Results of the Surgical Treatment of Acetabular Fractures

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Introduction. We hereby present a retrospective study of the clinical and radiological results obtained by 61 patients operated on for an acetabular fracture 9 years after surgery. The mean follow up was 62 months.

Materials and methods. In 58 cases the lesions were sustained as a result of high-energy trauma The most common fracture type, following Judet and Letournel’s classification, was a transverse fracture associated to the posterior wall (34,4%). 37 patients (60,7%) had associated lesions. In 51 cases (83,7%), the osteosynthesis was performed within the first two weeks. The final clinical-radiological assessment was carried out in 51 cases (83,7%) with a follow-up of at least one year.

Results. Fracture reduction was achieved anatomically in 38 cases (74,5%). 7 patients (13,8%) had a < 2 mm displacement and 6 (11,7%) had a displacement of more than 2 mm. The clinical results, according to Harris’ score, were excellent to good in 39 cases (76,5%) and acceptable to poor in 12 (23,5%). Three patients went on to develop a femoral head necrosis, two had necrosis in the posterior wall and 4 coxarthrosis. 4 patients had to undergo total hip replacement.

Conclusion. With an adequate surgical technique we can get satisfactory results in a high percentage of cases.

Key words: acetabulum, fracture, osteosynthesis.

Results del tratamiento quirúrgico de las fracturas del acetábulo

Introducción. Presentamos un estudio retrospectivo de los resultados clínicos y radiológicos de 61 pacientes intervenidos de fractura acetabular, durante 9 años, con un seguimiento medio de 62 meses.

Material y método. En 58 casos el mecanismo de lesión fue traumatismo de alta energía. El tipo de fractura más frecuente, según la clasificación de Judet y Letournel, ha sido la transversa asociada a pared posterior (34,4%). En 37 pacientes (60,7%) hubo lesiones asociadas. En 51 casos (83,7%) la osteosíntesis se efectuó en las dos primeras semanas. La evaluación clínico-radiológica final se realizó en 51 casos (83,7%) con un seguimiento mínimo de un año.

Resultados. La reducción de las fracturas fue anatómica en 38 casos (74,5%), desplazada < 2 mm en 7 (13,8%) y en 6 pacientes (11,7%) el desplazamiento fue mayor de 2 mm. Los resultados clínicos, según la escala de Harris, fueron excelentes o buenos en 39 casos (76,5%) y en 12 aceptables o pobres (23,5%). Tres pacientes desarrollaron necrosis de cabeza femoral, dos necrosis de la pared posterior y 4 coxartrosis, precisando 4 de ellos una prótesis total de cadera.

Conclusión. Con una buena técnica quirúrgica se pueden obtener buenos resultados en un alto porcentaje de casos.

Palabras clave: acetábulo, fractura, osteosíntesis.

In the last 35 years, the study of acetabular fractures has evolved thanks to the initial work of Judet and Letournel1, to the publication of Letournel and Jude2 and to the research of other authors who have followed in the same school1. Acetabular fractures are caused by high-energy trauma, with traffic accidents, especially automobile accidents being their main cause1. The increase in the number of vehicles circulating and their greater speed has increased the incidence of these fractures and decreased the age at which they occur1.
The classification of acetabular fractures proposed by Judet et al. continues to be used as a reference and their recommendations as to the surgical treatment to be applied have been validated by many studies, although there is some controversy as to certain specific fractures.

The aim of surgical treatment is to preserve painless functionality and mobility of the hip. The current trend in the case of displaced fractures is anatomical reduction and rigid internal fixation. Residual displacement of more than 2 mm is considered to favor early development of osteoarthritis.

The quality of fracture reduction is closely related to the type and complexity of the fracture, and certain patterns are associated with an adverse outcome.

There are few published studies with a prolonged follow-up, and most studies consider involvement of the femoral head and a high degree of residual incongruence of the coxofemoral joint to be adverse prognostic factors in the long term.

In this study we present the results of our experience of surgical treatment of acetabular fractures during a 9 year period. This is a retrospective study in which we analyze the type of fracture, associated lesions, approaches, treatment protocol, complications and final outcome.

MATERIALS AND METHODS

From January 1994 to December 2002, in our hospital, 118 acetabular fractures were treated. In 57 of them (48.4%) conservative treatment was applied and in 61 (51.6%) surgical treatment was applied.

