

WEDGE OSTEOTOMY IN ADVANCED FEMORAL EPIPHYSIOLYSIS

By

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Slipping of the upper femoral epiphysis with minimal and moderate displacement is a relatively simple problem from the therapeutic point of view. An articular deformity of that degree may be left alone because the function as a rule will be good or at least acceptable. The aim is to prevent further dislocation and to stimulate a fusion of the epiphyseal plate. If the slipping has gone as far as one third or more of the diameter of the neck of the femur, restoration of the normal anatomy is generally considered to be a prerequisite for good function. This type, which is called advanced or severe epiphysiolysis, offers complicated problems and will be the subject of this study.

It would seem logical to try to improve the situation by protracted extension with or without reduction manoeuvres under adequate anesthesia, in the same way as one reduces medial fractures of the femoral neck, and then to maintain the new position with internal or external fixation until fusion has taken place. However, even though some improvement in position is sometimes achieved this way in cases of newly slipped femoral epiphysis, these methods have proved ineffective. Sometimes what has first been called an "improved position" or an "exact reduction" has later turned out to be a failure. This erroneous interpretation is not unusual if the first roentgenographic controls include only frontal pictures with the leg in internal rotation and abduction, the usual postoperative position. This fact has been emphasized by many authors, particularly *Mau* (1927), *Waldenström* (1939, 1940). There are examples of excellent reduction in which the functional results are first-rate. However, reduction is either non-existent or inadequate in the great majority of cases, while necrosis of the femoral head occurs in others. The results of closed reduction of advanced slipping of the femoral epiphysis can only be regarded as

poor (*Rüther*, 1954). *Jerre* (1950) reported in his thesis that true reduction or essential improvement in position was achieved in only 24 of 117 cases. Ten of these 24, or 41 per cent, later incurred necrosis of the head of the femur.

Evidence of the futility of attempting closed reduction in most cases of advanced epiphyseal displacement was provided as we came to perform more and more arthrotomies and to try to achieve reduction under visual control. *Waldenström* (1939) pointed out that the position of the epiphysis was usually so firm that it could not normally be moved manually. In other words, the prerequisites for closed reduction were lacking. Instead, the epiphysis had to be separated with a chisel from the metaphysis of the femoral neck at the level at which the displacement had occurred. Not until that had been done could the epiphysis be moved into position and then nailed. This method gave a good anatomic position, but too often at the cost of poor hip function and even ankylosis.

The best results of this type of open reduction have been reported by *Klein et al.* (1953), from the Massachusetts General Hospital. "Joint stiffness" developed in only two of 16 cases. All the others showed good anatomic position and good function of the hip. Experience at the New York Orthopaedic Hospital, on the other hand, was quite different. *Howorth* (1949) published two anatomic and functional successes in a series of 31 cases. He therefore abandoned open reduction. In his opinion, it is safer to adopt conservative treatment until fusion of the epiphyseal line has occurred, and then to do subtrochanteric corrective osteotomy.

In general, the results of open reduction with this type of complete separation of the head from the neck of the femur are just as unsatisfactory as those of closed reduction. The reason for this may be inadequate nutrition of the femoral head after the intervention. It must be borne in mind that the blood supply of the epiphysis can only come from three sources (cf. *Tucker*, 1949).

1. small vessels from the femoral neck that penetrate the epiphyseal plate,
2. the ligamentum teres,
3. the periosteal vessels.

The vascular communications with the femoral neck are broken in the slipping of the epiphysis. The periosteal vessels on the anterior and superior aspects are stretched and put out of function, and the ligamentum teres may be ruptured. The circulation then depends entirely on the periosteal vessels in the *inferior* and *posterior* area of

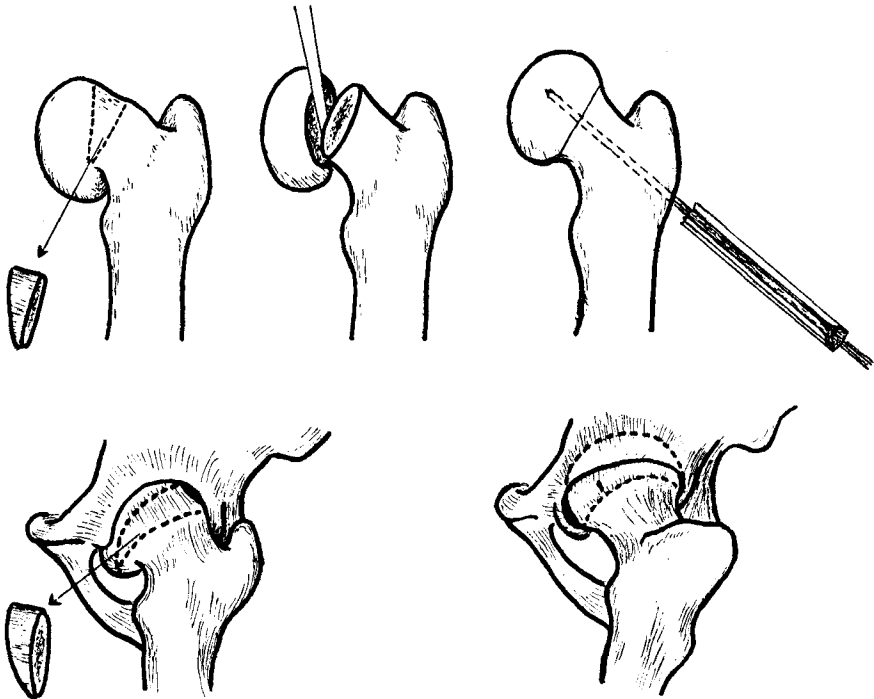


Fig. 1.

Wedge osteotomy of the femoral neck for reduction of advanced epiphysiolysis.
(Redrawn from J. Bone & Joint Surg. 1948: 30A: Martin and Badgley et al.)

the neck. Traumatism of these vascular communications is probably the cause of most poor results of both closed and open reduction.

