Isolated fractures of the anterior column and anterior wall are a relatively rare subgroup of acetabular fractures. We report our experience of 30 consecutive cases treated over ten years. Open reduction and internal fixation through an ilioinguinal approach was performed for most of these cases (76.7%) and percutaneous techniques were used for the remainder. At a mean follow-up of four years (2 to 6), 26 were available for review. The radiological and functional outcomes were good or excellent in 23 of 30 patients (76.7%) and 22 of 26 patients (84.6%) according to Matta’s radiological criteria and the modified Merlé d’Aubigné score, respectively.

Complications of minor to moderate severity were seen in six of the 30 cases (20%) and none of the patients underwent secondary surgery or replacement of the hip.

Isolated anterior column and anterior wall fractures account for only 6.3% of acetabular fractures. Their outcome is often analysed with other associated fracture patterns, particularly hemi-transverse or bicolumnar fractures, thereby masking their true prognosis. In spite of extensive literature on the management of acetabular fractures in general, information on outcome following open reduction and internal fixation (ORIF) of anterior column and anterior wall fractures is scarce.

In the majority of institutions, ORIF has become the standard treatment for any acetabular fracture which is displaced by > 5 mm, thereby allowing early mobilisation and minimising long-term complications. Promising results are also seen with closed reduction and percutaneous fixation for minimally displaced acetabular fractures.

We report the medium- to long-term functional and radiological outcomes of surgically treated anterior column and anterior wall fractures from a tertiary referral centre.

Patients and Methods
Between July 1999 and December 2007, 400 acetabular fractures were managed operatively in our institution. From a prospective database, patients whose fractures involved only the anterior column and or anterior wall were included in this case series. Data on the mechanism of injury, demographic characteristics, associated injuries, severity of overall injury (ISS), in patient records and post-discharge information were collected. Pre-operative assessment and classification were based on plain radiographs (antero-posterior and Judet views) and CT scans. In general, displacement of > 5 mm was considered an indication for surgical fixation. When possible, the patients were operated on within seven days from injury, and in cases of polytrauma once their physiological status was optimal. However, many patients underwent surgery after these times, mostly due to delays with inter-hospital transfer.

At induction, prophylactic antibiotics (cefuroxime 1.5 mg IV) were administered and a urinary catheter was inserted, if not already present. The patient was placed supine on a radiolucent fracture table which allowed assisted reduction by controlled traction using a distal femoral pin with the knee flexed to approximately 30°. Depending on the displacement and stability of the fracture fragments, either closed reduction and percutaneous fixation, or ORIF through an ilioinguinal approach was performed. A daily subcutaneous injection of low-molecular-weight heparin (LMWH) was used as thromboprophylaxis for a minimum of six weeks post-operatively. This was extended to 12 weeks in high-risk cases, such as polytrauma or obesity.

All patients were assessed clinically and radiologically at six, 12, 24, 36 and 52 weeks post-operatively in a specialist clinic. Thereafter, they were reviewed annually depending on their clinical progress.
The functional outcome was recorded at the last attendance according to the modified Merle d’Aubigné hip score,\textsuperscript{15} and the radiological outcome was assessed using plain radiographs (anteroposterior pelvic and Judet views) according to Matta’s criteria for accuracy of reduction and late outcome.\textsuperscript{9}

**Statistical analysis.** We used Microsoft Access for Windows (Microsoft Corporation, Redmond, Washington) to track all data. Descriptive statistics were used where needed for explanatory purposes. Statistical significance was set at $p < 0.05$.

