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PALLIATIVE SUBTROCHANTERIC OSTEOTOMY

Reexamination of 43 Patients treated in the Cripples' Hospital, Copenhagen, in the Period of 1926—1935

Subtrochanteric osteotomy as palliative treatment for congenital dislocation of the hip has now been employed in the Cripples' Hospital so long that an estimation of the obtained results seems warrantable. This inquiry is undertaken primarily with a view to the future attitude of the hospital to the indications and the operative technique. It is a task of revision that is necessary, and has to be done now and then for every therapeutic method adopted by the hospital. Our result of this investigation is being published because the literature has brought only a few reports on reexamination of fairly large patient materials with a sufficiently long observation period (Camitz & Wattermann).

Although palliative osteotomy for dislocation of the hip was employed the first time as early as in 1894 (Kiermisson) and has been used increasingly since 1918, owing to the work of Adolf Lorenz and von Bayer, the reports on the lasting results have been based only on relatively few cases. The historical development of the method falls outside the scope of this paper; yet, in the discussion we shall enter into the principal points of view concerning the treatment.

Material.

During the period of 1926—1935 altogether 52 patients have been treated in the Cripples' Hospital with osteotomy for congenital dislocation of the hip. Of this total, 43 patients (3 men and 40 women) have been reexamined. No information could be

obtained about 8 patients; and 1 died several years after the operation. (33 patients were reexamined by us personally, 6 were examined in the Orthopædic Hospital, Aarhus, and 4 were examined by their private physicians.)

Among the 43 patients the dislocation was unilateral in 33, bilateral in 10. The average observation period after the operation has been 7 years; the shortest is 1¼ years, the longest 17 years.

Treatment before the Osteotomy.

22 patients had been treated with reduction and plaster bandage for 2 × 3 months. The age at the time of reduction was 3—4 years (the youngest patient was 1½ years old, the oldest 6 years). In 2 of these cases the reduction failed; in 20 there was a relapse of the dislocation.

Half of the patients—21—had never been treated before, partly because the parents did not seek medical advice, partly because the physicism failed to diagnose the dislocation, and in a few cases the parents did not wish any treatment of the child.

Indications for the Operation.

The indications have been:

a) Subjective symptoms: Pain and tiredness in and round the hip-joint and in the lumbar region; pain aggravated by loading.

b) Objective signs owing to the impairment of the stability of the hip-joint: Waddling gait, Duchenne-Trendelenburg's symptom, increased lordosis.

Prior to the operation 37 patients had both subjective and objective symptoms. 2 patients were operated on account of the subjective symptoms alone; 4 patients had only objective symptoms. All the dislocations were complete, but 5 cases presented a nearthrosis. Particular mention will be made of these later on.

Operative Methods.

In 1926—1931 altogether 27 osteotomies were performed with the Hass technique for bifurcation osteotomy ad modum

Lorenz. Now, however, on going through this material it is found that even though the operating surgeon thought he was performing a typical spitting bifurcation osteotomy, the final result turned out to be an angular osteotomy of the Bayer type. In the following the abbreviation L. B. will be used for this group of osteotomies.

From 1931 to 1935 the type of osteotomy was changed to subtrochanteric oblique osteotomy (23 cases) from above and externally downwards and medially as given by Drehmann (abbreviated to Dr.). The osteotomy is placed at the level of the acetabulum, so that the osteotomy angle falls outside the socket. In 3 cases the osteotomy was performed at the level of the tuberosity of the ischium ad modum Schanz. In all cases with lordosis an attempt was made at the same time to turn the osteotomy in the sagittal plane with the angle opening posteriorly.