In order to minimize traumatism and facilitate open reduction, we have carried out *wedge osteotomy of the neck* (Fig. 1). Enough bone is removed from the superior and anterior part of the metaphysis so that the neck can be brought into good contact with the head through internal rotation and abduction. In other words, the head need not be violently prized up on to the neck in order to bring about reduction. Of fundamental importance in this operation is to spare the periosteum on the posterior and inferior aspects of the neck; the central osteotomy is done in the epiphyseal cartilage and the peripheral osteotomy in the metaphysis of the neck. The apex of the wedge should be situated somewhat ventrally, so as not to break the soft part communications. The position is then secured with a nail or a screw.

Good results with this method have been reported by *Badgley et al.* (1948), *Martin* (1948), *Compere* (1950), *Foley* (1953). A high percentage of cases with avascular necrosis or traumatic arthritis was found by *Howorth* (1949).

M A T E R I A L

Professor Sten Friberg introduced this method in the Orthopaedic Department of the Karolinska Institutet in 1945.

TABLE 1
Advanced Epiphysiolysis.
Wedge Osteotomy-Reduction-Internal Fixation:

38 hips	34 patients (4 bilateral)
Follow-up	21 ♂ 13 ♀
2-10 years	Age at operation 8-20 years

We have now assembled 41 hips operated on in this way. The period of observation runs from 2 to 10 years. Three cases in which capital necrosis will inevitably develop must be eliminated, for the object of the treatment is assumed to be correction of malposition at the site of displacement and a mobile, painless hip joint. These cases showed definite circulatory disorders in the head even before operation, and the intervention was made in order to facilitate arthroplasty at a later date. The series of advanced epiphysiolysis in which wedge osteotomy of the neck can be evaluated therefore consists of 38 hips in 34 patients—the operation was bilateral in four cases. The age of the patients operated upon varied from 10 to 20 years.

T E C H N I Q U E

The patients were prepared for surgery with a subcutaneous injection of morphine scopolamine one hour before the operation. As a rule we used inhalation anesthesia with ether. Five boys were given lumbar anesthesia. Two of them required no supplementary anesthetization, while intravenous narcotal or ether had to be given to the other three, in which the operation was unusually protracted. The patients were put in the supine position on an extension table. This facilitates roentgenographic examination in two planes at right angles to each other during the actual operation, and also makes it easier to apply plaster if required.

The hip joint was usually entered through an anterior iliofemoral incision. Sometimes the joint could be reached through a small anterior femoral incision. In this way we avoided stripping the origins of the tensor fasciae latae, the gluteus medius and minimus muscles

from the ilium. The anterior margin of the tensor fasciae latae muscle was separated from the sartorius muscle and retracted laterally. The straight head (iliac origin) of the rectus femoris could be saved in one-third of the cases, while subspinal transverse division was performed in the remainder. The anterior part of the joint capsule was detached from the oblique head (acetabular origin) of the rectus femoris and the iliac muscle by both blunt and sharp dissection. The joint was opened by a cruciform or possibly a T-shaped incision in the capsule. One shank was placed parallel with and near to the acetabular rim and the other at a right angle to it in the longitudinal axis of the neck of the femur. By external rotation and abduction of the leg and possibly extension of the hip joint, we generally achieved good visibility of both the head of the femur and of the anterior and superior boundary between it and the neck. Depending on the degree of malposition, we did a wedge osteotomy with an open angle ventrally of approximately 40 degrees and an open angle cranially of approximately 20 degrees. The anterior base of the wedge measured about 2 cm. The osteotomies were performed with a Lexer chisel, the proximal incision mainly in the epiphyseal cartilage and the distal in the metaphysis of the neck. To avoid injuring the soft part communications on the posterior and inferior aspects, we aimed at bringing the apex of the wedge slightly ventral to the postero-inferior part of the collum. This appears to be an important technical detail. If a large enough wedge was removed, it was usually easy to bring about reduction by internal rotation and adduction of the peripheral fragment. The subsequent position was usually so stable that the joint functioned smoothly when mobility was tested. The adjustment can never be perfect, however, since the diameter of the head is greater than that of the neck. In this connection it may be mentioned that open reduction with simple separation of the epiphyseal line using a chisel will, for mechanical reasons, inevitably give a less firm position. It is our impression that this is particularly true in absolutely new cases, in which the surface of the head of the fragment is concave and the osteotomy surface of the metaphysis of the neck may be flat. It is probably also true of older cases with secondary remodeling and erosion of the posterior part of the neck. In the latter cases the conditions for good surface contact and consequently for retention are poor. These disadvantages can to a great extent be avoided by the right type of wedge osteotomy. With the exception of a few cases, in which the position had become so firm that internal fixation was not considered necessary, we used in the first of our series a three-flanged cannulated nail, known as the Sven Johansson nail. It was inserted from the lateral aspect on a guide, the

position of which was supervised by roentgenography in two planes. In 21 cases we used a wing screw instead of a nail for internal fixation. Generally the screw was introduced through a new incision on the lateral aspect. Sometimes, however, we were able to continue the distal end of the incision distally and posteriorly, thus obviating the need for an extra skin incision.

In the cases in which the position was good after osteotomy and fixation with a nail or a screw was satisfactory, the patients were then put in bed with sand bags on either side of the leg operated on. Cautious active exercise in bed was instituted after the wound had healed, which usually took about one week. The patients were allowed to get up after six or seven weeks in bed and then began to walk in a walking chair and with crutches. We had no fixed time at which full weight-bearing was permitted, but instead were guided by the progress of consolidation. In good cases the roentgenograms showed the osteotomy to be consolidated after four weeks. Full weight-bearing was not permitted until at least three months and usually five or six months had passed. In other words, our principle was and still is: Early movement, late weight-bearing. The internal fixation was supplemented by a hip plaster cast in one-third of the cases. The plaster was removed from the lower leg after two or three weeks in order to permit exercise of the knee joint. Four to eight weeks later the plaster was cut open so that the ventral half could be lifted off and physiotherapy applied to the hip joint.

TABLE 2
Wedge Osteotomy—Reduction—Internal Fixation.
38 hips.

