Acta orthop. scand. 47, 79–88, 1976

INTERTROCHANTERIC OSTEOTOMY IN THE TREATMENT OF PERTHES' DISEASE

JAAKKO PURANEN & ERKKI HEIKKINEN

Department of Surgery, University of Oulu, Finland.

Intertrochanteric osteotomy has been carried out in 34 children with Perthes' disease. Five weeks after the operation the patients were allowed to move about freely. The average postoperative follow-up period was 27 months. At that time the results seemed to be at least as good as those of Thomas' splint therapy. The varus-derotation osteotomy performed in the initial stage accelerated the process of reossification and seemed to prevent subluxation. According to our findings it is worthwhile correcting the subluxation even in cases with irreversible changes.

Key words: Perthes' disease; venous congestion; intertrochanteric osteotomy

Accepted 10.x.75

The most common form of treatment for Legg-Perthes-Calvé's disease (LPC) in Finland is Thomas' walking caliper. If the results were convincing, it would be acceptable to restrict the child's natural need for and joy in movement for 2–3 years, which the splint treatment generally requires. Since the results are good in barely 50 per cent of the cases (Edgren 1965, Evans 1958, Herndon & Heyman 1952, Karadimas 1971, Mose 1964) and since splint treatment causes muscular atrophy and even leg length discrepancy (Carpenter & Powell 1960, Edgren 1965), it is not surprising that efforts have been made to find a better form of treatment, even in the operative line (Dreyer & Schäfer 1974). Axer (1965) has published a material of 12 patients in which the treatment was subtrochanteric osteotomy.

In LPC the femoral head "softens" and the most noticeable changes take place anterolaterally. In the fragmentation stage, predisposition to subluxation and anteversion of the femoral neck exists. The idea of the operation is to make the femoral head articulate well within the acetabulum.

Thus, in the active phase the caput is situated as if in a cast, and thus a shape corresponding to that of the acetabulum is preserved during the free movement of the child. The caput can be satisfactorily placed inside the acetabulum by varus and internal derotation osteotomy.

Our first osteotomy in 1970, on a case with subluxation in the fragmentation stage, was subtrochanteric. After that we changed the operative method to intertrochanteric osteotomy since it is technically easy to apply, the re-ossification

is fast, and it gives cosmetically a good result.

SURGICAL PROCEDURE

The degree of varus angulation and derotation required to effect a satisfactory covering was determined *in casu*. In subluxations the angle might be as great as 30°, while in the initial phase 10–15° sufficed. The optimal internal derotation was about 15–25°.

The trochanteric region was exposed from a lateral incision via the posterior fibres of the lateral vastus muscle. A self-adapting children's osteotomy plate of 105° by "Osteon" was used for the fixation. Osteotomy was performed in such a way that first a channel in the collum to accommodate the blade plate was cut with a special seating chisel. The size of the planned varus angulation was observed in the direction of the channel. To define the internal derotation, parallel spikes were fixed on each side of the planned osteotomy line.

The femur was cut intertrochanterically and the required internal derotation was made. After this a medially-opening wedge, equalling the varum, was sawn off. The self-adapting plate accomplished a stable fixation.

A few days after the operation, the hip was immobilized in a plaster cast in the neutral position for a month. The purpose of this cast was to adapt the hip joint to the position of internal derotation, to prevent the extremity from turning to a position of external rotation during walking. As early as in the plaster cast phase, the child was encouraged to walk, and no restrictions were set after the cast had been removed. The plate was removed 3–8 months after the operation.

Table 1. The time interval from the onset of symptoms to the operation.

Duration of symptoms (months)	No. of patients	Per cent
0– 3	8	23.5
4– 6	6	17.6
7–11	11	32.4
12–24	2	5.9
> 25	7	20.6
Total	34	100.0

Table 2. Treatment before the operation.

		No. of patients
No treatment		18
Thomas' splint		16
Duration of treatment (months)	0– 6	3
	7–12	6
	13–24	5
	> 25	2

PATIENTS

During the past two years we have operated upon almost all cases of LPC in the active phase. The material includes those patients who underwent the operation in the period 1970–1973. A total of 34 children were operated upon, of whom 30 were boys and 4 were girls. Their mean age at the time of the operation was 7.5 years, the youngest being 5 and the oldest 12 years old. The disease involved the right side in 15 cases and the left side in 19 cases. In five cases the disease was bilateral. However, the operation was performed on one side only, since the unoperated side had reached the definitive stage. Table 1 shows the time interval from the onset of symptoms to the operation, and Table 2 the treatment before the operation.