We shall not here enter into details of the operative technique but merely mention that in the Lorenz-Bayer osteotomy the incision was made as given by Hass: in the frontal plane from above and anteriorly—downwards and posteriorly. When the distal fragment is placed in abduction and inward rotation there is a continual contact between the two oblique cut-surfaces. The abduction position is fixed for 2 months in plaster, followed by rest in bed for 1 month. When now the limb is moved medially, the upper fragment is placed in adduction, and this gives the optimal supporting osteotomy, meeting the requirements advocated by Wattermann. In several cases there is found to be a typical spitting, with the point of the distal fragment aiming into the acetabulum. The after-treatment for Drehmann's osteotomy has been the same as for L. B. As a rule the treatment winds up with training exercises, sometimes massage and zinc-glue bandage. Nail fixation has been employed only in a few cases. For practical reasons no roentgenographic control was employed in the first years; and this naturally reduces the material employed here for analysis of the significance of the individual factors to the function of result.

There have been no technical errors as infection, death or perforation of the blood vessels anterior to the site of the opera-

tion. On the other hand, here have been several complications as lacking angle, slipping at the site of the osteotomy, etc.—conditions we shall return to later on.

A total of 43 patients have been treated with 53 osteotomies, as a bilateral operation was performed in 10 cases. As the Schanz osteotomies are not included in the total estimation of the therapeutic results, we have 27 osteotomies a.m. L. B. and 23 osteotomies a. m. Dr. for elucidation of the value of the palliative osteotomy.

Age at the Time of the Operation.

Patients	*Osteotomies*	*Age of Patients*
7	10	5—10 years
14	18	11—15 „
12	12	16—20 „
3	5	21—25 „
4	5	26—30 „
2	2	31—35 „
1	1	40 „

Thus the majority of the patients were operated on at an age between 10 and 20 years.

Therapeutic Results.

Before inquiring into the significance of the individual factors to the final result, it will be appropriate first to give an account of the therapeutic results based on ordinary clinical judgment. The cases have been classified in 4 groups—contrary to Hass, who sets up only 3 groups. We think in this way we get a more correct picture of the patients, as the absolutely good results thus form a group by themselves.

1. Excellent, *i.e.,* no complaints, good stability, no limping. "Trendelenburg" abolished, no or slight lordosis.
2. Good, *i.e.,* minor complaints, and considerable objective improvement.
3. Fairly good, *i.e.,* some improvement.
4. Unchanged.

In no case has the condition been aggravated. The shortening is left out of consideration, as the result is estimated after counterbalancing with correcting footwear. For that matter, the shortening resulting from the operation is moderate (about 2 cm.)

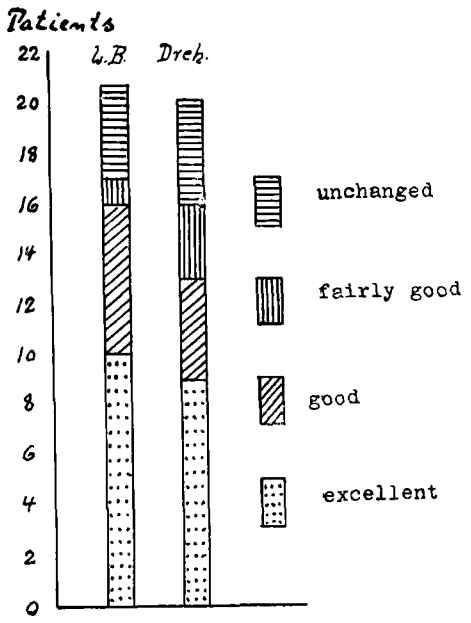

Fig. 1.
Results after subtrochanteric osteotomy (L.-B. and Dreh.).

21 patients have been treated with bifurcation osteotomy (L. B.).

10 patients with excellent result.
6 „ „ good „
1 „ „ fairly good „
4 „ „ unchanged „

20 patients have been treated with supporting osteotomy (Dr.).

9 patients with excellent result.
4 „ „ good „
3 „ „ fairly good „
4 „ „ unchanged „

Of the total number of patients 10 presented bilateral dislocation; they were all treated with osteotomy: 5 patients with bilateral L. B.; 2 with bilateral Dr.; 1 with L. B. and Dr.; 1 with L. B. and Schanz; and 1 with Dr. and Schanz. The total result has been 5 excellent, 4 fairly good, and 1 unchanged.