Of the 61 patients operated 45 were male (73.7%) and 16 female (26.3%). Mean age at the time of fracture was 35 years of age (range 14-86 years). Eight patients (13.1%) were under 17 years of age.

The cause of the fractures was high energy trauma in 58 cases (43 automobile accidents, 13 motorcycle accidents, one case of being hit by a vehicle and one case of falling out of a vehicle); whereas in the 3 remaining cases the cause of fracture was a fortuitous fall.

Thirty seven patients (60.7%) suffered associated lesions (Table 1), of these 17 had to be hospitalized in an Intensive Care Unit (ICU) for haemodynamic stabilization, 20 required some other type of trauma surgery and 6 cases required surgery by other specialists. Fracture of the pelvis and lower limbs were the most frequent associated lesions and these were seen in 13 patients (21.3%). There were 3 cases of ipsilateral femur fracture (floating hip). In 3 cases the lumbosacral plexus was involved with 2 sciatic nerve lesions that recovered spontaneously and one pudendal nerve lesion that did not recover and the patient currently suffers from erectile dysfunction.

Emergency surgery, in the first 24 hours after fracture, was carried out in 3 patients (4.9%): two of them had irreductible posterior dislocations with entrapment of a bone fragment from the roof and the posterior wall (Fig. 1) and another had complete sciatic nerve palsy due to compression (this patient recovered spontaneously from the palsy after stabilization of the fracture). In the remaining 58 cases (95.1%) osteosynthesis was carried out from 3 to 32 days after trauma. In 51 patients (83.7%) surgery was performed during the first 2 weeks and in 7 cases (11.4%) surgery was carried out later than 2 weeks after fracture due to the fact that these patients had to remain longer in the ICU.

In 55 patients (90.2%) early rehabilitation was started after the first 48 hours, once drainages were removed, with the patient in a sitting position. In 6 patients (9.8%) traction was maintained for a mean period of 13 days (range 7-21 days).

Weight bearing on the joint was allowed between weeks 10-12.

Mean hospital stay was 17 days (8-45); it was greater in those patients with associated lesions. The patients were seen as outpatients at 1 month, 3 months, 6 months and 1 year after surgery and subsequently once a year to discharge.

Of the 61 patients operated, the final clinical and X-ray evaluation was carried out in 51 with a minimum follow-up of 1 year (mean follow-up 62 months, range 8-108 months). It was impossible to contact the other 10 patients as they had moved.

Assessment of the fracture, indications and treatment protocol

X-ray assessment on arrival included the three classic views of the acetabulum, antero-posterior and oblique, alar and obturator, also a computed axial tomography CAT) and lastly, 3-D reconstruction.

Fractures are classified (Table 2) according to Judet et al. Of the 61 fractures 32 (52.4%) involved the right acetabulum and 29 (47.6%) the left acetabulum. The most frequent type of fracture was a transverse fracture associated with posterior wall fracture (Fig. 2) in 21 cases (34.4%),

<table>
<thead>
<tr>
<th>Associated lesions</th>
<th>Num. of cases</th>
</tr>
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<tbody>
<tr>
<td>Upper limb fractures</td>
<td>9</td>
</tr>
<tr>
<td>Lower limb fractures</td>
<td>13</td>
</tr>
<tr>
<td>Femur head fracture</td>
<td>1</td>
</tr>
<tr>
<td>Fracture of the pelvis</td>
<td>13</td>
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<tr>
<td>Floating hip</td>
<td>3</td>
</tr>
<tr>
<td>Rib fractures</td>
<td>8</td>
</tr>
<tr>
<td>Spine fractures</td>
<td>2</td>
</tr>
<tr>
<td>Lumbosacral plexus</td>
<td>3</td>
</tr>
<tr>
<td>Head and neck trauma</td>
<td>7</td>
</tr>
<tr>
<td>Internal organs</td>
<td>5</td>
</tr>
<tr>
<td>Contusions, skin lesions</td>
<td>10</td>
</tr>
</tbody>
</table>
fractures of the anterior wall and column were isolated and T fractures were the least frequent with only 3 cases (4.9%). On 6 occasions (9.8%) both columns were fractured, one of these cases had an associated anterior wall fracture and another a posterior wall fracture. In 27 patients (44.2%) there was also hip dislocation, 6 of these were central dislocations (9.8%) and 21 (34.4%) were posterior dislocations.

