INTRAOPERATIVE ARTHROGRAPHY AND THE ILIZAROV TECHNIQUE
ROLE IN THE CORRECTION OF PAEDIATRIC DEFORMITY AND LEG LENGTHENING

F. S. HADDAD, G. D. HARPER, R. A. HILL

From the Hospital for Sick Children, London, England

We performed intraoperative arthrography of the knee in 12 children with congenital short femur, Blount’s disease or Ollier’s disease in whom the Ilizarov technique was used for correction of deformity, leg lengthening or both.

In each case, arthrography revealed a joint surface considerably different from that assumed from plain radiographs, and resulted in a change in the placement of our reference wires before application of the frame. This gave significant improvement in the mechanical axis obtained at the time of removal of the frame. The technique is safe, cheap and easy to perform. It is a useful adjunct to the application of the Ilizarov frame when used for complex lengthening and correction of deformity in the leg.

Received 28 February 1997; Accepted 2 April 1997

Lengthening and the correction of deformity in patients with congenital abnormalities of the limbs are particularly liable to complications involving bone and soft tissue. Avoidance of many of these problems relies on accurate realignment of the mechanical axis of the limb, and careful preoperative and intraoperative planning is essential. When lengthening the tibia or the femur the correct orientation of the knee is a primary consideration. This is difficult in the immature knee as plain radiographs will not show the true cartilaginous morphology. In these cases, we have found intraoperative arthrography to be invaluable.

PATIENTS AND METHODS
We have used this technique in 12 patients. Two had angular correction for Blount’s disease, seven had femoral lengthening for congenital short femur, two had Ollier’s disease and one had growth arrest after sepsis. All 12 had simultaneous unilateral lengthening of the femur and tibia. There were five boys and seven girls with a mean age of 10.5 years (4 to 13).

Operative technique. The patient is placed on a radiolucent operating table. The entire limb is prepared for application of the Ilizarov frame. Any soft-tissue releases required are completed, and the corticotomy site is exposed before applying the frame. Under image intensification, a 16-gauge needle is then introduced into the knee by a lateral parapatellar approach which avoids the fat pad, and 5 ml of Omnipaque (Omnipaque-Nycomed (UK) Ltd, Birmingham, UK) is introduced into the joint. The knee is then manipulated until a full arthrogram of the tibiofemoral joint is obtained. This delineates the ‘true’ joint line which is used to guide the placement of distal femoral or proximal tibial reference wires. The rest of the frame is then applied relative to these wires.

RESULTS
In all cases the arthrogram provided useful information and influenced the placement of the reference wire. Figures 1 and 2 illustrate the true position of the joint line as shown by arthrography in patients with Blount’s disease and congenital short femur. No complications were encountered related to the arthrography.

DISCUSSION
Deformity and malalignment of a limb lead to deviation of the mechanical axis and malorientation of the joint, resulting in poor function, instability and later degenerative changes. The knee is the most vulnerable joint in the leg.
and malorientation is associated with later osteoarthritis.\(^4,7\)

The mechanical axis, which is the line of weight-bearing force, passes through the centre of the hip and ankle and is just medial to the centre of the knee in the frontal plane.\(^5,6\)

The line of the knee joint is approximately 3° off the perpendicular, so that the distal femur is in slight valgus and the tibial diaphysis in slight varus relative to it.\(^5,6\)

Identification of the line of the knee joint is relatively straightforward in the normal knee.\(^5\) Its transverse axis lies at a tangent to both distal femoral condyles. Identification of the line is more complicated in children in whom much of the condyle is cartilaginous. Greater difficulties arise when there are abnormalities of bone, cartilage or epiphyseal development which make plain radiographic assessment difficult or impossible.

The radiological changes at the knee in congenital short femur include dysplasia of the lateral femoral condyle, shallowness of the intercondylar groove, hypoplasia of the tibial eminence and flattening of the lateral tibial plateau.\(^9\)

In Blount’s disease, the posteromedial epiphysis of the upper tibia is sloping and may be fragmented, making delineation of the true joint surface almost impossible. In multiple enchondromatosis (Ollier), the metaphyseal masses of cartilage are continuous with the growth plates. We advocate the use of intraoperative arthrography to facilitate application of the frame in these patients. Once the level of the deformity has been determined and the necessary osteotomy performed, the frame should be applied and correction undertaken, so that orientation of the knee and the mechanical axis are restored. As the joint line is visualised in all planes, the frame can be adjusted to decrease the probability of subluxation of the knee during lengthening or correction of deformity.

An identical technique can be applied to corrective osteotomies which are not stabilised by external fixation. This principle can also be extended to other joints such as the elbow or ankle to improve anatomical and mechanical alignment after similar procedures.

We advocate arthrography at the time of the initial application of the frame since there is a small risk of infection at this stage. Later arthrography to allow adjustment of the frame should be avoided as it may expose the knee to seeding infection from pin-site sepsis.

Intraoperative arthrography of the knee is cheap, rapid, safe and minimally invasive. It helps to define the true joint

---

Figures 1a and 1b – Anteroposterior and lateral radiographs of the knee of a girl with Blount’s disease. Figure 1c – Arthrogram before insertion of a wire in the same knee delineating the true joint line.

Fig. 2

Arthrogram during application of the frame for congenital short femur showing the relative positions of the radio-opaque lateral femoral condyle and of the true joint line.
morphology and is an invaluable aid to insertion of the reference wire. It does not replace careful and detailed preoperative planning but is a useful adjunct in the optimal management of limb deformity and discrepancy.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


