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COXA VARA INFANTUM[1]

By

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The majority of the works written about this form of coxa vara have treated etiological, roentgenological and therapeutic problems, while relatively few have dealt with the late stage results.—In the following, the chief stress will be laid on an analysis of the clinical and roentgenological late stage results in a series treated by subtrochanteric cuneiform osteotomy.

Of recent years, the theory introduced by *Hoffa* regarding the congenital origin of the varus deformity seems to have been increasingly discarded. The designation coxa vara infantum has, therefore, been suggested; failing a better name, this is to be preferred to the old designation (*Bade, Hilgenreiner, Zimmermann* and others).—*Camitz* and others have pointed out that histological sections from coxa vara infantum *while in development* show resemblance with pictures taken of coxa plana (Morbus Perthes). *Nilsonne* is of the opinion that the varus deformity arises out of an ossification disturbance, which may possibly be caused by an inferiority in the supply of blood during the foetal life. According to *Elmslie,* collum femoris is not fully ossified until the age of about 4 years. During the course of the ossification process, the vessel system is extensively developed and of the greatest importance for the normal course of the ossification. It is, therefore, possible that an irregularity in the circulation arising e.g. through congenital anomalies or in any other way, may bring about disturbances, and that in this connection changes may arise similar to those found at coxa plana.—*Zimmermann* and others assume a congenital enchondralic ossification disturbance as being the cause of the varus deformity.

One may with reason here recall the fact that the pathological process in the collum must be established before the varus position

[1] Synonyms: Coxa vara congenita (Hoffa), developmental coxa vara, coxa vara à fissure verticale.

arises. As far as I know, such a *pre-stage* has never been published, which may have a natural explanation in the fact that there are no clinical symptoms at the stage which brings the patient to a doctor. It is, consequently, not known how long a period there is from the beginning of the process until the first symptoms set in. From the very moment that the varus position arises, the disease has entered into its *manifest stage*. It is only now that the clinical and roentgenological symptoms characteristic of coxa vara infantum appear.

The symptom which brings the patient to the doctor is that of limping. It differs in two respects from the same symptom in coxa plana. In coxa vara infantum the limping is continuous (in coxa plana, at least in its initial stage, nearly always intermittent) without any pain, while in coxa plana the patient practically always has pain.—In my series, the average age at which the symptoms have set in has been 3,3 years. In all cases, the patient has been able to walk without trouble until he has begun limping.

According to the degree of the varus position of the collum femoris, a greater or smaller displacement upwards of the trochanter major is obtained with a relative shortening of the femur and a positive Trendelenburg as a sign of insufficiency in the gluteal muscles. Even if it has been possible to make the diagnosis by means of anamnesis and clinical examination, it is only the roentgenological examination that gives the definite reply.

According to the classic description, the roentgenological picture is characterized by a varus position of the collum and by the so-called vertical fissure. This, however, is the picture of *the fully developed coxa vara infantum*. It does not seem to have been generally observed that the varus position and the vertical fissure represent two phases in the manifest form of the deformity. The primary is the varus position. The vertical fissure does not arise until the varus position has reached a certain degree. There does not seem to be any reason to doubt that the fissure is an insufficiency fracture, which, at a later stage, may proceed to a real pseudarthrosis. *Pauwels* also emphasizes that with increasing bending of the collum a cutting force ("Scherbeanspruchung") is added, which, together with the bending moment which occurs first and brings about the varus position, not only hinders the new formation of bone but also has as a consequence, a continuous breaking down of the bony trabeculae in the collum. With increasing deformity, the influence of the two detrimental moments increases. We may, therefore, agree with *Pauwels* that coxa vara infantum is a weight-bearing deformity.