The criteria for surgery was: fractures with a joint displacement greater than 2 mm\(^2\) and fractures with an acetabular index, in any of the X-ray projections (antero-posterior [AP], alar or obturator), of not less than 30° for the medial and posterior arch and less than 20° for the anterior arch. And, especially all fractures with posterior coxofemoral instability, amongst which are included the isolated fractures of the posterior wall or fractures associated with fractures of the posterior column, transverse, T-shaped or of both columns in which the posterior rim of the acetabulum was very displaced; displaced fractures of the acetabular roof; displaced fractures of both columns with a joint surface in several fragments; intra-articular fragments and partial fractures of the femur head that may cause instability and incongruence.\(^{29}\)

In all cases soft tissue traction was used until the moment of surgery.

In the patients with fractures and dislocation closed reduction under general or spinal anaesthesia was performed.

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### Table 2. Acetabular fractures according to the Judet-Letournel\(^1\) classification

<table>
<thead>
<tr>
<th>Simple lesions</th>
<th>Num. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior wall</td>
<td>3</td>
</tr>
<tr>
<td>Posterior wall</td>
<td>7</td>
</tr>
<tr>
<td>Anterior column</td>
<td>3</td>
</tr>
<tr>
<td>Posterior column</td>
<td>4</td>
</tr>
<tr>
<td>Transverse</td>
<td>5</td>
</tr>
<tr>
<td>Complex lesions</td>
<td></td>
</tr>
<tr>
<td>Transverse and posterior wall</td>
<td>21</td>
</tr>
<tr>
<td>Posterior wall and column</td>
<td>5</td>
</tr>
<tr>
<td>Anterior wall and column</td>
<td>4</td>
</tr>
<tr>
<td>Two columns</td>
<td>6</td>
</tr>
<tr>
<td>T fracture</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
</tr>
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</table>
Figure 2. (A) and (B) X-ray, obturator view, before and after reduction of a transverse fracture associated with a posterior wall fracture and posterior dislocation of the femur head. (C) and (D) Computed axial tomography images that show the typical antero-posterior direction of the transverse tracing and the displacement of the posterior wall. (E) Obturator X-ray after fixation with two compression screws and a neutralization plate, Kocher approach. (F) and (G) Alar and antero-posterior X-rays of the hip at 20 months with perfect union of the fractures.
in the first 24 hours, always after the necessary haemodynamic stabilization or intensive care.

On admission, antithromboembolic prophylaxis was initiated with low molecular weight heparin and to this was added antibiotic prophylaxis one hour before surgery and prophylaxis for heterotopic calcifications with indometacin, 25 mg every 8 hours for 6 weeks after surgery. Three units of packed red cells were reserved for surgery.

During fracture osteosynthesis the classical approaches for acetabular surgery were used, with the one that allowed repair of all the lesions being chosen. The approaches used were: In 38 cases (62.4%) the Kocher-Langenbeck; in 14 cases (23.1%) the ilioinguinal; in one case (1.6%) the Kocher-Langenbeck with osteotomy of the greater trochanter; in one case (1.6%) where there was entrapment of a bone fragment from the acetabular roof, an iliofemoral approach was used; in 5 cases (8.1%) a double approach was chosen (Kocher-Langenbeck + ilioinguinal) and finally, in 2 cases (3.2%) the ilioinguinal approach was used with distal extension (modified Smith-Petersen approach) that allowed a better access to fragments of the anteroinferior iliac process and the anterior, making it possible to perform an anterior arthrotomy (Fig. 3).

All 61 patients were operated under general or spinal anaesthesia and AO osteosynthesis material was used for the fixation of the fractures with reconstruction plates, initially of steel and currently of 3.5 mm titanium, together with 3.5 mm cancellous screws with a complete or partial thread. In the osteosynthesis of the anterior or posterior columns a reconstruction plate was always used, whereas for the anterior or posterior wall a plate, screws or both were used. Plates were placed: in 28 patients (45.9%) in the posterior column; in 12 (19.6%) in the anterior column; in 10 (16.3%) in the posterior column and the posterior wall; in one (1.6%) in the anterior column and wall and in 2 (3.2%) in both columns. In 6 cases (9.8%) a plate was used for fixation of the posterior wall. In two posterior wall fractures (3.2%) only screws were used. In 2 cases the posterior wall was fixated with long screws directed from the anterior

Figure 3. (A) and (B) Antero-posterior view of the pelvis and detail of a computed axial tomography (CAT) of a fracture of the anterior column and wall associated with a pelvic fracture. (C) Antero-posterior X-ray of the pelvis after fixation with a double anterior plate and three plates in the iliac bone by a distally extended ilioinguinal approach. (D) and (E) Antero-posterior view of the pelvis and CAT of a fracture of the anterior column and wall associated with a pelvic fracture and fracture dislocation of the femur head. (F) X-ray taken after fixation with a neutralization plate implanted by an ilioinguinal approach extended to perform an anterior arthrotomy and osteosynthesis of the femoral head.
column and in one case the anterior column was fixated with a screw directed from behind.