Technical errors	Avascular necrosis		Normal structure of the head
	Small area (osteoarthritis)	Entire head	
Osteotomy too far laterally	3	3	
No anatomic restoration			
Ineffective internal fixation			
Repeated reduction or nailing	4	1	3
Diastasis	1		
The nail driven into acetabulum	1		
The nail placed in the lower posterior part of the neck		1	
Wound infection			2
Satisfactory operation			19

COMPLICATIONS

It is to be expected that as complicated an operation as this one will be attended by numerous technical difficulties. The part played by these difficulties in the development of necrosis and osteoarthritic changes is hard to judge, but it would seem that operative complications actually represent causal factors. For, if we study the cases without osteoarthritis or capital necrosis, we find that the operation was usually uneventful. In three cases, however, a second operation with renewed fixation seemingly had no effect on the healing process and led to no apparent damage. As appears from Table 2, the technical errors in this operation are in general the same type as those seen in osteosynthesis of fractures of the medial neck. The difficulties are perhaps somewhat greater in epiphysiolysis, which explains the many technical pitfalls.

RESULTS

Good results: The anatomic and functional results were favorable in 24 cases, or 63 per cent. The roentgenographic changes in this group were confined to those corresponding to the operation, i.e. shortening of the neck, otherwise intact structure of the head, and normal articular space. Range of motion was good in all the cases. Only two cases had less than 80 degrees flexion. Shortening of the leg of 1 to 2.5 cm. was always observed, as was a certain degree of muscular atrophy. Ability to walk, stamina, etc., were good in this group. The following cases illustrate the course of treatment and results.

Case 1. 5454/45. A girl of 12 years had had pain in the left hip and a limp for several months. Roentgenographic examination at another hospital was considered to show nothing abnormal, and physical therapy was therefore prescribed. After a second attack of pain the patient was referred to the Orthopaedic Department. Roentgenograms now showed advanced epiphysiolysis (Fig. 2). Reduction was easily performed after wedge osteotomy. A cannulated nail was inserted for fixation. Normal anatomic conditions were restored at the site of displacement. Convalescence was uneventful. The patient was allowed to walk with crutches after six weeks. Full weight-bearing was permitted seven months after the operation. Follow-up examination nine years later (Figs. 2 and 3) revealed shortening of the left leg by 2.5 cm., no pain, excellent range of motion, and normal articular space on the X-rays.

Case 2. 6306/49 A girl of 10 years. The right epiphysis had slipped in two stages before the patient was brought to the Orthopaedic Department in 1949 (Fig. 4). Wedge osteotomy was carried out; reduction and fixation with a screw were followed by healing in a good position and by good function. Eighteen months later, while skiing, the patient suffered acute pain in the left hip. This time the epiphyseal

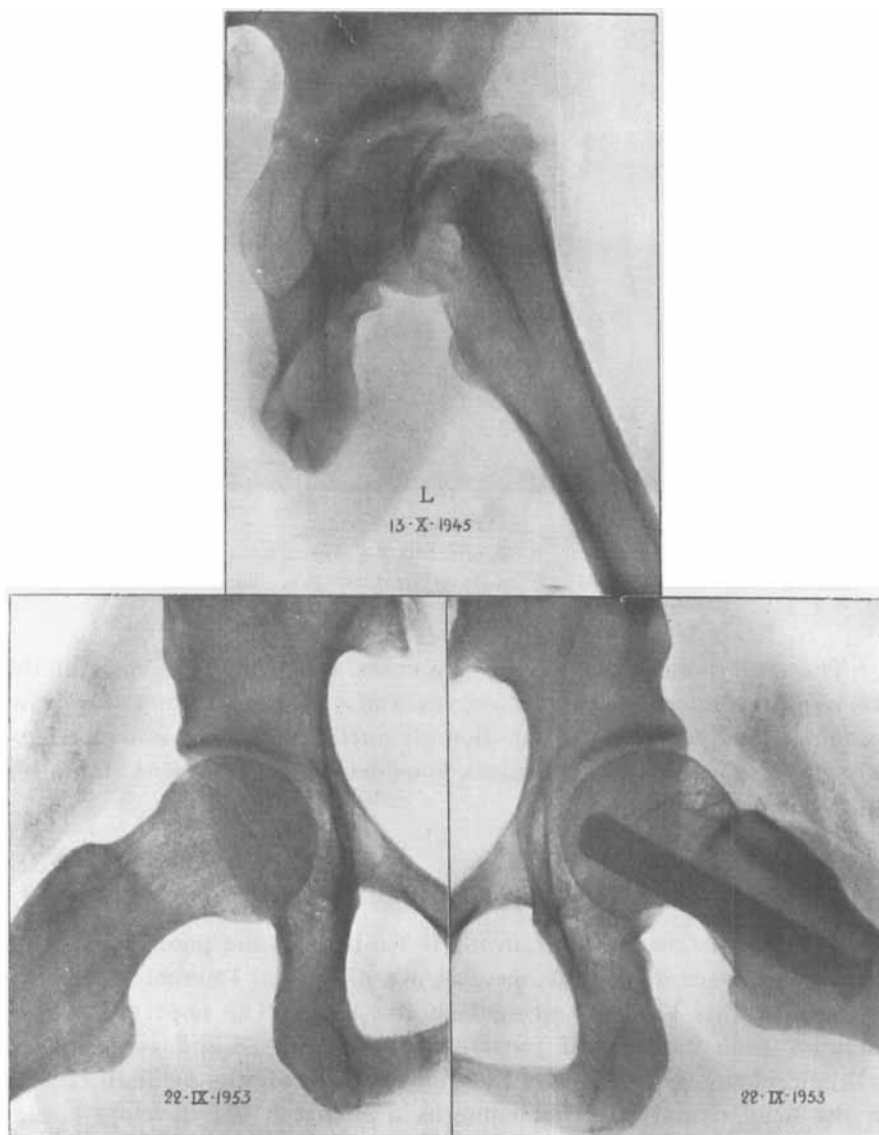


Fig. 2.

