

CASE REPORT

Remodelling of the femoral head after proximal femoral osteotomy for avascular necrosis associated with slipped capital femoral epiphysis

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Abstract: Avascular necrosis is the most devastating complication associated with slipped capital femoral epiphysis. In this case report, we present the clinical and radiological outcome of two patients after proximal femoral osteotomy for avascular necrosis associated with slipped capital femoral epiphysis. The Iowa hip score was used to assess the function. Periodic radiographic observations showed no progression of the collapse, and bone remodelling of the necrotic femoral head. Our evaluation of patients who underwent proximal femoral osteotomy for avascular necrosis prior to collapse of the femoral head suggests that its use resulted in acceptable clinical outcome with bone remodelling of the necrotic area (Fig. 4, Ref. 16). Full Text in free PDF www.bmj.sk. Key words: hip, slipped capital femoral epiphysis, avascular necrosis, osteotomy.

Avascular necrosis is the most devastating complication associated with slipped capital femoral epiphysis. The factors responsible for the development of avascular necrosis have been extensively described (unstable slipped capital femoral epiphysis, overreduction of an acute slip, reduction attempts of the chronic component in an acute-on-chronic slip, pins in superolateral quadrant of the femoral head, and femoral neck osteotomy) (1-7). However, at present there are no clear guidelines for the treatment of avascular necrosis in patients with slipped capital femoral epiphysis. In severe cases, when no satisfactory congruent position of the hip can be found, ablative procedures (hip arthrodesis or joint arthroplasty) may be performed (8, 9). The recommended methods for joint-preserving include the conservative treatment based on non-weight-bearing walking with crutches, and proximal femoral osteotomy. However, few reports are available in literature concerning the clinical and radiological outcomes of the treatment of avascular necrosis following slipped capital femoral epiphysis (8, 10, 11).

In these case reports, we present the clinical and radiological outcomes of two patients after proximal femoral osteotomy for avascular necrosis associated with slipped capital femoral epiphysis. The Iowa hip score was used to evaluate the function (12). The severity of degenerative joint disease (grade 0-III) was graded according to the system described by Boyer et al (13).

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Case reports

Case 1

A fourteen-year-old male patient had an acute severe unstable slipped capital femoral epiphysis treated with immediate skin traction. Early operative management was refused by pediatrician due to metabolic disorder (osteopenia brought on by relative vitamin D and calcium deficiencies at the age of pubertal rapid growth spurt). A relief of pelvifemoral muscle spasm occurred after four weeks of traction, and the patient was allowed to be ambulatory. Avascular necrosis developed 6 months after the initial trivial traumatic episode (turning over in bed) (Fig. 1).

Physical examination at that time revealed a discrepancy of leg length of 4.5 cm and left hip motion with extension of 0°, flexion of 100° with marked external rotation of 50°, no internal rotation, and a fixed external rotation deformity of 50° with external rotation of 50–70°. He demonstrated a marked externally rotated Trendelenburg gait with a short leg component on the left side. Radiographs revealed a total avascular necrosis developed primarily within 6 months after the occurrence of severe unstable slip.

Delayed trochanteric femoral valgus osteotomy with additional flexion and correction of rotation was performed 16 months after the diagnosis of avascular necrosis (Fig. 2). The follow-up lasted 6 years and the clinical and radiographic examinations carried out at the last follow-up revealed results as follows.

The Iowa hip score was 93 points. The male patient tolerated normal activity with minimal scarce left hip pain. The motion in the left hip was recorded as flexion of 120°, abduction of 45°, internal rotation of 10°, and external rotation of 35°. A residual leg length discrepancy of 2 cm and normal strength of



Fig. 1. Preoperative AP radiograph of the left hip.



Fig. 2. Radiograph taken one year after intertrochanteric femoral osteotomy.

muscles about the hip were noted. The grade of degenerative joint disease was I. It indicated one subchondral cyst, one osteophyte, no subchondral sclerosis and normal width of joint space on plain radiographs. Periodic radiographic assessments showed that during the period of 1 to 6 years, no progression of the collapse developed while the bone remodelling of the necrotic femoral head continued and the femoral head has reestablished its spherical shape (Figs 3, 4).