RESULTS

The status of the hip of each patient has been followed up on frequent occasions. The results are presented with the patients divided according to the stage of the disease which was present at the time of the operation (Table 3). The stage of the disease was evaluated according to Jonsäter (1953). The results were as-

Table 3. The stage of LPC at the time of the operation.

Stage	No. of patients	Per cent	No. of cases with subluxation
Initial	15	44.1	–
Fragmentation	10	29.5	2
Restitution	9	26.4	9
Total	34	100.0	11

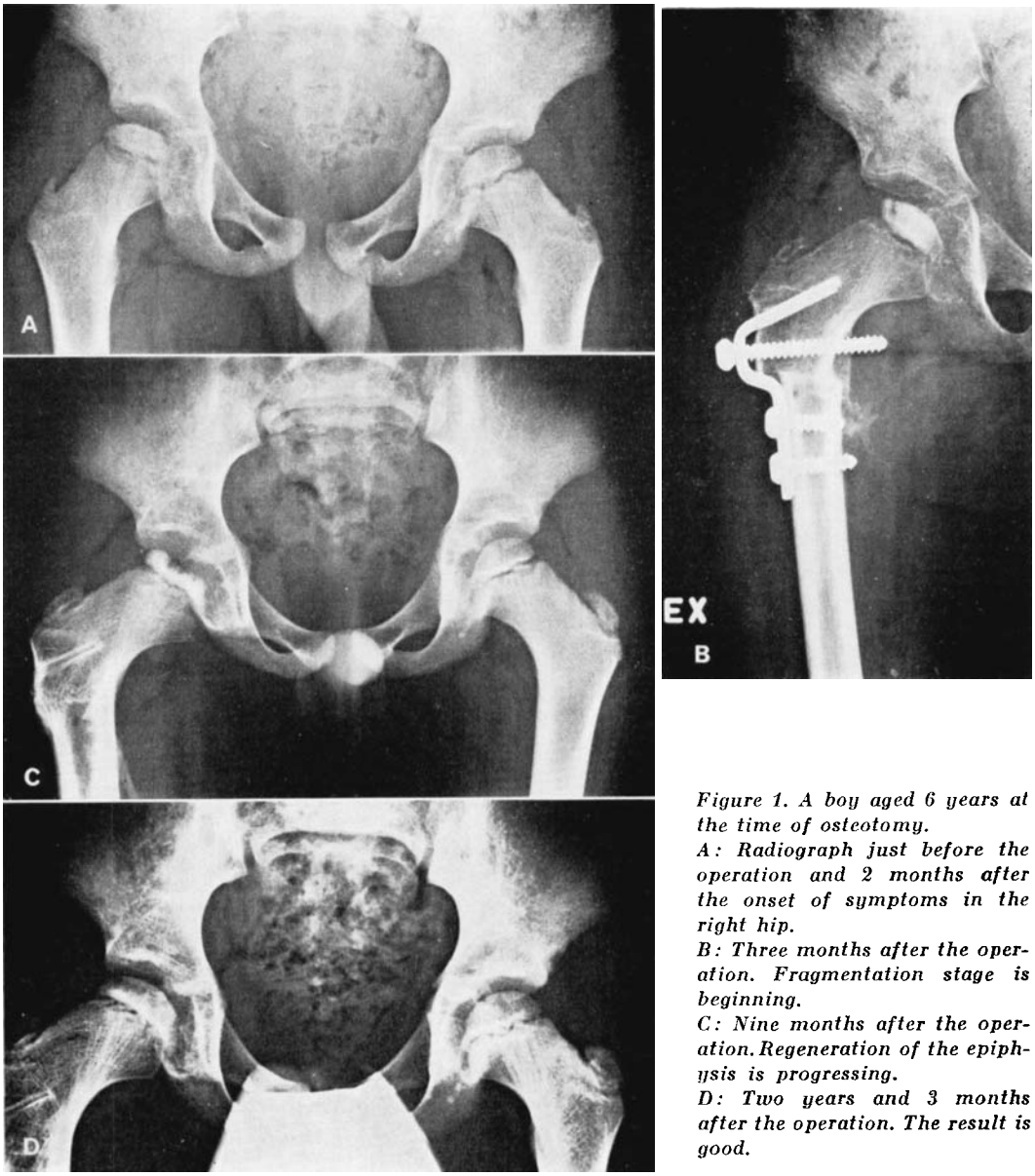

Figure 1. A boy aged 6 years at the time of osteotomy.
A: Radiograph just before the operation and 2 months after the onset of symptoms in the right hip.
B: Three months after the operation. Fragmentation stage is beginning.
C: Nine months after the operation. Regeneration of the epiphysis is progressing.
D: Two years and 3 months after the operation. The result is good.

sessed by the method of Mose (1964) employing the transparent device described by Edgren (1965).