Thus there was no practical difference between the results after the bifurcation osteotomy and the supporting osteotomy. But from the following it will be evident that the mobility of the hip-joint is impaired more often after bifurcation osteotomy than after supporting osteotomy, even though not to such an extent as to shift the clinical judgment of the results.

Analysis of Factors significant to the Function of the Osteotomy.

Osteotomy Angle in the Frontal Plane.

2 factors are of significance to the stability of the dislocation pelvis:

a) Axis of the lower extremities, its placing as near the midline as possible.

b) Tension of the gluteal muscles.

These requirements are met through valgus position of the osteotomy, but the possibility of a straightening of the angle is present here as well as in all other osteotomies. Hence an analysis of this factor will be of interest.

We have tried graphically to illustrate how the frontal angle changes by comparison of the conditions 2 months and 7—12 years after the operation. The figure outside each curve gives the age of the patient at the time of the operation, and for practical reasons the final result is reckoned as 7 years after the operation.

It is to be mentioned that when the term "frontal angle" is employed here, it does not mean the real angle in the frontal plane, but the angle measured on the roentgenogram with the hip extended and inward rotated 15°. Thus we are not working with the true angle, but this procedure is justifiable for comparative examinations of the same patient.

L. B.

Owing to lack of control roentgenograms 5 osteotomies have to be left out, so that the estimation here is based on 22 osteotomies.

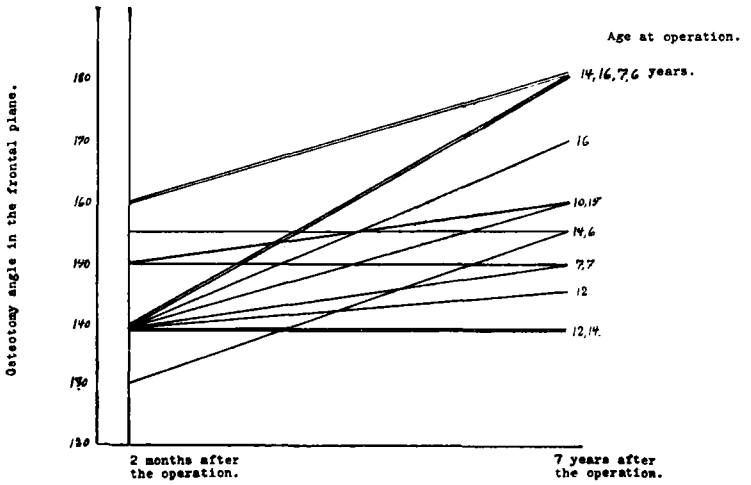

Fig. 2.

Subtrochanteric osteotomy ad mod. Lorenz-Bayer. Age at operation: 6—16 years.

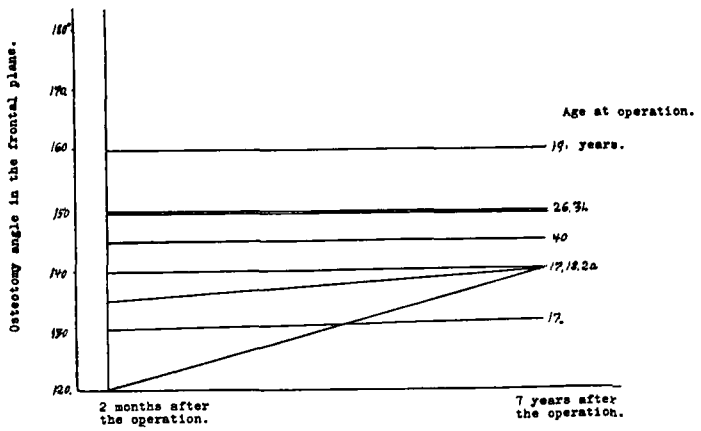

Fig. 3.

Subtrochanteric osteotomy ad mod. Lorenz-Bayer. Age at operation: 17—40 years.