The triangular fragment which is considered to be so extraordin-

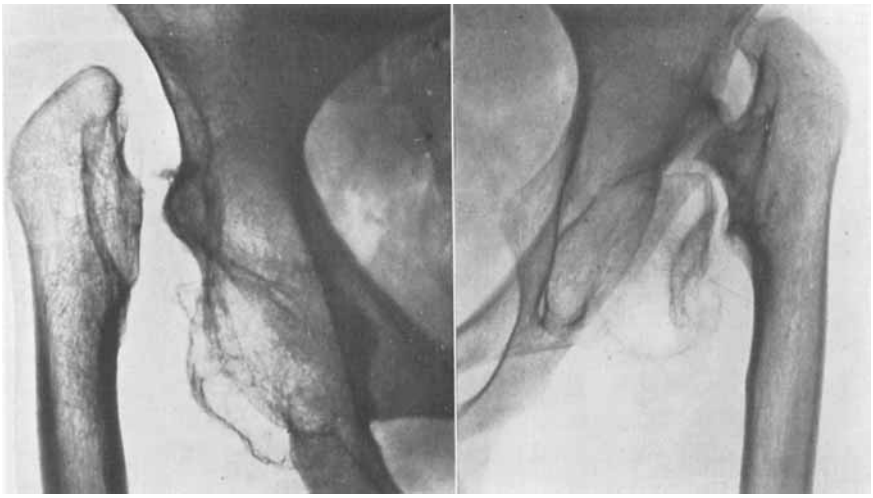

Fig. 1.
Man, 35 years. Bilateral coxa vara infantum. Collum is entirely resorbed. Complete separation between caput and collum. Caput, atrophic and derformed, remains in the shallow acetabulum.

arily characteristic of coxa vara infantum, but which it is not always possible to find clearly developed, is limited medially by the epiphyseal line and laterally by the fissure. The course of the latter is vertical, while the epiphyseal line in the beginning runs more or less horizontally, taking, in the final stages of the development of the deformity, the same direction as the fissure. In some cases, in the final stage, the epiphyseal line and the fissure may be united, whereby the triangular fragment, which possibly has existed previously, has dissolved and a real pseudarthrosis has arisen. If the condition remains unchanged after therapeutic measures, the connection within the pseudarthrosis may be entirely dissolved, and, as a final stage, a total separation of caput from collum results (Fig. 1). Simultaneously with the process described here, a resorbtion of the collum takes place, which may become complete. In this respect, consequently, the same conditions are encountered as so often exist at a pseudarthrosis after a medial collum fracture.

The logical treatment of coxa vara infantum is by subtrochanteric cuneiform osteotomy, the purpose of which is to restore the neck-shaft angle to its normal extension. *Schanz* seems to have been the first to use this operation consistently in order to reconstruct the neck-shaft angle. This method of treatment is also predominant in the therapeutic part of the literature.—After the operation the changes in the collum

TABLE 1
67 patients with 85 cases of coxa vara infantum.

		Bilateral	Unilateral		Summa	
			Right	Left		
After-examined	Operated cases	10 (In 3 cases only one side operated)	13	17	40	51
	Non-operated	4	2	5	11	
Non-after-examined	Operated cases	3	4	6	13	16
	Non-operated	1	–	2	3	
		18	19	30	67	

recede remarkably rapidly. In some cases, the vertical fissure is consolidated even before weight bearing of the hip.—Other methods of treatment were tried earlier but have not given good results. Among other methods, extension treatment has been used, and also osteosynthesis with tibia graft or boring (*Le Mesurier, Horwitz,* and others). Intra-articular incisions (osteotomy on the collum) has, according to unanimous statements, given bad results (*Erlacher*). In late stage cases, when a pseudarthrosis has already been established, other methods of operation have ben used, such as osteotomy ref. *McMurray* or Brackett's operation (*Langenskiöld*).

All cases that are included in this material and which have undergone operative treatment, have, with one exception, been treated with subtrochanteric cuneiform osteotomy. Osteosynthesis with thread has been used in a few cases. Plaster cast has been applied after the operation with the operated hip in sufficient abduction position to establish a good contact between the osteotomy surfaces. After an average time of 4–5 weeks, the abduction position is reduced, and after a further few weeks the walking exercises are commenced.—In some cases, especially the older age ones, the osteotomy is completed with subcutaneous abductormyotomy.