Initial stage

This group included 15 patients. The mean period of follow-up after the operation was 24 months, every case having reached the restitution stage. In 12 cases the epiphysis had gone through the fragmentation stage (Figure 1). The mean length of time of this stage was 6 months in the operated patients. In three cases definite evidence of fragmentation could not be seen, and the initial stage led

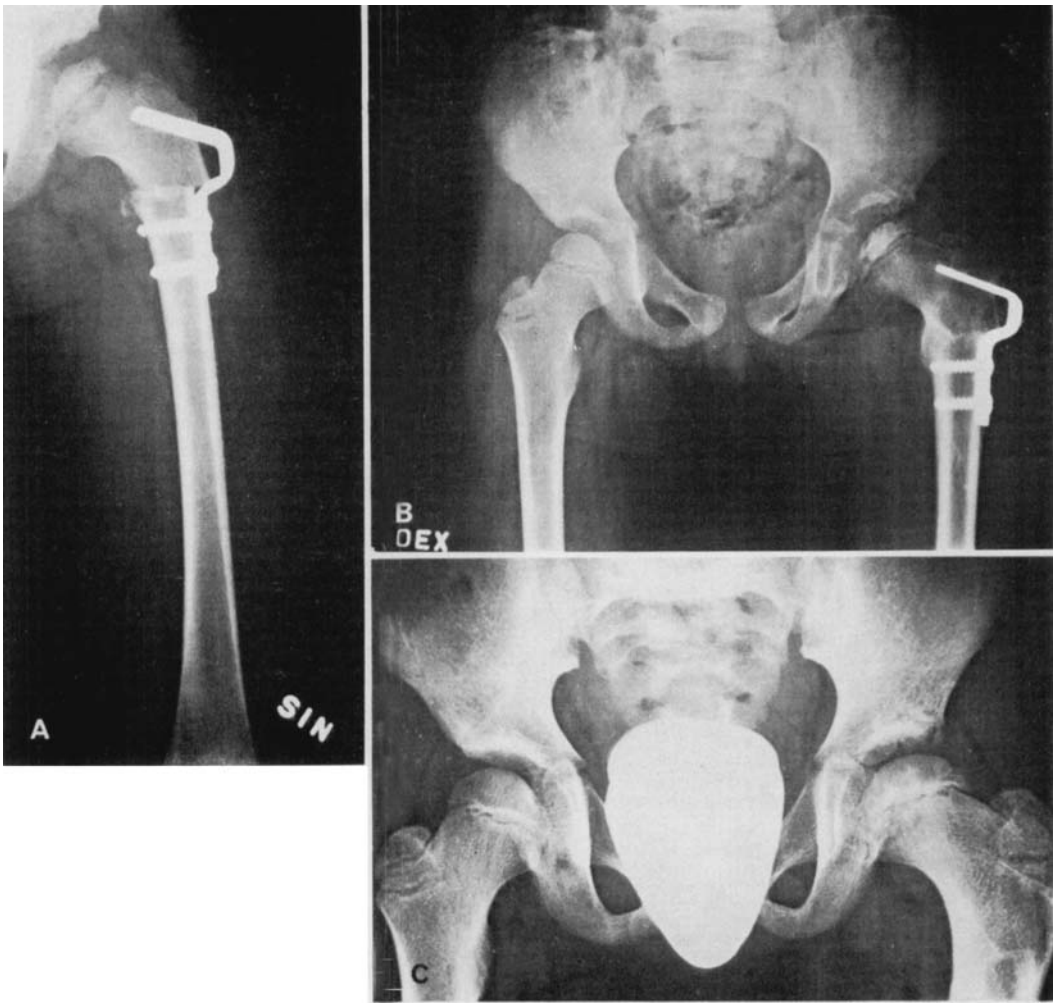

Figure 2. A girl aged 5 years at the time of osteotomy.

A: Radiograph just after osteotomy done 4 months after the onset of symptoms. Initial stage with condensation of the epiphysis. Note rarefaction of the metaphysis.

B: Six months after the operation. Flattening of the epiphysis but no clearly visible fragmentation.

C: Two years after the operation. During the process of the disease fragmentation did not occur. The result is good.

straight to the restitution stage 2–5 months after the operation (Figure 2).

In every case the femoral head had been moulded into a spherical shape during the restitution stage without subluxation.