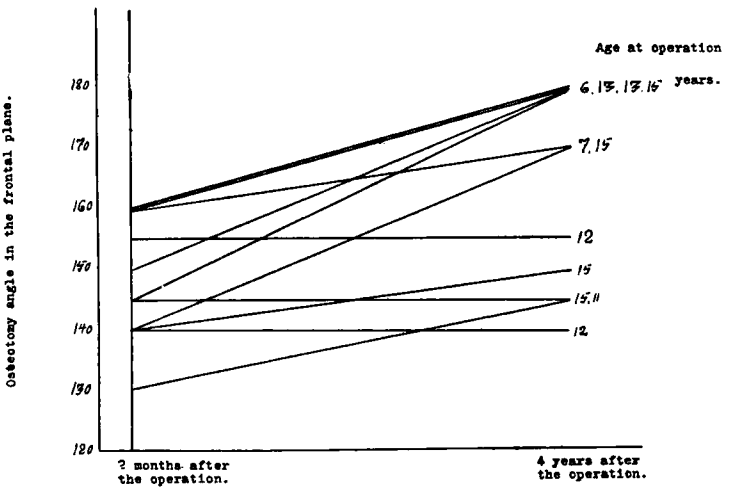

Fig. 4.

Subtrochanteric osteotomy ad mod. Drehmann. Age at operation: 6—16 years.

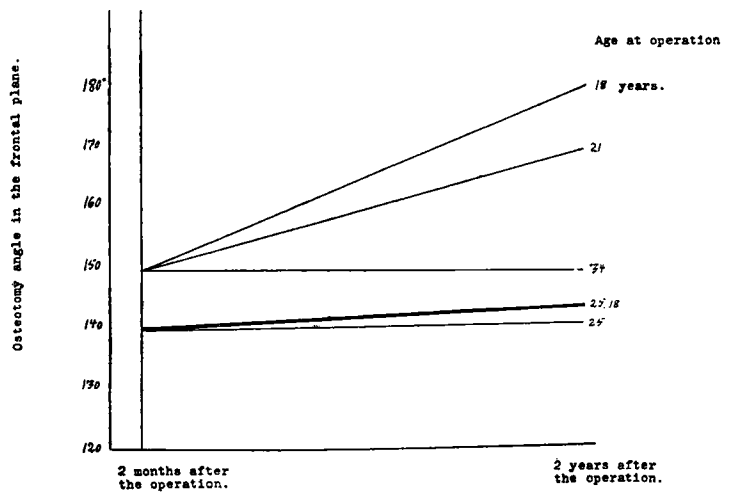

Fig. 5.

Subtrochanteric osteotomy ad mod. Drehmann. Age at operation: 18—34 years.

Within the age-class of 6—16 years the angle kept unchanged in 4 cases. In 10 cases the angle was straightened out partially (6) or completely (4). But in the age-class of 17—40 years the angle kept unchanged, as the improvement of the angle from 120° to 140° was due to an after-operation (1 osteotomy).

Drehmann.

Here we find similar conditions as after L. B.

Considering the material under one, it will be justifiable to think that the tendency to straightening of the frontal angle asserts itself especially in the young age-group, and here the limit has to be set at the age of 16 years.

It will be reasonable, therefore, in osteotomy on patients under 16 years to aim at a marked valgus position (130°) so as in this way to make more sure that the final osteotomy angle will be suitable (140—150°).

It has not been practicable to examine the osteotomy angle in the sagittal plane because post-operative control roentgenograms in this plane are lacking.

Frontal Angle—"Trendelenburg".

L. B.

We have examined whether there is any relation between the size of the frontal angle and Trendelenburg's phenomenon, setting up three degrees of "Trendelenburg": marked = +++; moderate = ++; slight = +.

Fig. 6 shows that in a great majority of cases the Trendelenburg phenomenon is abolished or improved when the frontal angle is 140—160°.

In 2 cases this condition remained unchanged in spite of a good frontal angle. It was not practicable to demonstrate the reason for this, but the possibility of muscular aplasia is to be considered. The material includes 3 cases that are of particular interest because the patient improved in spite of the lacking frontal angle. In two of these cases, on the other hand, there was a good angle in the sagittal plane (No. 2194/30: 160°; No.