Case 1. 5454/45. A girl aged twelve with a gradual slipping of the left femoral epiphysis. Nine years after wedge osteotomy and nailing.

slipping in the hip was advanced from the outset. The same operation was performed as on the right hip, and the anatomic and functional results were good. At the follow-up examination in 1954, the X-rays showed no degenerative changes and only a slight shortening of the neck on both sides due to the operation (see bottom of Fig. 4). Motion was excellent (Fig. 5).

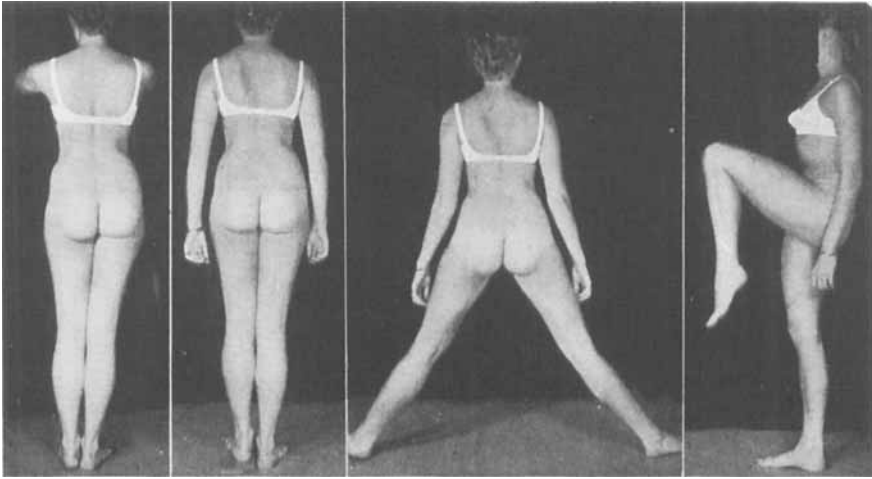


Fig. 3.

Case 1. Showing range of motion of left hip 9 years after wedge osteotomy and nailing. Function is practically normal but there is a shortening of $2\frac{1}{2}$ cm.

The long-range prognosis for the cases, which, on the basis of the follow-up examination two to ten years after the operation, were evaluated as anatomically and functionally successful, is not known. However, there is reason for optimism, considering the stringent standards established for this group.

POOR RESULTS

Extensive necrosis of the head: If we turn to the poor results, the number of cases of capital necrosis are of special interest. Extensive changes of this kind are present in five cases. The poor group also includes nine cases with partial capital necrosis and early osteoarthritic changes. As already mentioned, the nutritional disturbances in the head usually did not come as a surprise, but developed relatively slowly after technical mishaps at operation (Table 2). It is interesting to observe the series of roentgenograms in these cases. A few of them will be described below to illustrate the development and origin of the late results of surgical treatment of advanced epiphyseal slipping.

Case 3. 3278/46. A girl of 13 years had had pain in the left hip and had limped for one year. The symptoms were first interpreted by the physician consulted as "growing pains". Advanced slipping of the femoral epiphysis was diagnosed at the Orthopaedic Department (Fig. 6). Wedge osteotomy and reduction were uneventful.

