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CASE REPORT

Correction of a major flexion deformity developed after knee arthrodesis in child age A case report

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Septic arthritis in child age results in sequelae when treated late or inappropriately. Arthrodesis is a salvage option which is rarely performed in children because of its complications and resultant disabilities. We report the case of a 16-year-old boy who had been treated with arthrodesis of his right knee at the age of seven and subsequently developed a progressive osseous deformity, eventually resulting in a 130° flexion deformity of the knee. The deformity and the resulting limb length discrepancy were corrected using the Ilizarov method. In a single stage operation, a wedge resection osteotomy at the distal femur was performed and a ring fixator was applied. The mechanical axis was corrected first by gradual closing of the wedge thus avoiding damage to the posterior neurovascular structures, followed by lengthening.

Keywords : wedge resection osteotomy, Ilizarov, knee flexion deformity.

INTRODUCTION

Osteomyelitis and septic arthritis in child age are frequently seen in orthopaedic practice, in spite of advances in medical care and antibiotic therapy. When the diagnosis and treatment are delayed or inappropriate, the cases end up with sequelae which can be treated with limited choices and poor results. Salvage treatment with arthrodesis may be preferred for weight bearing joints like the knee and hip ; knee arthrodesis in children is however challenging because of the open physes (*7*). Our patient had been treated at the age of seven with a knee arthrodesis for a complicated septic arthritis, and he subsequently developed a progressive osseous deformation, up to 130° of angulation in the sagittal plane. We used the Ilizarov method to correct the angulation as well as the limb length inequality with a single stage operation.

CASE REPORT

The case we are reporting is a boy who had a delayed debridment and antibiotic treatment for acute septic arthritis of his right knee at the age of five. He then developed an early postoperative knee flexion contracture and degenerative joint changes, and he underwent arthrodesis of the knee at 7 years

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Fig. 1. — A : Preoperative lateral radiograph ; B : clinical appearance of the deformity.

of age. Although the arthrodesis was initially successful, a progressive osseous deformity developed, up to 130° angulation in the sagittal plane when he consulted us at the age of 16. He complained of shortness and deformity of right lower limb, resulting in difficulty in ambulation (fig 1A, 1B). Because of his deformity he could only walk with two crutches, and presented a severe waddling and only toe tip touch. He had multiple incision scars anterior to his knee and popliteal soft tissues were contracted. Hip range of motion was 30-130° in flexion, 30° internal rotation and 40° external rotation. The knee was fixed at 130° flexion and the range of motion of the ankle was normal. He also had a lumbar scoliotic attitude secondary to his short limb and pelvic tilt. We elected to perform a gradual correction with the Ilizarov method. The main problem was that the popliteal neurovascular structures would have to elongate approximately for 15 cm with correction of the deformity. To overcome this, the deformity was first corrected with a wedge resection osteotomy at the distal femur, and gradual correction of the knee, followed by lengthening to equalize the lower limbs (fig 2A, 2B). Separate frames were prepared for the femur and tibia, each with three carbon circles and a half circle close to the knee. The two frames were connected to each other with two hinges placed medially and laterally in line with the posteriorly placed apex of the wedge resection (fig 3A, 3B). The femoral frame extended from the subtrochanteric region to just proximal to the deformity, and the tibial frame extended from the distal end of the deformity to the supramalleolar region. A wedge osteotomy was made with an open technique, with its apex posteriorly. We waited for three days before starting correction. Correction was done with a posteriorly placed distractor by closing the wedge at a daily rate of 4°. Equinus deformity was prevented during correction by active exercises of the ankle and an orthosis worn between exercises. Once the angular correction was achieved, an orthoroentgenogram was taken and a 65 mm shortening was measured (fig 4). The hinges connecting the tibial and femoral components were exchanged for solid rods, and lengthening was started at a 1 mm daily rate. The lengthening period lasted for 55 days, at the end of which a total of 50 millimeters of lengthening was