3814/35: 140°). In the third case there was no angle in either plane; yet the Trendelenburg phenomenon and the lordosis improved. The possibility cannot be excluded that the critical judgment of the case prior to the operation (which was not performed by us) may have been too severe. The abolition of the Trendelenburg phenomenon in the two cases was due presumab-

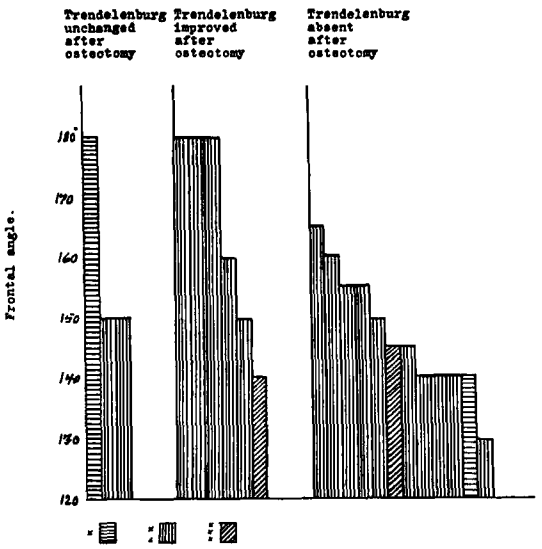

Fig. 6.

Osteotomy L.-B. The relation between the frontal angle and Trendelenburg's symptom. Each column represent one osteotomy.
The hatching of the columns indicates the degree of Trendelenburg's symptom before the operation.

ly to the fact that the trochanter is pulled sufficiently downwards through the good sagittal angle, so that the glutaeus medius now has become sufficient. Later, in the discussion, we shall take up this question.

Drehmann.

Fig. 7 shows that in this group too there is agreement between a good frontal angle and improvement or abolition of

"Trendelenburg". In 7 cases there was no angle—a finding that will be mentioned more in detail. Here it is to be pointed out that in all these 7 cases the Trendelenburg phenomenon remained unchanged.

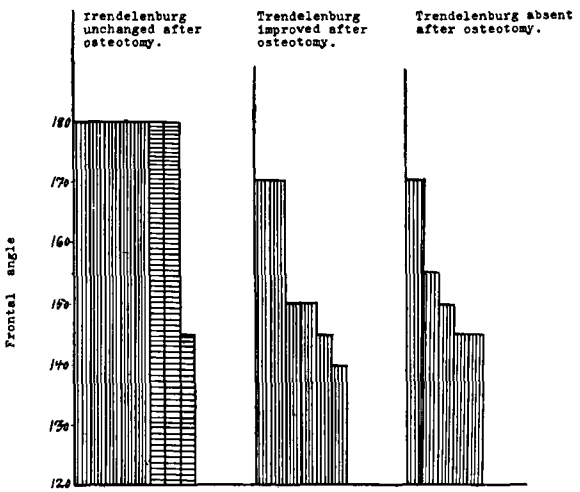

Fig. 7.
Osteotomy Drehmann. Relation between the frontal angle and Trendelenburg's symptom.
The hatching of the columns indicates the degree of Trendelenburg's symptom (see Fig. 6).

Significance of the Sagittal Angle to the Lordosis.

At this reexamination it has not been practicable to make distinction between the two types of osteotomy, as sufficient information about the angle before and after the operation is wanting. But, considering the total material under one, we find:

7 cases of unilateral osteotomy with a sagittal angle of 170—140°. In 6 cases the lordosis improved. In one case the lordosis kept unchanged, notwithstanding a sagittal angle of 170°. In 11 cases of unilateral osteotomy there was no angle in the sagittal plane, and the lordosis remained unchanged.

