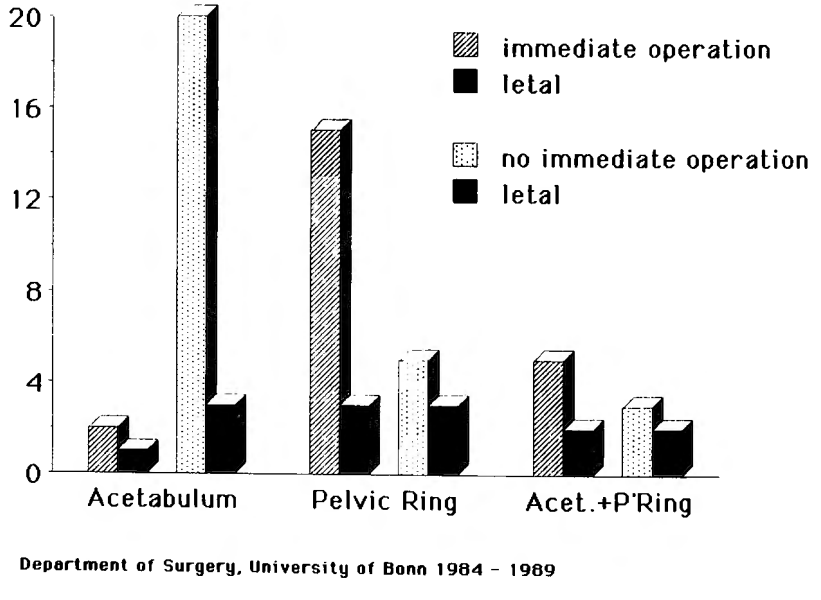


Table 4 Pelvic fractures in Polytrauma; Development of number of immediate operations and letality.



Whereas in the first years we decided to stabilize the pelvic ring only in cases of failure of conservative treatment, we now propose the stabilization with an external fixateur as a routine emergency procedure especially in polytraumatized patiens (Table 3, 4).

In conclusion it must be stated that therapy of pelvic fractures in polytrauma often will need compromises. The older the patient the more we will renounce extended joint reconstructions and perform live saving measures only. These however may include external fixation procedures.

LITERATURE

1) Boehler J: Konservative Therapie der Luxationsfrackturen im Hüftbereich. Langenbecks Arch klin Chir **316**: 417–421, 1966.
2) Hochstetter AV, Rüedi Th: Anatomie und Zugangswege zum knöchernen Becken. Langenbecks Arch klin Chir **361**: 161–167, 1983.
3) Judet R, Judet J, Letournel E: Fractures of the Acetabulum: Classification and surgical approaches for open reduction. J Bone Jt Surg **46-A**, 1615–1646, 1964.
4) Jungbluth KH: Frakturen de Azetabulum. Langenbecks Arch klim Chir **361**: 179–183, 1983.
5) Letournel E: Die operative Versorgung der Hüftpfannenbrüche. Langenbecks Arch klin Chir **316**: 422–437, 1966.
6) Letournel E: Acetabulum fractures. Clin Orthop Rel res. **151**: 81–106, 1980.
7) Müller KH, Müller-Färber M: Die Osteosynthese mit dem Fixateur externe am Becken. Arch Orthop Traumat Surg **92**: 273–283, 1978.
8) Müller-Färber J, Müller KH: Die verschiedenen Formen der Beckenringverletzungen und ihre Behandlung. Unfallheilkunde **87**: 441–455, 1984.
9) Muhr G: Zugänge zur Versorgung von Beckenfrakturen. Heftez Unfallheilkunde **140, 77–83, 1979.**
10) Nutz V: Therapeutische Probleme der Acetabulumfraktur beim Polytrauma. Langenbecks Arch klin Chir **370**: 129–139, 1987.
11) Pennal JF, Tile M, Waddell JP, Garside H: Pelvic disruption. Assessment and classifcation. Clin Orthop **151**: 12–21, 1980.
12) Poigenfürst J: Beckenringbrüche und ihre Behandlung. Unfallheikunde **82**: 309–319, 1979.
13) Rüter A, Burri C: Operative Behandlung der Azetabulumfrakturen. Hefte z Unfallheikunde **140**: 105–121, 1979.
14) Schroeder L, Havemann D: Äubere Stabilisation von Beckenfrakturen. Unfallmedizin Tag d Landesverb d gewerbl Berufsgen **48**: 101–110, 1982.
15) Vasey H: Frakturtypen des Becknringes. Hefte z Unfallheilkunde **140**: 7–12, 1979.
16) Weigant H, Schweikert CH: Frackturtypen des Azetabulums. Hefte z Unfallheilkunde **140**: 13–26, 1979.
17) Zimmer W, Exner G, Leffringhausen W: Wege der Behandlung von Beckenfrakturen. Unfallmedizin Tag d Landesverb d gewrbl Berufsgen **48**: 85–100, 1982.