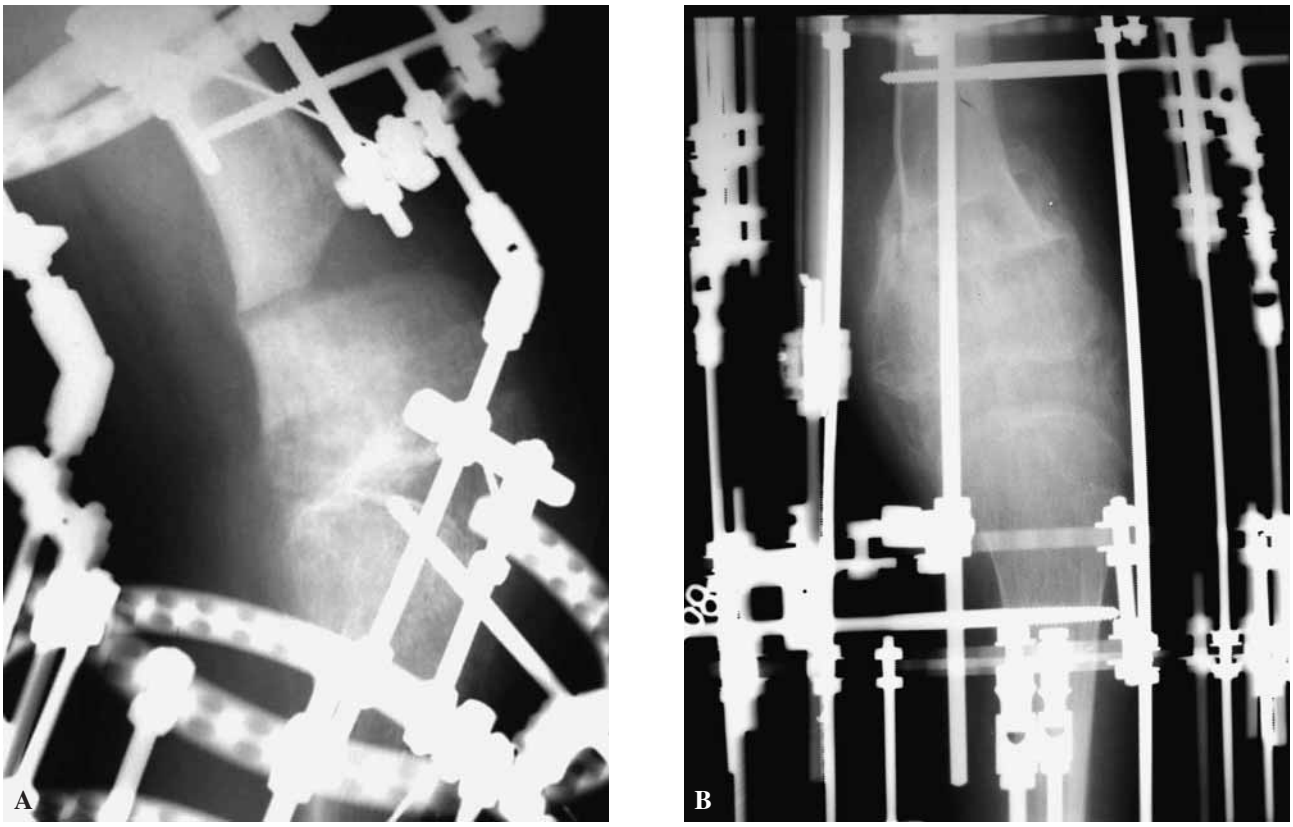

Fig. 2. — A : Lateral radiograph of the wedge resection osteotomy. Note that the hinges correspond to the peak of the osteotomy. B : Radiological appearance after correction of deformity (AP view).

obtained. The fixator was removed after 4 months, and a protective plaster cast was applied for another 6 weeks. Unprotected full weight bearing was then allowed. In the final evaluation, done 3 months after completion of treatment, hip range of motion was 0-130° of flexion, with 40° internal and 45° external rotation. The ankle had 10° dorsiflexion and 30° plantar flexion. Neurovascular examination was normal (fig 5A, 5B, 5C).

DISCUSSION

Flexion deformity of the knee, although tolerable to some extent, can be a severely disabling deformity. Higher degrees of this deformity result in shortening of the limb as well as disturbing the function of the hip, the ankle and even the spine, thus greatly disturbing ambulation and causing secondary adverse effects on all the locomotor system (*6*). Our patient had a 30° flexion contracture of the hip as well as a secondary lumbar scoliotic attitude due to pelvic tilt. Secondary contractures may rapidly revert with correction of the underlying deformity and restoration of the balance of the body, especially in younger age. The preoperative 30° flexion contracture of the hip in our patient and his scoliotic attitude had disappeared after three months treatment. Arthrodesis is rarely needed in childhood. The most common indications are specific or nonspecific arthritis or severe instability. The arthrodesis procedure is different in children than in adults. The growth plates are still open and vulnerable, they may easily be damaged, causing a progressive disabling deformity (*7,10*). In our case, the distal physis of the femur was most probably damaged during the arthrodesis procedure.

Various methods are described in literature for the treatment of flexion contracture and malankylo-

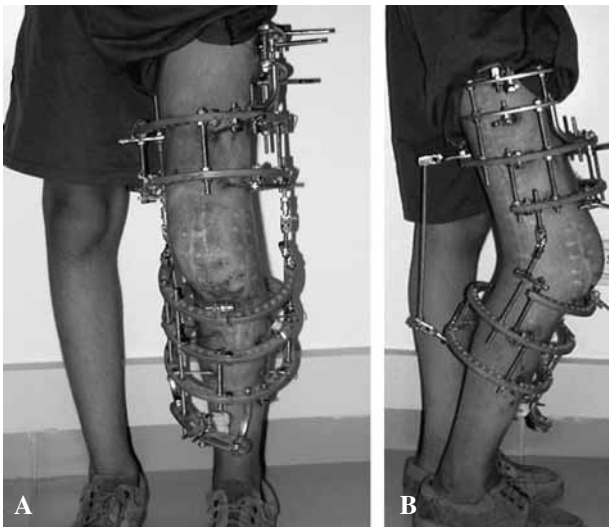

Fig. 3. — Clinical appearance during correction of deformity. Anterior (A) and Lateral (B). The fixator extends from the subtrochanteric region of the femur to the pilon of the tibia.