Case report (Figure 3). The left hip of a 6-year-old boy was affected by LPC. He was treated with Thomas' splint for 2 years. When the boy was 9 years old, LPC was also diagnosed in the right hip. Osteotomy was performed 3 months after the symptoms appeared. The fragmentation stage took 3 months, whereas the corresponding time on the conservatively treated left side was 14 months.

During the process of the disease it was recognised that this case showed evidence of the "head at risk" (Catterall 1971). In spite of this

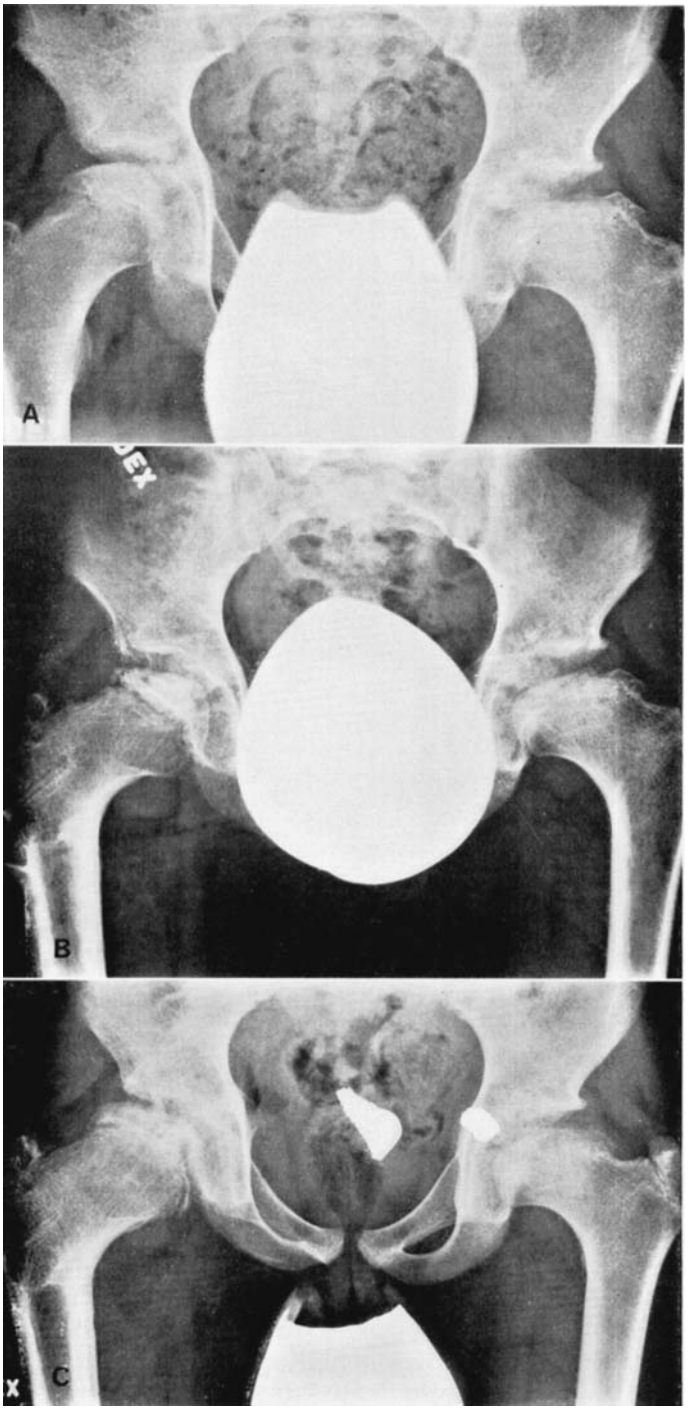

Figure 3. A boy aged 9 years at the time of osteotomy of the right hip. LPC present for 3 years in the left hip.
A: Radiograph just before operation and 3 months after the onset of symptoms in the right hip.
B: Six months after the operation. The epiphysis shows the "head at risk" fragmentation.
C: Two years and 5 months after osteotomy. The femoral neck is broad, but the shape of the right head is more satisfactory than the left one which is elliptical in shape.