**Results**

During the study period, a total of 30 of 400 acetabular fractures (7.5\%) were isolated anterior fractures of the acetabulum. These 30 patients (20 men) had a mean age of 46.8 years (20 to 86). A total of 26 (86.6\%) anterior acetabular fractures involved the anterior column (Figs 1a and 1b), two the anterior wall (Figs 2a and 2b) and two involved both. Road traffic accidents and falls from a height were the cause of the injury in 21 (70\%) and nine (30\%) patients, respectively. All were closed fractures, and one was associated with an anterior dislocation of the hip. Serious head, chest and abdominal injuries (an Abbreviated Injury Score (AIS)\textsuperscript{16} > 2) were recorded in six, seven and four cases, respectively. Two patients had a concomitant lumbar spine fracture, one a tear of the bladder, and two had ipsilateral tibial fractures. The mean ISS was 11 (4 to 45).

The mean time to surgery was 10.6 days after injury (3 to 44). Seven cases (23.3\%) were treated by closed reduction and percutaneous fixation (Figs 1c and 1d) and 23 (76.7\%) by ORIF through an ilioinguinal approach (Figs 2c and 2d). The mean operative time was 190 minutes (40 to 315). There were several complications: five patients had symptoms of neuropraxia of the lateral cutaneous femoral nerve, which were permanent in two, one developed a direct inguinal hernia, one a subclinical heterotopic ossification (Brooker class 2\textsuperscript{17}), one a MRSA wound infection, and one was diagnosed with pulmonary embolism. Two patients developed pneumonia during their early post-operative course. All the complications were confined to the ORIF group except for one case of transient neuropraxia associated with closed reduction and percutaneous fixation. The mean in-patient stay after operation was 16 days (3 to 44). This mean stay after operation was longer for the ORIF group than the closed reduction and percutaneous fixation group (19.1 days (10 to 44) versus 5.1 days (3 to 7), respectively, $p = 0.02$). Partial
weight-bearing was allowed at a mean of 6.2 weeks (2 to 11) post-operatively. The mean time to full weight-bearing was 10.8 weeks (6 to 16).

The mean follow-up was four years (2 to 6) and 14 (46.7%) patients were followed for five years or more, thereby offering evidence of their mid-term outcome. At the final review 26 patients (90%) were available for a complete assessment of functional outcome. The other four were not contactable.

The assessment of radiological outcome was available in all 30 cases. The quality of reduction, as assessed on the early post-operative radiographs, was rated as anatomical in 15 patients (50.0%), satisfactory in 13 (43.3%) and unsatisfactory in two (6.7%). The late radiological outcome according Matta’s criteria was graded as excellent in 12 patients (40.0%), good in 11 (36.7%), fair in four (13.3%), and poor in three (10.0%). The clinical outcome according to the modified Merle d’Aubigné score was excellent in eight patients of the 26 assessed (30.8%), very good in eight (30.8%), good in six (23.1%) and fair in four (15.4%). None of the patients needed total hip replacement during follow-up.

**Discussion**

The outcome for patients with a fracture of the acetabulum is continually evolving through improved surgical approaches and new methods of fixation. There is ample evidence that surgery for displaced acetabular fractures results in a favourable outcome. To our knowledge, only the Letournel series has so far provided substantial evidence on the outcome of individual simple acetabular fracture patterns such as anterior column and or anterior wall fractures. This can be attributed to their rarity and the fragmentation of experience between different trauma centres.

There are weaknesses in this study. The number of patients did not allow for subgroup analysis. However, for the first time, they provide a separate analysis of the

**Figure 2a** – anteroposterior radiograph of a fracture-dislocation of the right acetabulum (anterior column and wall). **Figure 2b** – pre-operative axial CT scan showing the comminution of the anterior wall/column fracture and the dislocation of the femoral head. **Figure 2c** – anteroposterior pelvic radiograph four years post-operatively. Fracture was stabilised with plates and screws. **Figure 2d** – iliac oblique right acetabular radiograph four years post-operatively.
mid-term outcome of these rare fractures. The method of treatment was not randomised but was mainly the surgeon’s preference based on the characteristics of the patient and the fracture. The comparative results between ORIF and closed reduction and percutaneous fixation should be interpreted with caution owing to the small numbers and lack of randomisation.