In the case of patients with other fractures these were all treated in the same operation, first the long bones were fixated and lastly the acetabulum.

For the assessment of results, general parameters were considered, such as operation time, transfusions and local and general complications. The presence of heterotopic calcifications was also determined, according to the classification by Broker et al.10

The quality of the reduction was assessed by means of the classical projection of the acetabulum during the postoperative period and during subsequent revisions. Three categories were considered: anatomical reduction, displacement of less than 2 mm and displacement greater than 2 mm or loss of joint reduction11.

A simple hip X-ray was performed at the end of the follow-up, and degenerative changes seen were reported12 (no change, minimal changes, less than 50% of the joint affected and joint destruction greater than 50%). For the final assessment of clinical outcome we used the Harris scale13 (90-100 points: excellent results; 80-90: good; 70-80: acceptable and below 70: poor).

**RESULTS**

Mean OR time was 159 minutes (60-565), it was higher in some patients due to the fact that several surgical procedures were carried out under one anesthesia.

A mean of 1.6 bags of red blood packs were required after surgery (range 0-5).

Amongst the complications (Table 3) intraoperatively a tear occurred in the superior gluteal artery which was solved by ligating it; in the immediate postoperative period there was 1 infection of the surgical wound with *Staphylococcus aureus* which was satisfactorily treated with debridement and specific antibiotics, 3 cases of lateral popliteal sciatic nerve palsy in cases in which Kocher-Langenbeck approaches were performed, which recovered without sequelae and 2 lesions of the femorocutaneous nerve in iliouinguinal approaches (1 due to traction that had a partial recovery and another due to rupture of the nerve that left an affected area on the lateral part of the thigh).

There were no or very minimal heterotopic calcifications in 48 patients (94.2%). Two cases (3.9%) operated by means of a Kocher-Langenbeck approach were Broker type II and another patient operated by an iliofemoral approach (1.9%) was a Broker type III.

Three patients (5.8%) developed avascular necrosis of the femoral head and 2 (3.9%) necrosis of the posterior wall (Fig. 1) with joint instability and wear of the femur head. All had a comminute fracture of the posterior wall and dislocation.

Of the 51 patients that we were able to assess clinically and by means of X-rays, 6 (11.7%) required another operation with 4 total hip replacements (2 cases of femoral head necrosis and 2 cases of posterior wall necrosis), one revascularization surgery of the femoral head with a vascular iliac crest graft from the iliac crest (this was a 17-year-old patient with necrosis) and one screw extraction from the posterior wall due to intra-articular protrusion.

Anatomic reduction of the fracture was achieved in 38 cases (74.5%), in 7 (13.8%) the displacement was less than 2 mm and in 6 patients (11.7%) the displacement was greater than 2 mm: 4 of these had an initial osteosynthesis failure in complex fractures with a great degree of comminution and 2 of these had apertures of the dorsum sellae (Fig. 4).

In the final X-ray assessment of the joint, no degenerative changes were observed in 31 cases (60.8%), minimum osteoarthritic changes were seen in 8 (15.7%), there was less than 50% joint destruction in 3 patients (5.8%) and more than 50% in 9 (17.7%): there were 3 cases of femoral head necrosis, 2 cases of posterior wall necrosis and 4 coxarthrosis.

According to Harris score12 in 39 (76.5%) patients results were good to excellent and in 12 (23.5%) acceptable to poor.

**DISCUSSION**

The main aim of the treatment of acetabular fractures must be the same as the treatment of any other joint fracture, i.e. restoring perfect congruence that will guarantee good long-term functionality of the joint14,15. In this sense we feel, as do most authors, that surgery makes it possible to achieve anatomical reduction, stable fixation and an early beginning of rehabilitation.