The series presented above was treated in the Orthopaedic Clinic of the Caroline Institute, Stockholm, during the years 1927–1941. The material comprises altogether 85 hips with coxa vara infantum, the number of patients being 67 (table 1). 52 patients with a total of 65 changed hips have been after-examined. 47 hips have been operated on and are described in detail in table 2.

The average age on the occasion of the operation and of the after-examination is 10.9 and 27.3 years respectively. *The average duration of the observation time is, consequently, 16.4 years.* The average age

TABLE 2

Case no.	Journal no. and year	Sex	Age at operation	Age at after-examination	Side	Neck-schaft angle before operation	Neck-schaft angle at after-examination	Trendelenburg's sign before operation	Trendelenburg's sign at after-examination	Functional group	Roentgenanatomical group	Leg-shortening		Remarks
												a) Before operation	b) At after-examination	
1	10957 1926	♂	10	30	Left	62	110	+	+	2	2	3	1.5	
2	11446 1927	♀	9	30	Left	85	105	+	—	1	2	2	0	
3	12618 1927	♀	12	33	Left	72	137	+	—	1	1	3	1	
4 a	13379 1928	♂	18	28	Right	56	125	+	—	2	1	2	0	
4 b	„		Non-oper.		Left	79	–	+	—			–	0	
5	13774 1928	♀	11	31	Left	77	142	+	—	2	1	2	3	
6	13867 1928	♂	7	27	Left	85	135	+	—	1	1	2	0	
7	14389 1929	♂	6	25	Right	95	120	+	—	2	1	2	1	
8	15614 1929	♂	13	33	Left	65	104	+	—	1	2	2	2.5	

9	16419 1929	♂	20	39	Left	51	81	+	—	2	3	4	7	
10 a	17010 1929	♂	11	30	Right	83	128	+	—	2	2	–	0	
10 b	„		11		Left	50	105	+	?	2	2	1	1	
11	17126 1929	♂	7	26	Left	93	142	+	—	1	1	2	0	
12 a	16523 1930	♀	3	21	Right	107	137	+	—	1	1	1	0	
12 b	„		3		Left	110	120	+	—	1	1	–	0	
13	18916 1930	♂	3	21	Left	99	145	+	—	1	1	1	0	
14 a	19082 1930	♀	8	26	Right	62	95	+	—	1	3	0	0	
14 b	„		8		Left	43	69	+	—	1	3	0	0	
15 a	20031 1931	♂	Non-oper.	33	Right	90	Not measurable			3	3	1	0	
15 b	„		16		Left	90	Not measurable	+	+	3	3	0	0	
16	20438 1931	♂	17	34	Right	*	Not measurable	+	+	3	3	8	13	* Complete separation of the caput from the neck
17	21493 1931	♀	4	21	Right	75	127	+	—	1	3	2	0	
18	23744 1932	♂	6	32	Left	76	120	+	—	1	3	4	1	

TABLE 2 (cont.)

Case no.	Journal no. and year	Sex	Age at operation	Age at after-examination	Side	Neck-shaft angle before operation	Neck-schaft angle at after-examination	Trendelenburg's sign before operation	Trendelenburg's sign at after-examination	Functional group	Roentgenanatomical group	Leg-shortening		Remarks
												a) Before operation	b) At after-examination	
19 a	5641 1932	♀	20	29	Left	39	Not measurable	+	—	1	3	1	1.5	Osteotomy ad mod. McMurray
19 b	„		30	29	Right	54	„	+	—	1	3	–	0	
20	26039 1932	♂	10	26	Right	63	118	+	(+)	2	1	3	2	
21 a	26330 1932	♂	7	23	Right	•	135	+	—	2	2	1	0	* Roentgen-pictures are lacking
21 b	„		Non-oper.		Left	93	115	—	—	–	–	–	0	
22	26573 1932	♀	14	30	Right	73	138	+	—	2	3	3	2.5	
23	27131 1933	♀	12	28	Right	50	97	+	(+)	2	3	4	1.5	
24	27896 1933	♂	21	36	Left	83	112	+	+	2	2	3	3	
25	28599 1933	♀	10	25	Left	53	117	+	—	2	1	1.5	2	
26	29883 1934	♂	15	30	Right	Not measurable	Not measurable	+	+	1	3	10	?	Complete separation of the caput from the neck
27	30109 1934	♂	10	24	Right	75	128	+	—	2	1	3.5	2	