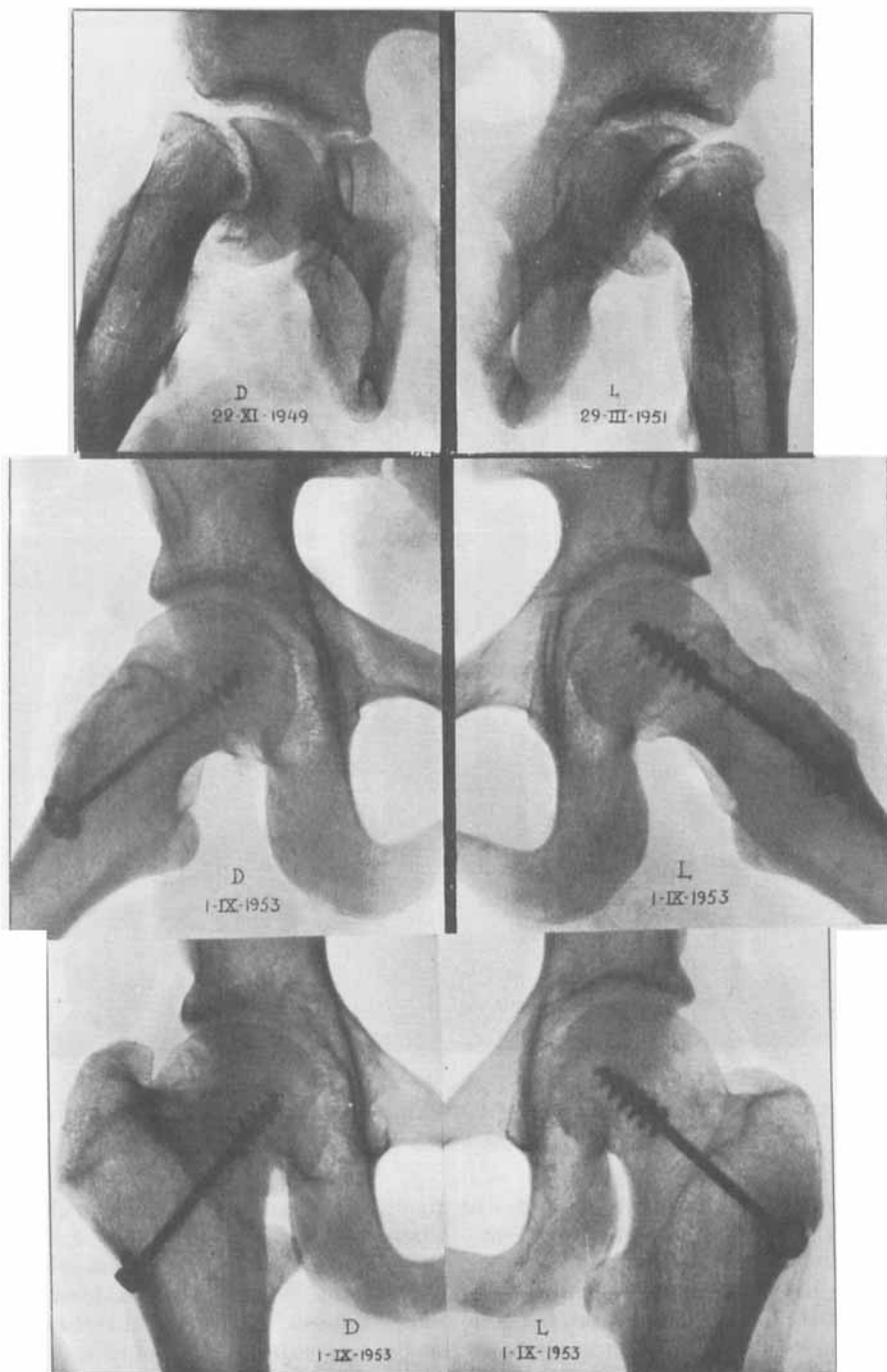


Fig. 4.

Case 2. 6306/49. Bilateral severe slipping reduced by wedge osteotomy of the neck and fixed with screw. The anatomic restoration is satisfactory as shown in the five- and three-year follow-up views.

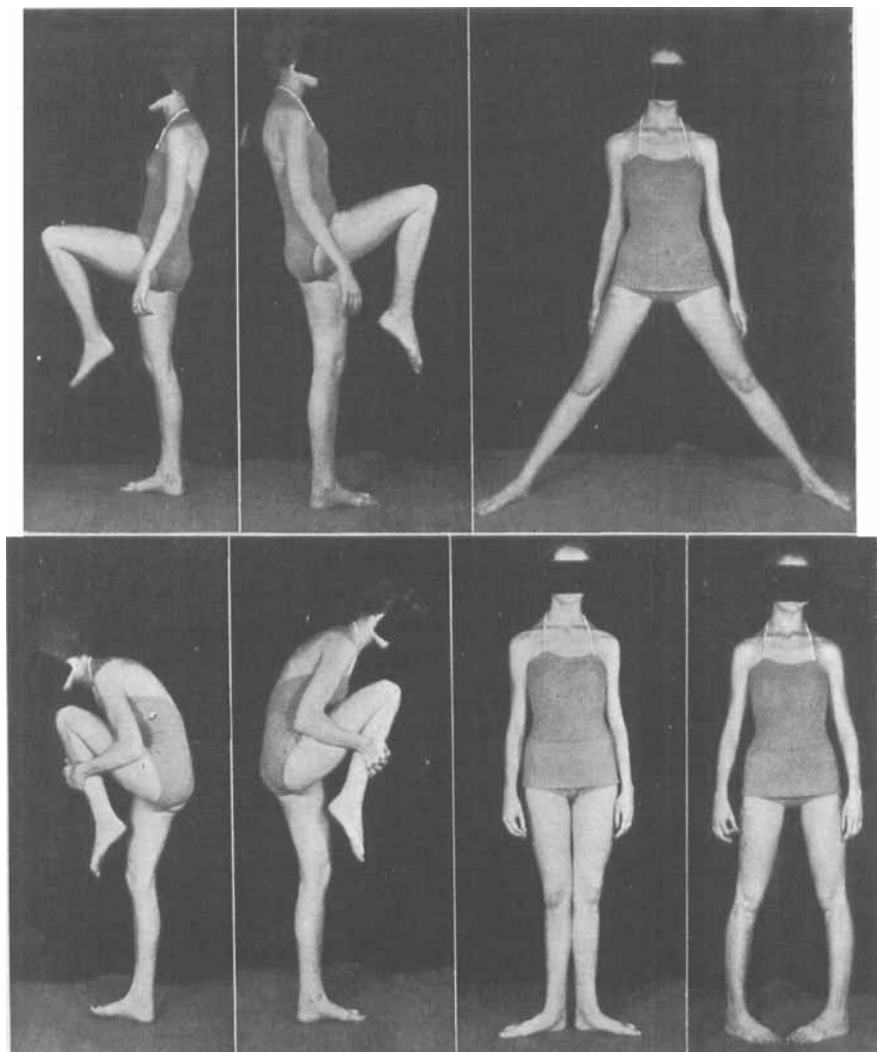


Fig. 5.

Case 2. Showing range of motion of both hips five and three years, respectively, after wedge osteotomy and screwing.

A diastasis developed in connection with fixation with a three-flanged cannulated nail. The nail was withdrawn and replaced by a wing screw on September 13, 1946. Roentgenograms 3 months later showed signs of consolidation of the osteotomy. Full weight-bearing was permitted after seven months. Nine to 12 months after the operation the roentgenograms began to show incipient nutritional disturbances. Typical capital necrosis then developed, later necessitating subtrochanteric osteotomy. The follow-up examination seven years after the first operation revealed the hip to be ankylosed in a good position. The patient could walk as much as ten kilometers.