The indication for surgical treatment is clearly defined as it is known that displacements greater than 2 mm lead to

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**Table 3. Complications**

<table>
<thead>
<tr>
<th>Complications</th>
<th>Num. of cases</th>
</tr>
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<tbody>
<tr>
<td>Perioperative</td>
<td></td>
</tr>
<tr>
<td>Infection of surgical wound</td>
<td>1</td>
</tr>
<tr>
<td>Femorocutaneous lesion</td>
<td>2</td>
</tr>
<tr>
<td>Lateral popliteal sciatic palsy</td>
<td>3</td>
</tr>
<tr>
<td>Hemorrhage of the superior gluteal artery</td>
<td>1</td>
</tr>
<tr>
<td>During evolution</td>
<td></td>
</tr>
<tr>
<td>Gluteus muscle failure</td>
<td>3</td>
</tr>
<tr>
<td>Hip dislocation</td>
<td>1</td>
</tr>
<tr>
<td>Lack of symmetry of lower limbs</td>
<td>2</td>
</tr>
<tr>
<td>Avascular necrosis of the femoral head</td>
<td>3</td>
</tr>
<tr>
<td>Posterior wall necrosis</td>
<td>2</td>
</tr>
<tr>
<td>Coxarthrosis</td>
<td>4</td>
</tr>
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</table>
early osteoarthritis. Other aspects such as the decrease of the acetabular coverage rate, situations that affect posterior stability or the involvement of the roof or intra-articular fragments of the femoral head have been considered by most authors.

We are in favor of traction from admission until surgery, in an attempt to decrease the pressure of the joint cartilage of the femur head and prevent early osteoarthritis, since the involvement of the joint cartilage of the femur head is a significant prognostic factor in determining the evolution of these fractures.

Surgery, with the exception of emergency situations, such as dislocations that cannot be reduced and sciatic nerve palsy on admission, must be postponed a few days to facilitate haemostasis of the pelvis vessels. There is a correlation between results and delaying surgery beyond the third week. The ideal time to surgery varies according to different authors: at 48 hours or at 12-16 days as recommended by Letournel and Judet, and may depend on the presence of associated lesions. In our study 83.7% of our patients underwent surgery in the first 2 weeks.

The choice of approach depended on the anatomy of the fracture, on its age (older fractures required more extensive approaches), on the possibility to access the iliac bone, and on the lower incidence of complications in the postoperative period. The ideal approach is that which allows repair of all lesions. Surgery was performed more and we prefer the double approach, anterior + posterior, to the iliofemoral approach, which had greater morbidity. Under certain circumstances, when there is a displaced fragment of the anterior wall that includes the antero-inferior iliac process, the femoral head is affected, or there is a free intra-articular fragment we extended the incision distally, in a similar way to the Smith-Petersen approach, to be able to perform an arthrotomy, extract or fixate any fragments and ensure a perfect reduction of the anterior wall. The ilioinguinal approach also allows the use, if needed, of each of its windows, without having to completely dissect the others. This means that mini-approaches are used, in an attempt to avoid blood vessels and slide the osteosynthesis.
material under them. We performed our last surgeries in this way.

The techniques and instruments necessary for the reduction of different fractures are perfectly defined in the initial work of Letournel and Judet2,12 and the contributions of other authors14,17,19,20. An osteosynthesis located on the more medial rim of the anterior column and on the posterior column with the more distal screw resting on the ischiatric tuberosity is also described14,17,20. In fractures of the posterior column or transverse fractures with a very oblique ascending course towards the greater sciatic notch we prefer to place two plates over the posterior column, a small one very near the notch and the classic plate with 7-8 holes with its lower part resting on the ischiatric tuberosity (Fig. 5). There is one situation that requires a certain ingenuity when considering fixation of a dorsum sellae that is avulsed from the rim of the anterior column and displaced medially. In these cases we use a plate of a third of a tube bent at 90° to achieve containment. The placement of a lag screw from a posterior approach towards the anterior column (this procedure was performed in 1 case in our series) is difficult and requires orientation and skill. We recommend doing the opposite, i.e. placing a lag screw from an anterior approach towards the posterior column (2 cases in our series).

In our series of cases we had no significant early complications directly related to surgery such as intraoperative death, which, in Letournel’s2 series of 569 cases was 2.3%, or pulmonary embolism which was 2.1%. Our superficial infection rate was lower than that mentioned by Letournel, Judet2 and Matta1.