The follow-up assessment included radiological and functional criteria, which are considered as the benchmark for these types of injury. Only 10% of the overall number of patients were lost to follow up and 14 (47%) were followed for five years or longer. A ten-year review of all available cases is planned.

In a search of the English literature we compared our experience of the surgical management of isolated anterior column and anterior wall fractures with other series. Two of the authors (RM, NKK) independently assessed the suitability of the manuscripts, which were retrieved from PubMed using the keywords ‘anterior column’, ‘anterior wall’ and ‘acetabular fracture’. Wherever there was discrepancy in the reviewers’ opinion after reviewing the abstracts, the whole manuscript was screened and a consensus reached.

The combined incidence of anterior column and anterior wall fractures in our series (7.5%) was higher than in other series (6%), which could be attributed to the referral patterns in our region. The only other series reporting a similar incidence (6.6%) is from Oxford, United Kingdom. As with several other reports, our incidence of isolated anterior wall fractures is low (1.3%) and almost equal to that of the landmark series of Letournel in 1993. Isolated anterior column fractures were also generally more common in our study (6.5%) than in others (2.5% to 6.6%).

The timing of operation, although a key factor in optimising the outcome of acetabular surgery, was not optimal in our series as 30% of the cases were operated on more than ten days after injury. As already mentioned in an earlier study, delays with inter-hospital transfer and weaknesses of the tertiary referral system were the main reasons.

Although several approaches to the anterior acetabulum have been described including a modified Smith-Peterson, a modified triradiate the ilioinguinal approach continues to be the benchmark procedure and gives adequate access to most types of anterior acetabular fracture. However, because of the small numbers in our study any particular difficulties or advantages of this approach for the different types of anterior column and anterior wall fracture, could not be evaluated individually. Closed reduction and percutaneous screw fixation, complemented in some cases by a neutralising external fixator, provided a reasonable alternative for our minimally displaced fractures (23.3%). The previously reported advantages of this option were also evident in this small group, but further comparative analysis was not feasible.

Our overall rate of definite complications (six of 30, 20%) is in accordance with that of other comparable series. The complications are either minor and associated mostly with the surgical approach, or related to the trauma. In our series all but the incisional hernia and heterotopic ossification, developed in patients who were operated on more than ten days after injury.

The functional outcome following acetabular surgery can be assessed using various hip scores, thereby making comparison between studies difficult. Many report the overall functional scores of their cases, making it difficult to draw conclusions on subtypes. There are only two series reporting the functional outcome of anterior acetabular fractures. Mears et al used the Harris hip score and reported 72% good to excellent results. In Letournel’s series, the modified Merle d’Aubigné and Postel hip score recorded 86% of the fractures having very good to excellent function, which is similar to our figure of 84.6%.

Most of the available series report only the early radiological outcomes following fixation, with little or no emphasis on the final radiological outcome. It has been shown that the quality of reduction assessed in the immediate post-operative period determines the development of osteoarthritis requiring total hip replacement. In this case series, the post-operative residual displacement was < 3 mm in 28 of the 30 cases (93.3%), and at the time of final radiological assessment of 20 of 26 (76.9%) maintained their good to excellent outcome. Two cases had an unsatisfactory reduction and a poor final radiological score, but reported good to fair function. Five of the radiologically reviewed cases with a satisfactory reduction initially deteriorated and scored only fair at final follow-up, with good or fair function. All patients with an anatomical reduction had optimal clinical and radiological outcomes, in accordance with other series.

We found that the outcome following fixation of an anterior acetabular fracture was satisfactory and similar to that in other large series.

**Supplementary material**

Two tables showing a) the patients with anterior column and/or anterior wall fractures and their clinical characteristics and b) the existing English literature on isolated anterior column and anterior wall fractures and reported data, are available with the electronic version of this article at www.jbjs.org.uk

**References**