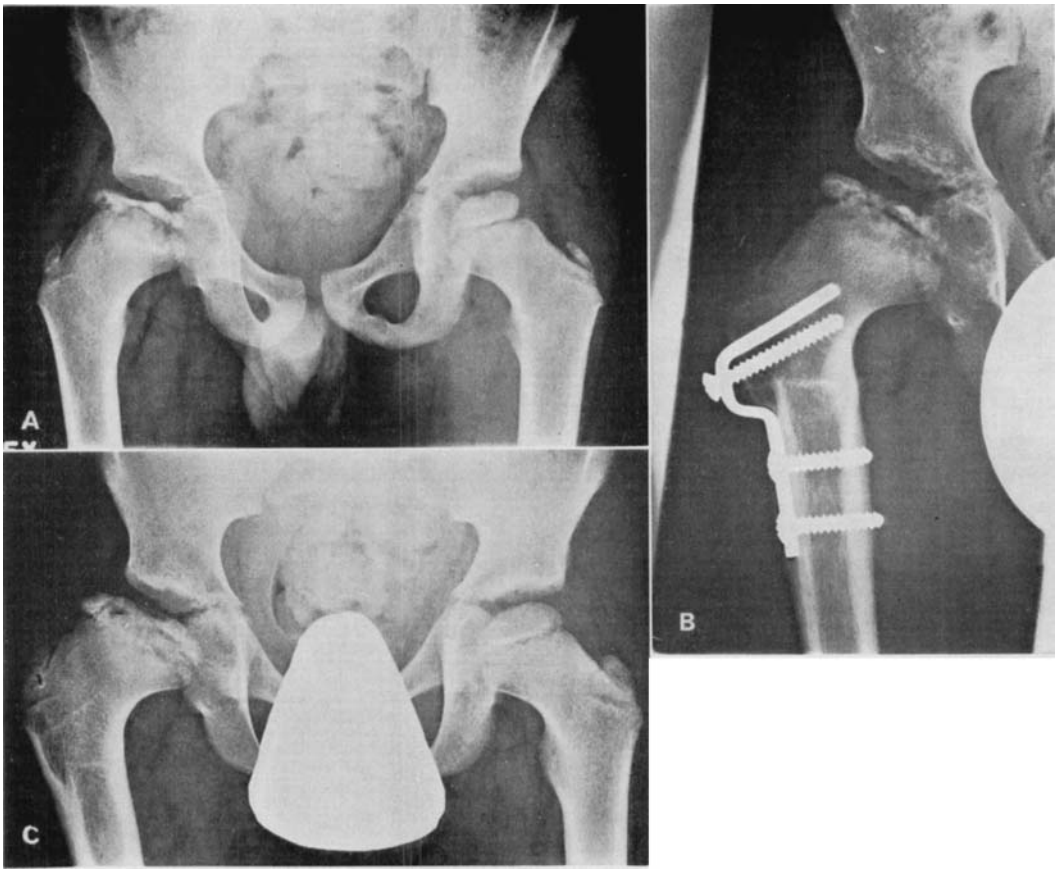

Figure 4. A boy aged 8 years at the time of osteotomy. He was previously treated for 8 months with Thomas' splint.

A: Ten months after onset of symptoms. The epiphysis is flattened, fragmented and subluxated.

B: Five months after the operation. The head is not satisfactorily centralized inside acetabulum because the osteotomy has been done with insufficient varus angulation.

C: Two years after the operation the head is still subluxated and irregular.

bad prognostic sign the last roentgenogram (2.5 years after the operation) showed that the right femoral head was being moulded into a spherical shape, whereas the left one was elliptical.

In this bilateral case a better result was obtained in the operatively treated hip than in the conservatively treated one, although in the latter the disease manifested itself 3 years earlier. It is a generally held view that the earlier the disease appears, the better is the prognosis (Edgren 1964, Mose 1964, Axer et al. 1973).

Fragmentation stage

This group was made up of ten cases, two of them also exhibited subluxation. The mean postoperative period of observation was 28 months. In these cases, a shorter than expected fragmentation stage was observed. The mean duration of the fragmentation stage was less than 8 months including both pre- and postoperative periods. Every patient had reached the restitution stage and the results were good except in two cases. In one of them, the correction of subluxa-