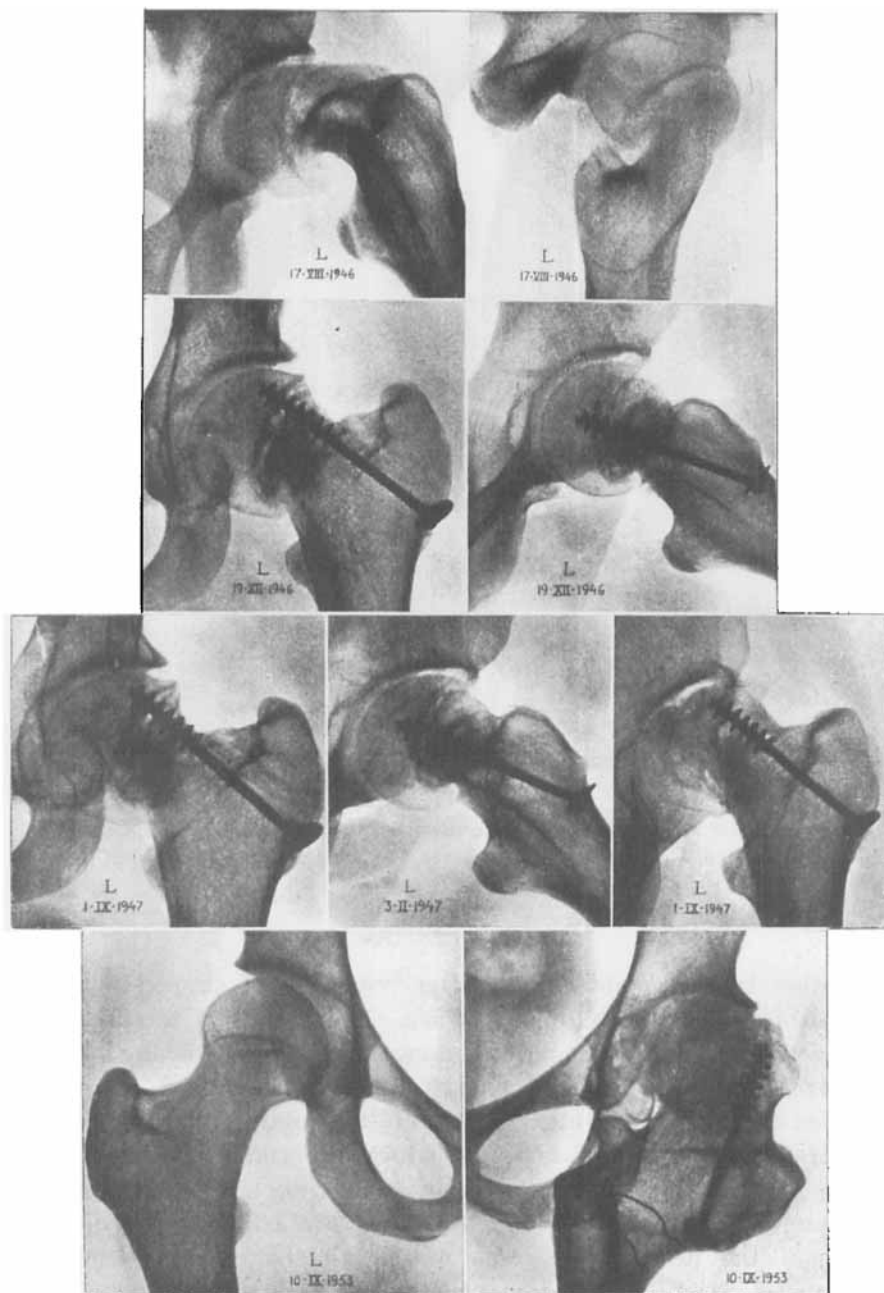


Fig. 6.

Case 3. 3278/36. A girl aged thirteen with gradual slipping of the left epiphysis. Nailing after wedge osteotomy caused separation. The nail was withdrawn and a screw was used. An aseptic necrosis appeared 12 months later.

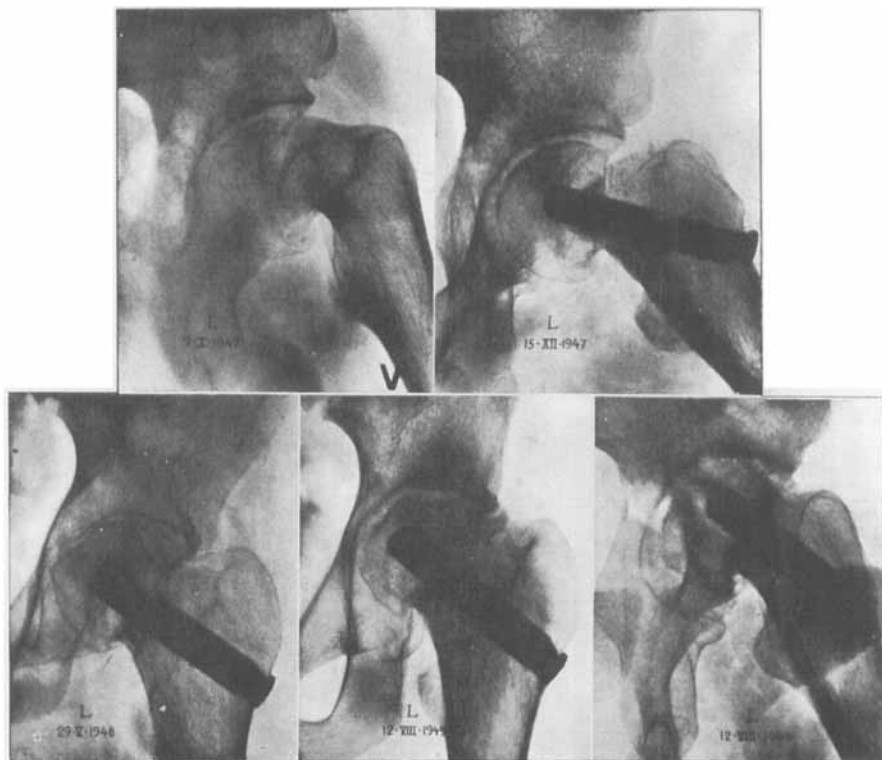


Fig. 7.

Narrowed articular space and irregular outline of the femoral head appearing six months after wedge osteotomy and nailing. The poor result was attributed to technical difficulties.

Another type of joint change after reduction of slipped femoral epiphysis is described in the literature. Clinically, this is early ankylosis, while the roentgenograms show advanced narrowing of the articular space plus calcium atrophy. *Waldenström* used the term "cartilage necrosis", while others speak of "traumatic arthritis". Figure 7 illustrates one of these cases, in which the contact between the osteotomy surfaces was poor at operation. Only six months after operation we found advanced narrowing of the articular space. The contour of the head had become wavy, but the central structure seemed to be intact. If we examine the entire series of X-rays, we find limited areas of necrosis near the joint cartilage. At some stages the pictures look like coxa plana. The explanation in these cases too is probably to be found in a nutritional disturbance. I therefore see no reason to put this type of complication in a special category, but rather

consider that it can be regarded as a nutritional disturbance or as necrosis of the head.