Case 2

A twelve-year-old female patient had an acute severe unstable slipped capital femoral epiphysis treated with a closed partial (nonanatomic) reduction and internal fixation using two screws. The position of both pins was considered accurate with central axis of both implants within 4 mm off the femoral head centerline. The distance from the tip of the screws to the subchondral bone was considered indicative of no risk of penetration. Partial avascular necrosis developed 10 months after the initial trivial traumatic episode (also turning over in bed).

The screws were removed and avascular necrosis was treated conservatively (non-weight-bearing walking with crutches, range-of-motion exercises and anti-inflammatory medication). However, the patient had a limitation in internal rotation of the involved left hip and a mild limp with left groin pain. To locate exactly the necrotic segment, CT scans were taken in frontal and sagittal planes.

Proximal femoral valgus osteotomy with additional flexion and correction of rotation was performed 17 months after the

diagnosis of avascular necrosis. The patient was followed up for 4 years. The clinical and radiographic examinations carried out at the last follow-up revealed results as follows.

The Iowa hip score was 92 points. The female patient tolerated normal activity with minimal fatigue at the end of the day. The acceptable range of motion in the left hip was observed (flexion of 130°, abduction of 40°, internal rotation of 10°, and external rotation of 5°) with a residual leg length discrepancy of 1 cm, and normal strength of pelvifemoral muscles. The grade II of degenerative joint disease was found with a few subchondral cysts and osteophytes, slight subchondral sclerosis and slight narrowing of the cartilage space on plain radiographs. Continuing radiographic observations up to a period of four years after the femoral osteotomy have shown no progression of the collapse, and progression in bone remodelling of the necrotic area.

Discussion

The treatment of avascular necrosis in patients with slipped capital femoral epiphysis can be difficult and unrewarding for both, patient and clinician (11, 14). In addition, only few studies on this subject have been reported in this field of orthopaedic surgery (8, 10, 11). The aims of treatment, namely the maintenance of the range of motion of the hip and prevention of epiphyseal collapse can be reached using conservative treatment. Range-of-motion exercises, non-weight-bearing walking with crutches and anti-inflammatory medication help to minimize the



Fig. 3. Radiograph showing remodelling of the femoral head 6 years after femoral osteotomy.



Fig. 4. The femoral head is congruent and without apparent deformity on the frog-leg lateral radiograph.

symptoms and epiphyseal collapse. The removal of pin reduces the additional damage incurred to the hip joint with a closed physis and pin protrusion.

The goal of osteotomy for segmental necrosis of the femoral head is to transfer the forces to a less involved or normal region by rotation of the diseased area away from the weight-bearing zone (10, 14, 15). The radiographs may help to determine the amount of femoral head involvement. In partial avascular necrosis, the CT scans in frontal and sagittal planes are critical to investigate the location of the necrotic segment and to determine the appropriate type of osteotomy (16).

In case of total head necrosis with the hip in a poor functional position, an examination under anaesthesia and dynamic arthrography can be used to define the shape and size of the femoral head and to confirm the most congruent position of the femoral head within the acetabulum (11). Intertrochanteric osteotomy is indicated to reposition the lower extremity in a more functional arc of motion, which is essential for remodelling the femoral head (14).

The Iowa hip score is markedly weighted for pain and function, which are considered relevant factors in patients with avascular necrosis of the femoral head. In the presented study, the Iowa hip scores were acceptable after proximal femoral osteotomy, and the bone remodelling of the necrotic area has been observed. Large series of slipped capital femoral epiphysis have been published but no information on treatment outcome in patients with avascular necrosis has been clearly described (1, 2, 6, 9).

The clinical and radiological results in our cases appear to support the joint-preserving strategy for the treatment of avascular necrosis after slipped capital femoral epiphysis. It can save time in younger individuals before other procedures are required.

Our evaluation of patients who underwent proximal femoral osteotomy for avascular necrosis prior to the collapse of femoral head suggests that the use of this strategy resulted in an acceptable clinical outcome with bone remodelling in the necrotic area. According to our report, the joint-preserving strategy appears to be a valid alternative in the treatment of the difficult problem of avascular necrosis after slipped capital femoral epiphysis.

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