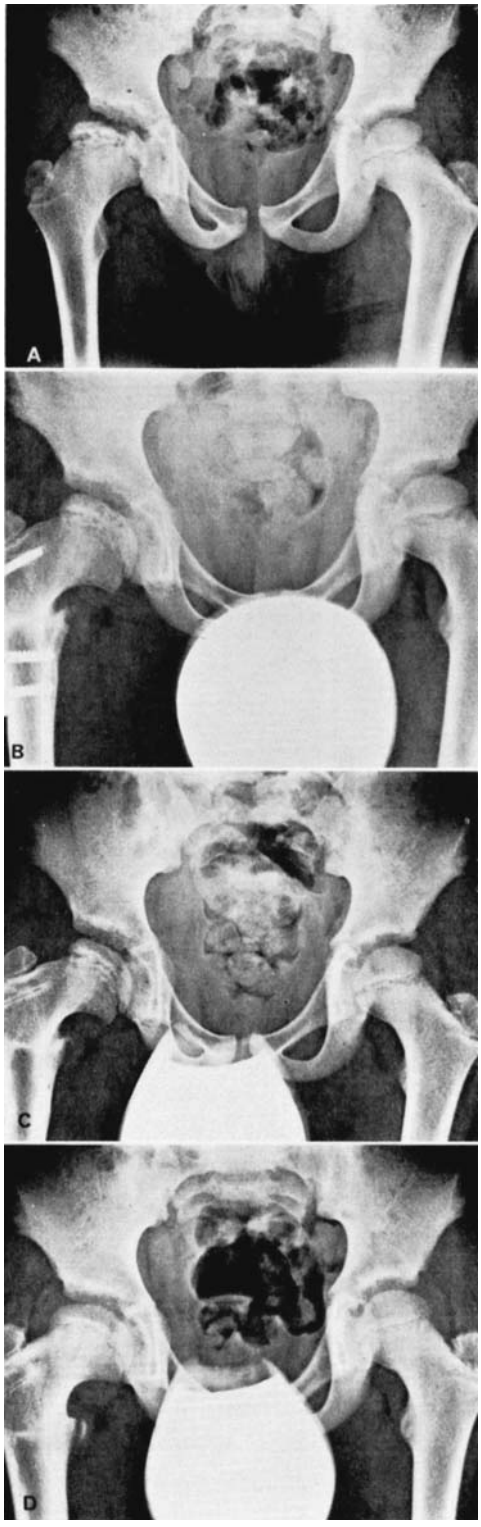

Figure 5. A boy aged 8 years at the time of osteotomy. He was previously treated for 15 months with Thomas' splint.

A: Radiograph just before the operation and 18 months from the onset of symptoms. Restitution stage with subluxation of the head.

B: Two months after osteotomy.

C: Five months after osteotomy. The shape of the head is becoming spherical.

D: Two years after osteotomy. The result is good.

tion was not satisfactory as too small a wedge had been removed (Figure 4). In the other case, noticeable osteolytic cavities were observed in the metaphysis. The collum remained short and wide and the femoral head somewhat elliptical.

Restitution stage

In every one of these nine cases the indication for operation was subluxation. The mean period of follow-up after the operation was 32 months. In these cases the fragmentation stage had lasted for 14 months during conservative treatment. In eight cases as early as a few months after the operation considerable improvement in the shape of the head of the femur was seen (Figure 5). In one case at the time of osteotomy and 3 years after the onset of symptoms, the epiphyseal line was closed and in spite of good centralization satisfactory moulding of the subluxated and irregular femoral head (with a wide and short neck) was not achieved. An epiphyseodesis of the greater trochanter was performed in a case where the damage to the capital epiphysis had led to closure of the growth plate with progressive coxa vara deformity.

The following case shows that with osteotomy the epiphysis can also be repaired in the late phase if the epiphyseal line is not closed.