In another case total necrosis of the head began to develop nine months after an apparently completely uneventful operation. Reduction appeared to be perfect and fusion took only a short time. Here the reason for the circulatory disturbance was probably that the nail, which was situated in the postero-inferior area of the neck and the head, had crushed the vessels essential to nutrition, which we had deliberately tried to save from damage at operation.

Two of the five cases of total capital necrosis were submitted to secondary operation. The remaining patients manage with greatly reduced range of motion or ankylosis in good position.

Partial necrosis of the head and early arthritis deformans: Nine cases showed partial necrosis or early evidence of arthritis deformans at after-examination. It was found that most of the cases which were designated as early arthritis deformans at the last roentgenographic examination, had reached this stage via limited necrosis of the head, as described in the following:

Case 4. 429/50. The patient, a boy of 15 years, had had pain and limitation of movement in the left hip for one year. The femoral epiphysis had slipped by stages, the last time just before admission to the Orthopaedic Department (Fig. 8). Good reduction was achieved following wedge osteotomy. Nailing was so difficult that it was decided to apply a plaster cast to the hip instead. The position deteriorated. Fusion occurred five months later after operation, and weight-bearing was permitted after a further 2 or 3 months. Roentgenographic examination one year after the operation revealed clearly delimited partial necrosis of the superior lateral part of the head (Fig. 8). Three and a half years after operation the picture was one of arthritis deformans. At the follow-up examination, May 1953, the patient said he had no pain, while the range of motion was good objectively.

The fact that the symptoms were so unimportant at after-examination does not justify optimism for the future. The degenerative changes had not yet had time to progress to the point of having an appreciable effect on the patients' normal activity. The long-range prognosis is poor in the group of nine cases, designated "early osteoarthritis" or "partial necrosis", even if the function of the hip remains relatively good for 10 to 15 years after operation.

DISCUSSION

The displacement occurred by stages in the majority of cases of advanced epiphysiolysis operated on in the present series. If the condition had been diagnosed earlier and consequently submitted to a sim-

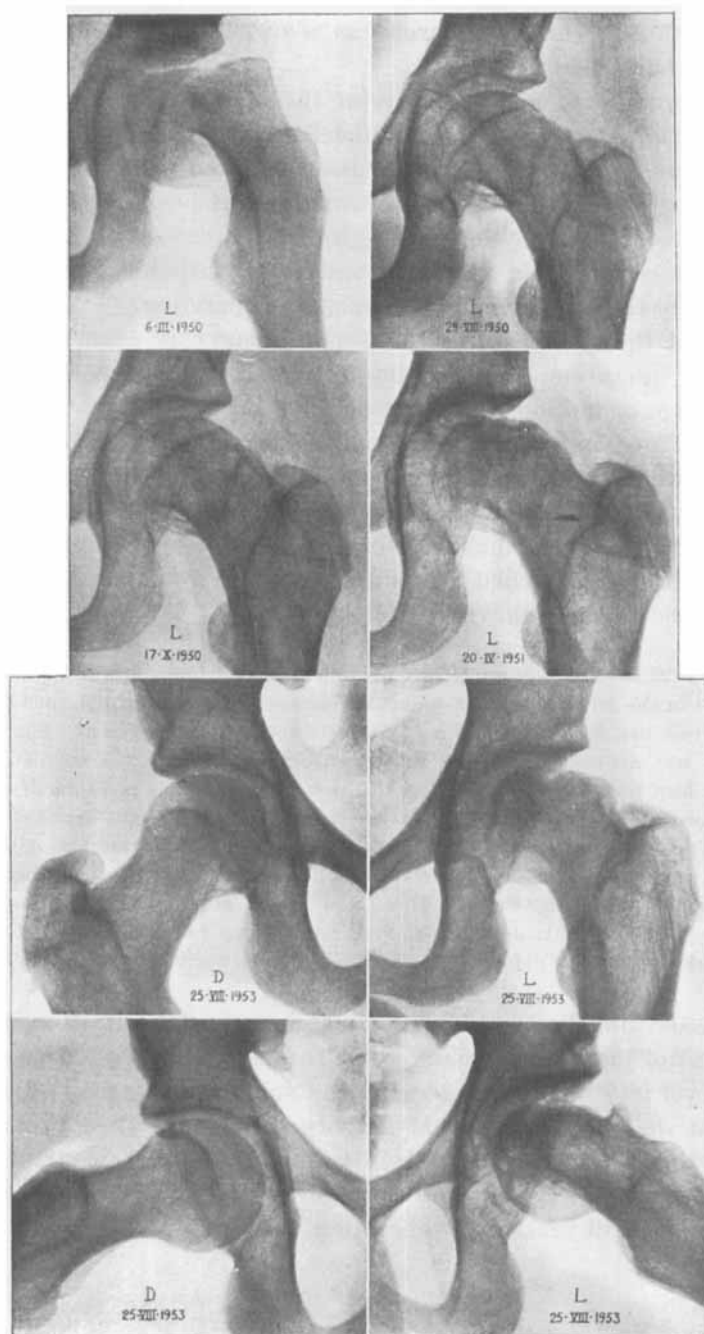


Fig. 8.

Case 4. 429/50. A boy aged fifteen had a gradual slipping of the left hip. Following wedge osteotomy, nailing had to be given up after several unsuccessful attempts. Fixation in plaster of Paris. A localized avascular necrosis appeared 12 months later. At the $3\frac{1}{2}$ -year follow-up the roentgenographic features may be characterized

pler and less risky method of treatment, satisfactory function of the hip would have been restored in many patients who are now or will become incapacitated. It is therefore extremely important that the medical profession and the general public be better informed about the nature of this disease. In this connection we must emphasize the need for repeated roentgenographic examinations with both frontal and Lauenstein projections.

The aim of the treatment, a painless and mobile hip, was achieved in more than 60 per cent of the present series of 38 hips with advanced epiphysiolyis. The prognosis was considered to be favorable in the majority of the cases. We have no guarantee that we are right, since the observation period is still too short for final evaluation. The disadvantage of the method is the high frequency of necrosis of the head.