6 cases of bilateral osteotomy with a sagittal angle of 170°; prior to the operation these patients had all a severe lordosis. On reexamination there was found only a slight or normal lordosis. In one case of bilateral osteotomy, but without any angle, the lordosis remained unchanged. Thus we have re-examined 32 osteotomies, in 13 of which there was not found any angle in the sagittal plane, and in all of these the lordosis remained unchanged. In the remaining 19 cases the lordosis had improved. The total material includes 7 cases of osteotomy with a good angle in the frontal plane (170—140°), but without an angle in the sagittal plane; and in all of these cases the lordosis remained unchanged. So it seems justified to claim that the osteotomy angle in the sagittal plane is of significance to the correction of the lordosis.

Mobility in the Hip-joint after Osteotomy.

27 L. B. and 22 Dr.

Osteotomy with free	*L. B.*	*Dr.*
Flexion	15	11
Side movements	10	12
Rotation	6	7

If the material is treated in this way, that free mobility means free flexion and movements to the side with only slight reduction of the rotation, there are only 6 L. B. but 14. Dr. with free mobility. With limited or greatly limited mobility there are 21 L. B. and 8 Dr. Thus the mobility of the hip-joint is better after Dr. than after L. B. (Fig. 8).

Shortening.

After osteotomy the former shortening is increased by 1—2 cm.; 3 cm. is the greatest increase in shortening we have measured. At present no comparison has been worked up between the increase in shortening after L. B. and after Dr.

Does the Post-operative Anatomical Result correspond to the Subjective and Objective Symptome?

Lorenz-Bayer.

a) 8 osteotomies with satisfactory angles in both planes. In all these cases the objective symptoms disappeared (2) or improved (6). In all the cases the subjective symptoms subsided completely (5) or in part (3).

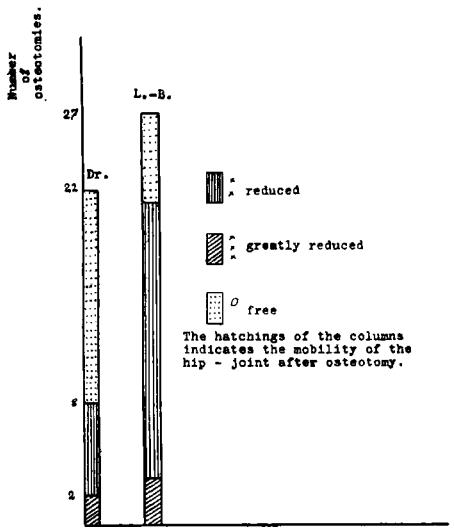

Fig. 8.
Mobility of the hip-joint after osteotomy.

b) 5 osteotomies with a good angle in the frontal plane, but no angle in the sagittal plane. In all these case the subjective symptoms and "Trendelenburg" improved. The lordosis was improved in 2 cases, but persisted unchanged in 3.

c) In this material there is no roentgenographically verified case with a good angle in the sagittal plane but no angle in the frontal.

d) 4 cases with no angle after osteotomy. In 2 of these cases the subjective and objective symptoms improved; in 2 they remained unchanged.

Drehmann.

a) 5 cases with satisfactory angles in both planes. In all these cases, subjective and objective improvement.

b) 3 cases with a good angle in the frontal plane, but no angle in the sagittal plane. In all three cases the Trendelenburg phenomenon was improved. In 2 cases the subjective symptoms disappeared completely; in 1 they improved considerably. No information given about the lordosis.

c) 3 cases with a good angle in the sagittal plane, but no angle in the frontal plane. In all three cases the lordosis has improved. "Trendelenburg" somewhat better in 1 case, but unchanged in 2.

d) No angle after osteotomy in 2 cases. Objective symptoms unchanged, with slight improvement of the subjective symptoms. Still, the condition has to be considered unchanged.

Owing to lack of roentgenographic control the number of cases suitable for this estimation has been very limited. Still there appears to be good agreement between a satisfactory anatomical result and a satisfactory clinical result.

Nearthrosis—Osteotomy.