The incidence of preoperative lesions to the sciatic nerve varied from 12-31% according to the series2,21-23. Two cases in our series were associated with posterior dislocation of the femoral head. The bilateral lesion of the pudendal nerve is frequent in the postoperative period21 due to perineal pressure in patients placed in the prone position. Lesions of the femorocutaneous nerve are related to the ilioinguinal approach: 11.7% in our series, 18% for Helfet and Schmeling21 and 12% for Letournel and Judet2.

Our clinical results are similar to those obtained by other authors. We have found no correlation between results and patient age, such as other authors mention1, but we have found a correlation with associated lesions. We have no proof of deterioration over time such as that mentioned by Letournel and Judet2.

Clinical results are closely related to X-ray results. It is known that the quality of the reduction is the main predictive factor in the evolution of the joint. Displacements greater than 2 mm are indications of a poor prognosis and, eventually, joint osteoarthritis2,3. Of 38 patients that underwent anatomic reduction, 31 showed no radiologic changes in the final X-ray, 2 showed minimal changes, and the remaining 5 were the cases of necrosis of the femoral head and of the posterior wall. Of the 7 patients with displacements of less than 2 mm, 5 showed no changes in the final X-ray and 2 had a joint lesion of less than 50%. Of the 6 cases with postoperative displacements greater than 2 mm, 4 evolved to an early coxarthrosis, the 2 remaining cases had displacements of the dorsum sellae with a good index of acetabular coverage, one of these had minimal alterations seen on the final X-ray and the other had less than 50% affected.

The quality of the reduction achieved is closely related to the type and complexity of the fracture, and certain patterns are associated with adverse outcomes2,3. In our series we have not had an excessive number of complex fractures, and this is closely related to the results seen.

Outcomes also reflect the experience and the learning curve of the surgeon2,3,8,9. Several surgeons have presented papers with poor results and inconsistent protocols and our first cases also reflect this. Outcomes can also be affected by the presence of associated lesions. In our series there were cases that also had lesions of the long bones, all of which were resolved during the same operation, always starting with long-bone osteosynthesis.

According to the series the incidence of femoral head necrosis varies from 2-12%,2,3,8,9,21, in our series it was 5.8%. Authors such as Wright et al24 have reported femoral head necrosis rates of 23%. The average rate of femur head necrosis after dislocation was 7.5% for Letournel and Judet2. In our cases there was always a posterior dislocation of the femur head and reduction of the fracture was considered anatomic.

Posterior wall necrosis was not much commented on in the literature until the work of Saterbak et al7, which would explain the poor evolution of some of these fractures with loosening of the osteosynthesis material, joint instability, and wear of the femur head that may be confused with necrosis and justifies the high incidence of this condition in some series24. For us, when there is comminution of the posterior wall it is always necessary to use a cortico-cancellous autologous graft (Fig. 6).

The incidence of heterotopic calcifications varies from 3-69% according to the series2,3,8,21,22. In our series it was 5.8% with 2 type II Broker cases in Kocher-Langenbeck approaches and 1 type III Broker in the only iliofemoral approach we performed. Correlation of heterotopic calcifications with the approach is constant in the literature with an almost inexistent number of calcifications with an ilioinguinal approach7 and an increase in the incidence by up to 35% in the iliofemoral approach7. A high rate of heterotopic calcifications that varies from 27-54% is observed when a combined Kocher-Langenbeck and ilioguinal approach is used2,17,25. In our 5 cases we did not have heterotopic calcifications. All our patients received prophylactic indomethacin.
Figure 5. (A) and (B) Antero-posterior view of the pelvis and details of a computed axial tomography of a transverse fracture associated with a posterior wall fracture in a 14 year old. (C) and (D) Control X-ray 16 months after fixation with a double plate on the posterior column using the Kocher approach.
REFERENCES


Figure 6. (A) and (B) Obturator and antero-posterior views of the hip with a transverse fracture associated with a posterior wall fracture. (C) and (D) Computed axial tomography images that show the transverse course and comminution of the posterior wall. (E) and (F) Alar and obturator X-rays 5 years after fixation of the posterior column with a neutralization plate and an autologous graft to achieve reconstruction of the posterior wall fixed with a plate, Kocher approach.

**Conflict of interests:** We, the authors, have not received any economic support to carry out this study. Nor have we signed any agreement with any commercial firm to receive benefits or fees. On the other hand, no commercial firm has provided nor will provide economic support to non-profit foundations, educational institutions or any of the other organizations that we are members of.