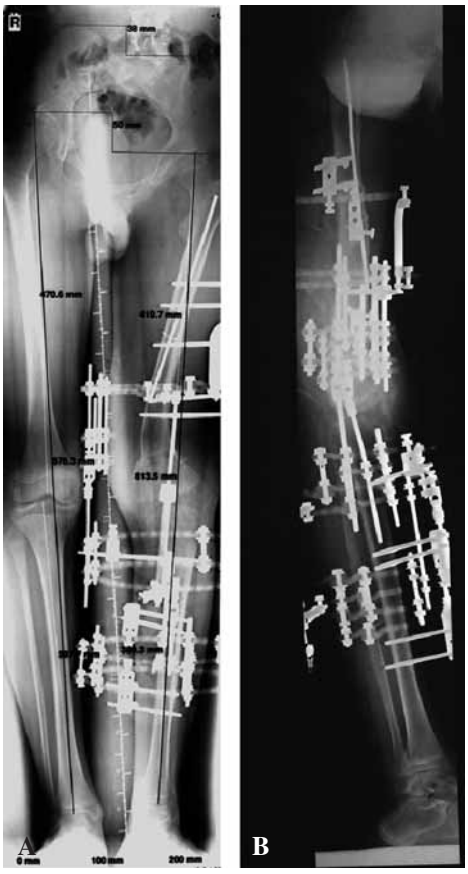

Fig. 4. — Anteroposterior (A) and Lateral (B) orthoroentgenograms of the limbs after the deformity was corrected. A 65 mm length discrepancy was measured.

Fig. 5. — The radiological and clinical appearance of the patient at final evaluation: AP radiograph (A), Lateral radiograph (B), Clinical appearance (C).

sis of the knee (*1,2,3,4,5,9,11*). Most of them are appropriate for a limited degree of deformity. For a reasonable degree of deformity the best method would be correcting the deformity with a hinged external fixator, with an osteotomy and hinge placement at the apex of the deformity. The current concepts of external fixator treatment include percutaneous osteotomy and gradual correction of deformities. In our case however, this would have been unsuitable because of the extreme degree of deformity. The popliteal neurovascular structures would be the limiting factor in determining the speed of correction, and union of the osteotomy site was thus expected to occur before correction of the deformity, as the neurovascular structures could not tolerate elongation faster than 1 mm/day. Therefore, we designed an open wedge resection osteotomy to achieve rapid correction with only minimal lengthening of the posterior neurovascular structures Following the angular correction, the limb was safely lengthened at a rate of 1 mm/day. The design

of the frame is an important consideration. A long standing severe and developmental contracture of the soft tissues would be difficult to correct and the resistance they create would be excessive. Furthermore the tibia and femur are the longest bones of the body, which results in long moment arms and forces not only resisting correction and lengthening but also threatening the stability of the fixator, and this may result in loosening, deformation or breakdown of the fixator especially in the long run. We designed our fixator with these considerations in mind. To avoid these complications the fixator's proximal and distal components were designed as long as possible. The femur and the tibia were fixed until their furthest possible point to the deformity which was the tibial pilon and the subtrochanteric region of the femur. Four circles were used for each part of the frame. On each side of the deformity, distally on the femur and proximally on the tibia, half circles were used. This was necessary in order to fit the fixator on the extremity in the flexed position. With this strong fixator, we were able to complete the treatment with only one operation and to achieve both full correction and lengthening of the extremity. The most commonly encountered problem in external fixator treatments is pin tract infection, which can be managed with local care and oral antibiotic treatment in most cases. More severe pin tract infections may necessitate pin extraction and debridement. In our case we had pin tract infections of grade I and II according to Paley, however no pin extraction or debridement was necessary. More serious complications may be seen less commonly in deformity corrections like injuries to neurovascular structures. This may be due either to direct injuries during pin penetration or to traction injuries during correction or lengthening *(8)*. Our patient reported some subjective burning pain on the dorsum of his foot, but this disappeared when we stopped lengthening for 5 days followed by lengthening at half speed for 7 days. At the end of the treatment, physical examination revealed no sensory or motor deficit. We believe that the most important points to mention in our treatment are firstly the osteotomy being done in a wedge resection type thus enabling angle correction without a traction injury to neurovascular structures, while preventing bony union prior to correction. Secondly the fixator was designed longer and stronger than usual so that it would withstand high moment forces for long enough.

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