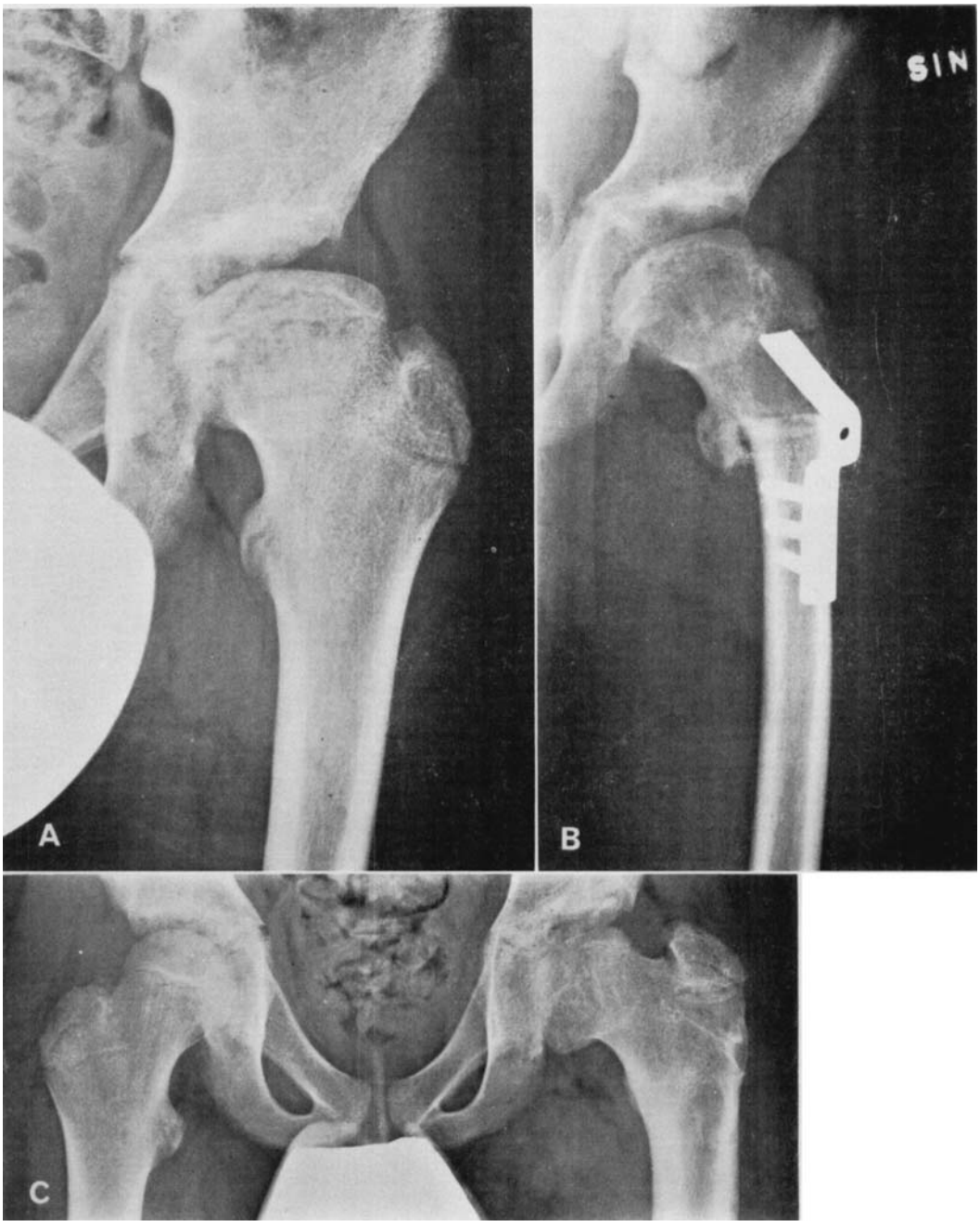

Figure 6. A boy aged 12 years at the time of osteotomy. He was treated for 4 years with Thomas' splint.

A: Radiograph just before the operation.

B: Subluxation of the head corrected with varus osteotomy.

C: Ten months after the operation. The shape of the head is considerably improved.

Case report. LPC was diagnosed in the left hip in an 8-year-old boy. He was treated with Thomas' splint for 4 years. During this time a marked muscular atrophy developed in the extremity, which was 2.5 cm shorter than the other. On account of the subluxation the patient was operated upon. Within a few months the femoral head became almost spherical. In addition, the difference in leg length was reduced to less than 2 cm.

Clinical results

The operations were not accompanied by early and late complications. Every hip has been painless postoperatively. Four patients limped, but none had a positive Trendelenburg sign. A patient treated for 4 years with a splint, had, at the time of operation, a leg length discrepancy of 2.5 cm, which diminished to 2 cm. Fourteen children had shortening of the affected extremity of 0.5–1.5 cm and 19 did not have any discrepancy at all. Every patient could walk and run freely except a boy with a flexion contracture of the hip requiring physiotherapy. Most of the patients exhibited some internal derotation which, however, seemed to disappear in the course of time.

DISCUSSION

With intertrochanteric osteotomy including internal derotation and varus angulation, a good and permanent centralization of the femoral head within the acetabulum was achieved. In the opinion of Laurent (1973), subluxation of the head is an absolute indication for osteotomy. The present material showed that it is worthwhile correcting the subluxation even in cases where irreversible changes have already occurred. In subluxations the procedure allowed the femoral head to be moulded into a spherical shape within a few months, if the capital growth plate was not prematurely closed at the time of the operation.

The most satisfactory results have been obtained when the operation has been carried out in the early stage (Axer 1973, Haraldsson 1973). With our osteotomy, performed in the initial stage, the healing process was accelerated and subluxation seemed to be prevented. Although according to Sommerville (1971) osteotomy itself does not speed up the process of revascularization or of reossification, the present series definitely shows that this happens. In Edgren's (1965) material, the mean length of time for the fragmentation stage was 10.6 months in patients treated conservatively. The present study showed that the mean fragmentation stage took 12 months in those cases in which one hip was treated conservatively or when the operation was carried out in the restitution stage. In subjects operated upon in the initial stage, the fragmentation stage was shortened to 6 months on average, and in three cases this stage could not be demonstrated at all, as also found by Dreyer & Schäfer (1974). These three cases might have healed in the same way with conservative treatment. We feel, however, that by this simple operation the good results were attained with minimum physical restriction of the children.