28	30188 1934	♂	14	29	Right	44	100	+	—	2	3	3	6
29	31299 1934	♀	15	29	Left	85	145	+	—	1	1	4	0
30	31494 1934	♂	9	23	Right	94	Not measurable	+	—	1	2	5	3.5
31	31547 1934	♂	15	29	Left	62	135	+	—	2	3	?	9
32	32860 1935	♀	7	19	Left	81	110	+	(+)	2	1	1.5	1
33	33590 1935	♂	8	21	Left	74	120	+	—	1	2	2	0
34 a	34481 1935	♂	8	21	Left	79	138	?	—	1	1	?	0
34 b	„		12		Right	79	140	?	—	1	1	–	0
35	35287	♂	10	21	Left	91	142	+	—	2	1	1.5	0
36 a	2458/36	♂	16	28	Left	46	140	(+)	—	2	3	2	0
36 b	„		16		Right	76	133	(+)	—	2	3	–	1.5
37	572/38	♀	11	21	Right	75	117	+	—	2	2	2	4.5
38	2928/38	♀	3	13	Right	70	111	—	—	1	1	2	0
39 a	3186/40	♂	12	20	Left	60	145	+	—	1	1	–	0
39 b	„		13		Right	66	123	+	—	1	1	–	0
40	3851/40	♀	5	13	Right	70	121	+	—	2	2	1	5