In 5 cases of unilateral dislocation with nearthrosis and good mobility, especially abduction, osteotomy was performed. The result has been excellent in 2 cases, good in 2, and fairly good in 1 case. In 2 cases the nearthrosis was found roentgenographically to develop further after osteotomy. The pain subsided after the osteotomy in all the cases, presumably from lightening of the load. Whether osteoplastic support ad modum Lance is preferable to osteotomy, is a question we cannot consider here. Osteotomy has been satisfactory in all the cases here concerned. The only inconvenience has been that the mobility of the hip-joint has been reduced more or less—what is quite natural because of the mechanical conditions—but this limitation has not so marked as to become particularly invalidating.

Complications.

Out of 50 osteotomies 17 were accompanied by complications either in direct connection with the operation or shortly after. In some of the cases there were several complications. 27 L. B. presented 13 complications, but the 23 Dr. had only 6 complications. The following complications have been observed.

1. Flexion contracture (3 cases).
2. Lateral displacement of the distal fragment (4 cases).
3. No angle primarily (2 Dr. and 2 L. B.).
4. Osteotomy healed in varus position (2 cases).
5. Osteotomy healed with excessive valgus (4 cases).
6. Ankylosis of the hip-joint (1 L. B.).
7. Excessive outward rotation (1 case).

Nos. 2, 3, 4, 5 and 7 are to be characterized as technical errors that ought to be avoidable. In No. 6 the pre-operative mobility was greatly reduced; after the operation, flexion contracture and ankylosis developed.

DISCUSSION

Even though result after palliative osteotomy may be said on the whole to be satisfactory, there is still some reason to consider the result with some reservation. The greatest group of the patients is yet under 30 years, and it may be, perhaps, that the present favourable picture of the result in the following years will be less satisfactory on account of secondary changes in joints and musculature resulting from the special static conditions.

The aim of our reexamination, however, has been not only to ascertain the therapeutic results, but also to throw some light on the questions that are of significance to the indications for the operation and to the operative technique.

It is of interest to compare our results with the results reported from other clinics; but for such a comparison only the results reported by Camitz are suitable. Working up our material after the principles of classification adopted by Camitz and Hass, we then have:

Cripples' Hosp.: L. B. and Dr., unilateral dislocation (31 patients): 14 good results, 10 satisfactory, and 7 unsatisfactory.

Camitz: L. B. and Schanz, unilateral dislocation (24 patients): 19 good results, 4 satisfactory, and 1 unsatisfactory.

Cripples' Hosp.: Bilateral dislocation (10 patients): 5 good result, 4 satisfactory, and 1 unsatisfactory.

Camitz: Bilateral dislocation (19 patients): 8 good results, 6 satisfactory, and 1 unsatisfactory.

Considering the groups of good and satisfactory results under one, in cases of unilateral dislocation the Cripples' Hospital has a serviceable result in 79 % of the cases, Camitz in 96 %. For cases with bilateral dislocation the corresponding figures are for the Cripples' Hospital 90 %, for Camitz 76 %. Thus there is no great difference between the two materials, even though the percentages are to be taken with the usual reservation that applies to such small figures.

The size of the osteotomy angle and its constancy are of importance to the stability of the dislocation pelvis; the point of the angle is hardly of any significance as a point of support for the acetabulum, but the size of the angle gives an expression for the degree of adduction of the osseous part above the site of the osteotomy and for the downward turning f the trochanter —be it in the frontal plane, the sagittal or the intermediate. We know that these two factors are of importance to the stability of the pelvis, partly through the support afforded the pelvis by the bony parts above the site of the osteotomy, partly—and this is most important through the activation of the gluteal muscles. Hence the stability of this angle is an important point. We have arrived at the result that after the age of 16 years the angle keeps practically unchanged whereas Camitz thinks that this limit may be set as low as 10 years. On analysis of Camitz' material, however, we find that in the age-group of 0—16 years the osteotomy angle straightened out in 14 out of 23 cases, *i.e.*, 60 %, while in patients who where over 16 years at the time of the operation the angle straightened out only

in 3 out of 7, *i.e.*, 43 %. We think, therefore, it is more reasonable, when possible, to raise the age-limit for osteotomy to 16 years—what will also be in good agreement with the biological laws for the growth of bones.