The good results yielded by osteotomy can be partly accounted for by mechanical factors. When the caput is well settled within the acetabulum the weight-bearing surface expands, and because of varum the strain exerted by the pelveofemoral musculature on the hip joint decreases. Also Catterall (1971) has stated that the shearing force would be much less if the growth plate were inclined to the horizontal plane, as occurs in varus osteotomy. However, these factors do not alone explain the shortened fragmentation stage and the generally fast and good moulding of the caput. Probably there are also other factors such as the effect of osteotomy in the reparation of hip arthrosis.

Intraosseous venography indicates obstruction in the venous flow in the initial

and fragmentation stages of LPC (Suramo et al. 1974). Obviously these disturbances in the venous circulation hold a central position in the pathogenesis of the disease. Osteotomy, performed in the initial stage, improves venous circulation (Heikkinen et al. 1976) and accelerates the process of healing even to such an extent that the fragmentation stage possibly does not occur at all.

The length of follow-up is so far too short to allow a final evaluation. However, even on the basis of the present results, a conclusion can be drawn that no complications have appeared, and that the results seem to be at least as good as those in conservative treatment. Operative treatment offers one notable advantage; the child is allowed to move freely 1–2 months after the operation. This is an advantage not only for the child but also for the parents, for whom conservative treatment is a considerable burden.

REFERENCES

Axer, A. (1965) Subtrochanteric osteotomy in the treatment of Perthes' disease. *J. Bone Jt Surg.* **47**-B, 489–499.

Axer, A., Schiller, M. G., Segal, D., Rzetelny, V. & Gershuni-Gordon, D. H. (1973) Subtrochanteric osteotomy in the treatment of Legg-Calvé-Perthes' syndrome. *Acta orthop. scand.* **44**, 31–54.

Carpenter, E. B. & Powell, D. O. (1960) Osteochondrosis of capital epiphysis of femur (Legg-Calvé-Perthes' disease). *J. Amer. med. Ass.* **172**, 525–527.

Catterall, A. (1971) The natural history of Perthes' disease. *J. Bone Jt Surg.* **53**-B, 37–53.

Dreyer, J. & Schäfer, S. (1974) Actual problems in the treatment of Perthes' disease. *Z. Kinderchir.* **15**, 106–117.

Edgren, W. (1965) Coxa plana. *Acta orthop. scand.*, Suppl. 84.

Evans, D. L. (1958) Legg-Calvé-Perthes' disease. *J. Bone Jt Surg.* **40**-B, 168–181.

Goff, C. W. (1954) *Legg-Calvé-Perthes' syndrome and related osteochondroses of youth.* Charles C Thomas, Springfield, Illinois.

Haraldsson, S. (1973) Derotation varization osteotomy in the treatment of Perthes' disease. *Acta orthop. scand.* **44**, 105–108.

Heikkinen, E., Puranen, J. & Suramo, I. (1976) The effect of intertrochanteric osteotomy on the venous drainage of the femoral neck in Perthes' disease. *Acta orthop. scand.* **47**, 89–95.

Herndon, C. H. & Heyman, C. H. (1952) Legg-Perthes' disease. *J. Bone Jt Surg.* **34**-A, 25–46.

Jonsäter, S. (1953) Coxa plana. *Acta orthop. scand.*, Suppl. 12.

Karadimas, J. E. (1971) Conservative treatment of coxa plana. *J. Bone Jt Surg.* **53**-A, 315–325.

Laurent, L. E. (1973) Varus-rotation osteotomy in the treatment of Perthes' disease. *Acta orthop. scand.* **44**, 104–105.

Mose, K. (1964) *Legg-Calvé-Perthes' disease.* Thesis, Århus. Universitetsforlaget, Copenhagen.

Sommerville, E. W. (1971) Perthes' disease of the hip. *J. Bone Jt Surg.* **53**-B, 639–649.

Suramo, I., Puranen, J., Heikkinen, E. & Vuorinen, P. (1974) Disturbed pattern of venous drainage of the femoral neck in Perthes' disease. *J. Bone Jt Surg.* **56**-B, 448.

Correspondence to: Jaakko Puranen, Department of Surgery, University of Oulu, Oulu, Finland.