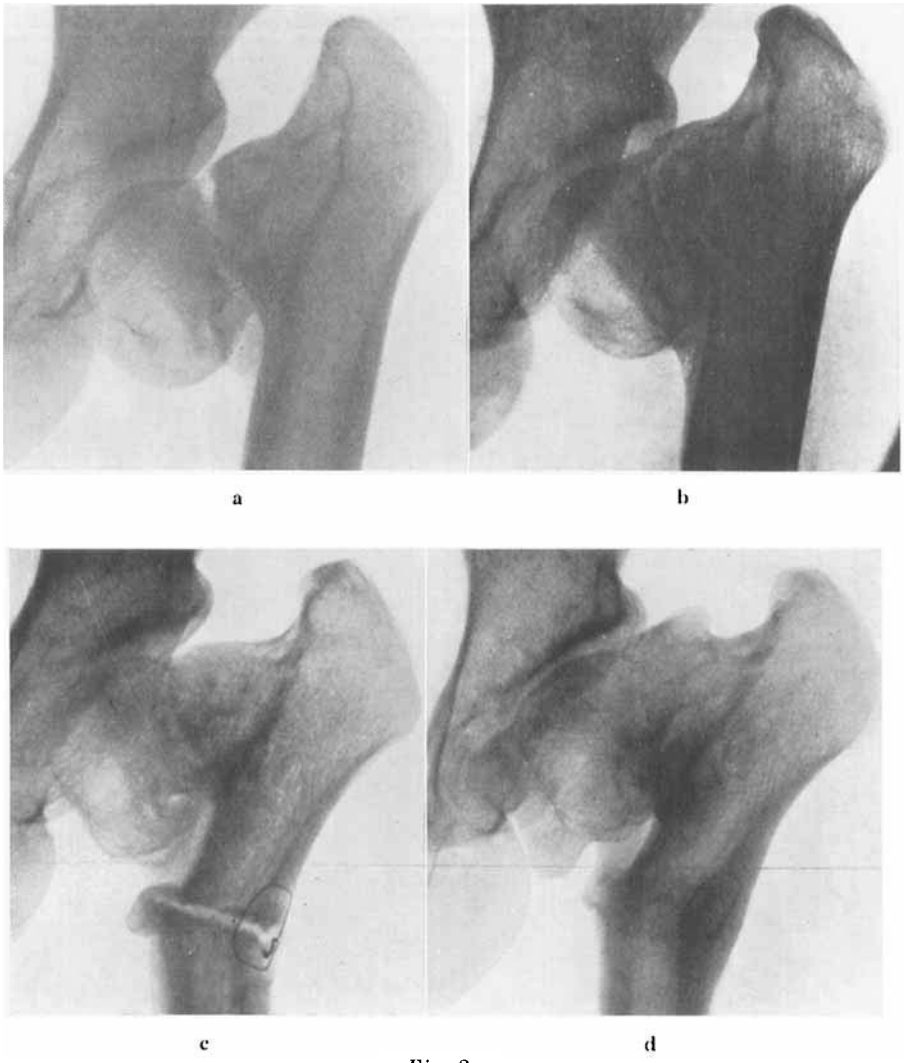

Fig. 2.

Case 19 (Table 2). Case operated on adult age (right side). a) Roentgen photo at the age of 20. b) Roentgen photo 7 years later shows an approximately unchanged picture. Possibly, there are signs of healing of the fissure. c) Roentgen photo at the age of 29, two months after the operation. Still considerable varus position. d) Roentgen photo at the age of 36, seven years after the operation. Considerable deformation of caput, possibly as a consequence of the changed weight through the osteotomy. The fissure is healed.

on the occasion of the first examination, when the diagnosis coxa vara infantum was made, is 6 years. Consequently, an average of 4.9 years passed before the operation was made. This is a fact to be borne in mind when judging the late stage results.

ROENTGENOLOGICAL CHANGES IN OPERATED CASES

Even though it is possible to reconstruct the collum shaft angle by a subtrochanteric cuneiform osteotomy, there are, as was established at the after-examination in the caput, collum and acetabulum some changes which, primarily or secondarily, can be referred to the pathological process in the collum and to the varus deformity. Before passing over to the clinical and general roentgenological late stage results, I will give a report on these changes, mainly dwelling upon the permanent changes in the operated cases of which I have not previously found any description, and describing only briefly such changes as are found in untreated cases, for these latter, contrary to the former cases are well known.

a) *Changes in collum.*

In all cases, a shortening of the collum of the affected side was proved to exist at the after-examination. In some cases (Fig. 5 and 6) the shortening was very inconsiderable, but in all other cases of a very remarkable size. The shortening of the collum is most obvious in the cases which have been operated on at a late stage (Fig. 2–4). In some cases it is not possible to see that any growth has taken place. These growth disturbances in the collum cannot be explained in any other way than *that the primary changes in collum have influenced the epiphyseal line, and this to such an extent that the increase in length has been hampered or has entirely ceased.* Even if, in the roentgenologically early stages, the epiphysis line can be regarded as intact, the pathological process itself (or its origin) must unfavourably influence the osteogenetical activity. There is no other explanation of the hampered increase in length.—In cases where the collum is maintained, an increased growth in width has been established (Fig. 5 and 6).

The shortening in the collum must imply an insufficiency in the gluteal muscles, and, in consequence of this, an impairment of the functional result, to which I will revert later.

b) *Changes in caput.*

The predominant caput change is the deformation, which can appear at a rather early stage. In these cases, the caput has, during the development of the process, an obvious bone atrophy (Fig. 3 and 4). It is probable that this atrophy results in reduced strength whereby a deformation easily arises. In other cases, the deformation sets in at a later stage, when the individual has grown up. In all cases with de-