This should not, however, cause us to abandon the method. As *Friberg* stressed in his preliminary report in 1947, we cannot expect a normal hip joint, but instead must evaluate the results in relation to the patient's condition without an operation. With this in mind, 24 good hips in a total of 38 operations can be regarded as relatively good results.

Three cases, in which distinct necrosis could be observed at operation, were eliminated from the follow-up series. Here surgical treatment is justified in order to restore anatomic conditions and thereby facilitate arthroplasty at a later date. In a few cases slight discoloration of the articular cartilage on the head could be seen at operation. Probably, therefore, there was some degree of circulatory disturbance already at the time of the operation in other cases as well as the three eliminated due to the presence of definite capital necrosis. If a circulatory disorder of this type progresses and leads to impairment of hip function, this undesirable complication cannot be entirely blamed on the operation.

It is obvious that wedge osteotomy facilitates the actual reduction. This part of the operation is generally simple if one uses the technique described here. Subsequent fixation with a nail or a screw, on the other hand, is complicated, and the technical difficulties appear to be responsible for most of the poor anatomic and functional results. In order to minimize traumatization when nailing in ordinary cases of slipped epiphysis, *Severin* (1954) recommended a slender and more pointed nail, the Nyström nail, rather than the coarsely cannulated three-flanged Sven Johansson nail. Severin's insistence on a gentle and precise technique is highly applicable to internal fixation following

osteotomy of the neck. A screw was used for fixation in 21 cases (see Fig. 4), and seemed to provide a gentle means of good fixation.

An anterior incision according to Sprengel or to Smith-Petersen was generally used. The question arises whether a lateral incision according to Gibson or Ollier does not provide better visibility. The latter incision should, at all events, facilitate screwing or nailing. It might also help to save the periosteal vessels on the posterior and inferior aspects of the neck from damage in connection with osteotomy. *Wilson* (1949) emphasized the importance of making the incision in the capsule as near the acetabular margin as possible in order to avoid unnecessary injury to the vascular supply. We tried to adhere to this principle in the present series. In cases in which the epiphyseal line has already begun to fuse, it might be wiser to await spontaneous synostosis and to perform subtrochanteric corrective osteotomy at a later date.

S U M M A R Y

An operation consisting of wedge osteotomy, reduction plus fixation has been used since 1945 to restore normal anatomic conditions in 38 hips with advanced epiphysiolysis.

Good anatomic and functional results were achieved in 63 per cent.

The disadvantage of the method is the high frequency of postoperative necrosis of the head of the femur. Partial necroses eventually take the shape of traumatic arthritis and osteoarthritis.

The author discusses the cause and prevention of the circulatory disorders associated with the operation.

Early diagnosis, permitting a milder form of treatment, should be possible. Maximal displacement is often the result of repeated slipping. It is essential that information about the disease be widely disseminated. The importance of repeated roentgenographic examinations, including the Lauenstein projection, should be emphasized.

R E S U M E

Pour rétablir des conditions anatomiques normales dans le glissement très prononcé de la tête fémorale on a recouru depuis 1945 à l'ostéotomie cunéiforme du col + la fixation pour 38 hanches.

Un résultat anatomique et fonctionnel favorable a été obtenu dans une proportion de 63 %.

La haute fréquence des nécroses de la tête constitue un inconvénient. Les nécroses partielles se présentent par la suite comme une arthrite traumatique ou une ostéoarthrite.

La cause des troubles de la circulation et les mesures pour y obvier sont discutés dans la présente étude.

Il doit, toutefois, être possible d'établir le diagnostique plus tôt ce qui permet un traitement moins dangereux. En fait, la position défectueuse maximale est souvent le résultat des glissements réitérés. Une connaissance plus ample de la maladie s'avère nécessaire. L'importance des examens radiographiques réitérés et des projections Lauenstein sont à recommander tout particulièrement.

RIASSUNTO

Fin dal 1945, per restaurare le normali condizioni anatomiche in 38 casi di avanzata epifisiolisi dell'anca, e' stata praticata l'osteotomia cuneiforme, consistente in una riduzione mantenuta da un mezzo di fissazione.

Buoni risultati anatomici e funzionali sono stati ottenuti nel 63 per cento dei casi.

Lo svantaggio del metodo e' dato dall'alta frequenza di necrosi post-operatoria della testa femorale. Una necrosi parziale puo' dare il quadro dell'arterite post-traumatica e dell'osteoartrite.

L'Autore discute le cause e il modo di prevenire i disturbi circolatori derivanti dall'intervento.

Una precoce diagnosi, che permette un piu' mite trattamento, puo' essere possibile. Il massimo spostamento spesso corrisponde a successivi e ripetuti scivolamenti della testa, e la conoscenza di questo fatto, tanto importante, e' essenziale.

Va sottolineata l'importanza di ripetuti esami radiografici, inclusa la proiezione di Lauenstein.

ZUSAMMENFASSUNG

Seit 1945 wurde zur Behandlung von fortgeschrittener Epiphysenlösung in 38 Hüften eine Operation angewendet, die in einer Keilosteotomie, Reposition und Fixation zur Wiederherstellung normaler anatomischer Verhältnisse bestand.

Gute anatomische und funktionelle Ergebnisse wurden in 63 % erzielt.

Der Nachteil der Methode ist die Häufigkeit der post-operativen Nekrose des Femurkopfes. Teilweise Nekrose endet in traumatischer Arthritis und Osteoarthritis.

Der Verfasser bespricht die Ursache und die Vorbeugungsmöglich-

keiten der lokalen Kreislaufstörungen die im Zusammenhang mit der Operation auftreten.

Frühzeitige Diagnose, die eine weniger eingreifende Form der Behandlung gestattet, sollte möglich sein. Maximale Verschiebung ist oft das Ergebnis wiederholter Gleitungen. Es ist wichtig dass die Kenntnis der Erkrankung in weitesten Kreisen verbreitet wird. Die Wichtigkeit von wiederholten Röntgenuntersuchungen, besonders auch in Lauenstein'scher Lage, wird hervorgehoben.

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