It has been a disputed question whether osteotomy would be indicated in cases with nearthrosis. Our material shows that it is justified to perform osteotomy when there is good mobility in the nearthrosis; but we must realize that, owing to the mechanical conditions, the mobility will always be impaired (twin-joint!). Still, in future we shall be more reserved in such cases and prefer an osteoplastic operation for support of the dislocated head of the femur, possibly, in cases with marked adduction, combined with a correcting osteotomy.

Several authors have rightly advised against the performance of bilateral bifurcation osteotomy, because the final result was compromised by lowered mobility in both hip-joints. Our material includes 5 patients on whom bilateral L. B. was performed. In 3 of these cases the result was excellent, while it was fairly good in two. This is not an altogether poor result, and, as we have mentioned before, it presumably will be attributable to the circumstance that the L. B. operation here cannot be looked upon as a clear-cut bifurcation osteotomy.

Also Hass has now given up the classical bifurcation osteotomy and prefers a supporting osteotomy, as advokated by Lance and Wattermann. Camitz too has given up the bifurcation osteotomy, but he chose instead the low osteotomy ad modum Schanz.

Our material has shown that a good functional result is dependent upon a truly serviceable anatomical position at the site of osteotomy—and by this we mean an expedient osteotomy angle in the frontal and sagittal planes, with adduction of the proximal fragment, and the distal fragment supporting against the proximal.

Whether these requirements may be met through the technique that has been employed in the Cripples' Hospital, or it may be preferable to adopt the technique given by Lance Jun. or by Wattermann, must depend on which of the methods has

the greatest percentage of faulty results. We have chosen to lower the fault percentage through certain expedient measures as roentgenography during and after the operation, locking osteotomy ad modum Momsen, and prolongation of the period of immobilization.

To us it seems important to lay particular stress upon the angle in the sagittal plane or in the intermediate plane, as by this it is practicable both to activate the musculature of the buttocks and to change the static conditions so that the lordosis is straightened out.

In 1923, at a meeting of the Danish Medical Society. Guildal and Bentzon discussed what type of osteotomy would be the most serviceable. Bentzon recommended the subtrochanteric osteotomy because the shortening was smaller and the mobility better. Guildal preferred the spitting osteotomy because it gave better support and straightened out the lordosis better. It will be warrantable now to assert that the supporting osteotomy offers some advantages to the spitting osteotomy: the mobility is better, and the stability of the pelvis is not inferior to that obtained by spitting osteotomy.

Our material includes a few cases in which, in spite of an expedient osteotomy angle, there is still a so considerable degree of muscular insufficiency that the mechanical elongation of the muscles is not adequate. In doubtful cases, therefore, it is essential before the operation to pay attention to the quality (aplasia) of the gluteal muscles and carry out an electrical examination of them before planning the operative technique. In cases where the upward displacement of the trochanter is so great that it does not seem likely that a turning of the trochanter will be sufficient to activate the muscles of the buttock, the activation might be improved by moving of the trochanter ad modum Lexer or Allbee, and an estimation of the quality of the musculature will be decisive in this respect.

SUMMARY

1. After an average observation period of 7 years, reexamination of 41 patients with congenital dislocation of the hip treated

with subtrochanteric osteotomy (bifurcation osteotomy and supporting osteotomy) shows:

Unilateral dislocation in 31 patients: 14 good results, 10 satisfactory, and 7 unsatisfactory.

Bilateral dislocation in 10 patients: 5 good results, 4 satisfactory, and 1 unsatisfactory.

2. There is demonstrated concordance between the anatomically satisfactory osteotomy and the clinically good result.

3. The osteotomy angle is straightened cut in a large percentage of patients under 16 years, and hence a position of overcorrection is advisable in such cases.

4. In our material the percentage of technical faults is too great. The cause of this is mentioned, and the possibility for an improvement of the technique is discussed.