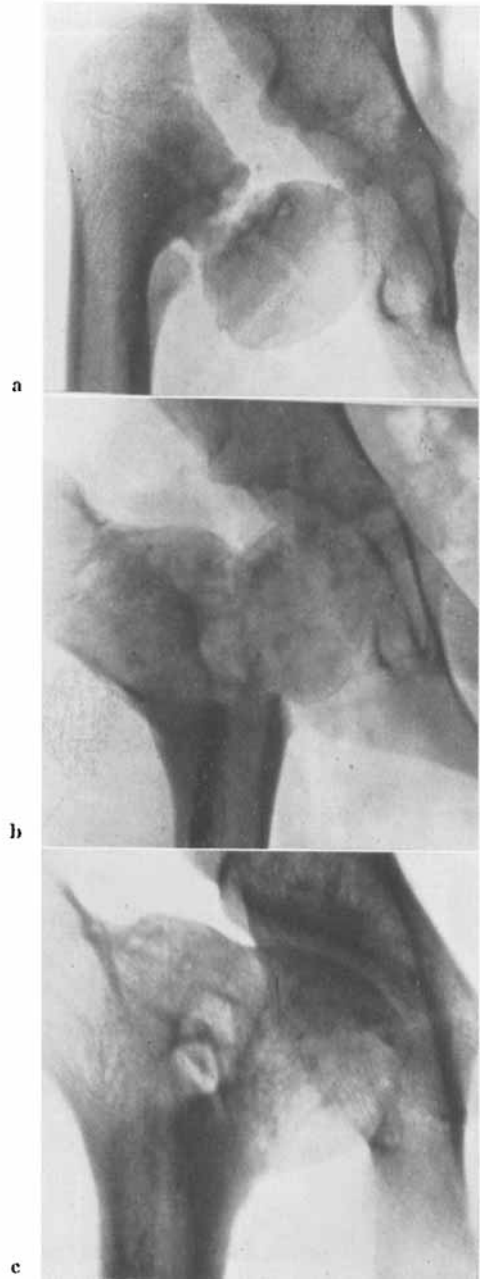

Fig. 3.

Case 10 (Table 2). Late operated case (left side). a) Roentgen photo at the age of 11. Pronounced varus position, almost entirely resorbed collum and a shallow acetabulum. b) Roentgen photo 5 months after the operation. c) Roentgen photo 10 years after the operation. Collum is practically entirely missing, and caput is directly attached to the femur shaft. Caput small and deformed, acetabulum shallow.

formation of the caput it is proved that, where it has been possible to bring about a normal neck-shaft angle after the operation, the deformation has been very inconsiderable, or there has been no deformation at all, but where the angle is smaller than the normal one, a deformation arises which is mainly located in the lower parts of caput, where a lip- or covering like a parrot's beak has occurred (Fig. 5). This change may, in certain cases, be similar to the one found after an epiphysiolysis capitis femoris. It is also reasonable that this should be so, since, in both cases, it is a question of a changed caput weight bearing with an approximately similar direction. (Regarding the frequency of the deformation, cf. p. 18 a. 20).—In some cases it is found that caput has lost its normal spherical shape and become more flattened.—Signs of caput necrosis have not been found in any case.

c) *Changes in acetabulum.*

In practically all cases followed up it has been proved that the acetabulum is more shallow than usual. An obvious correlation between the depth of the acetabulum, on the one hand, and the size of the neck-shaft angle and the length of collum, on the other hand, exists, in that the more normal the angle and the more the length of collum approaches the normal length, the better developed is the acetabulum, and vice versa (compare Fig. 3 and 4 with Fig. 5 and 6). Under unfavourable conditions, the acetabulum can, during growth, become increasingly shallow (Fig. 4). The fact is probably that an unphysiological neck-shaft angle and a shortened collum do not exercise the formative influence which can prevent a continuous levelling of the acetabulum.

To complete the picture of a *fully developed coxa vara infantum* the following should be added to the roentgenological symptoms already known—the varus position and, possibly, the vertical fissure—: 1) *a shortened collum,* 2) *a more or less deformed caput,* and 3) *a shallow acetabulum.*

We find, consequently, that the definite changes in caput, collum and acetabulum as described here originate at the same time as the varus deformity develops, and that the longer the process continues undisturbed, the more characteristic will the changes be. Once established, it is not possible to affect them. The only thing we can achieve is a restitution of the neck-shaft angle. *The earlier this restitution takes place during the course of the pathological process, the less characteristic will the changes be in the parts concerned of the hip joint, and the better will the functional results be in the long run.* In the event

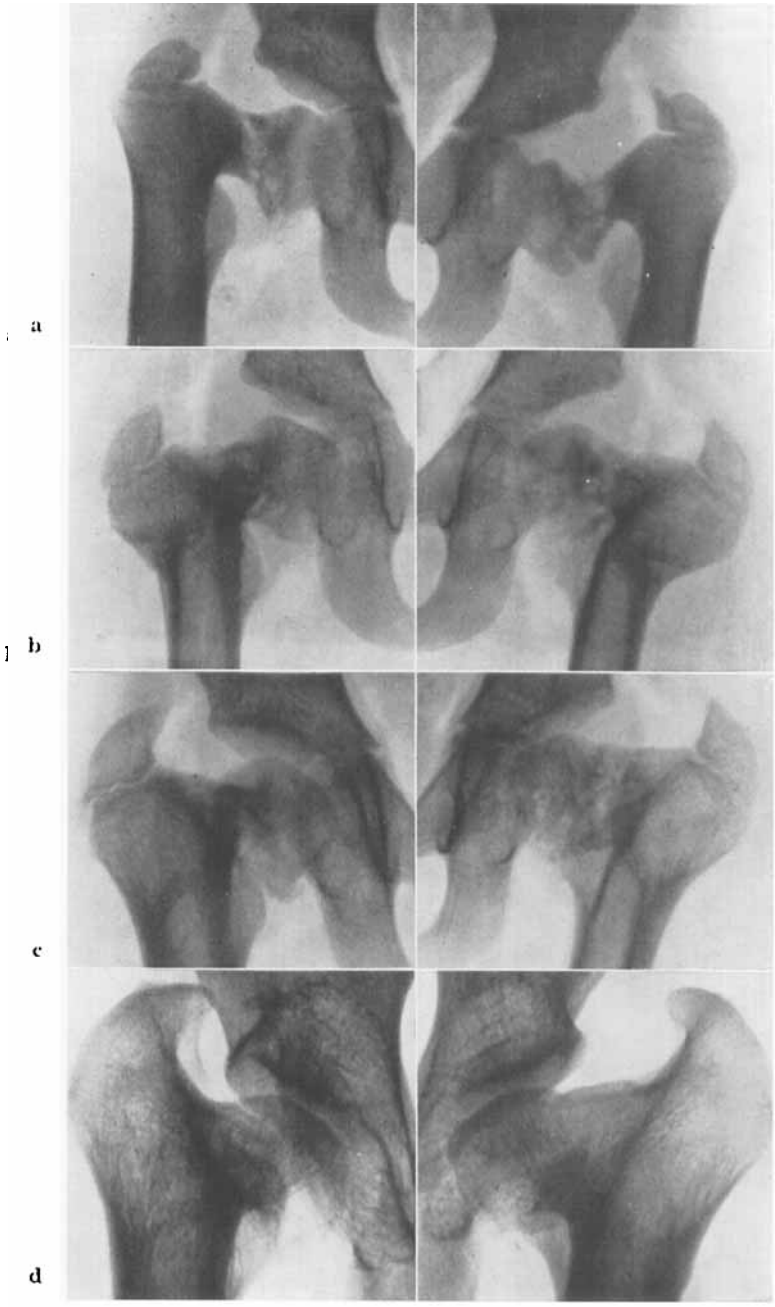

Fig. 4.

Case 14 (Table 2). a) Considerable varus position bilaterally (roentgen photo at the age of 8 immediately before the operation). b) Roentgen photo 5 months after the operation. Collum-shaft angle not completely reconstructed. c) Roentgen photo 2 years after the operation. Caput and collum pass into each other without any sharp limit. Collum greatly shortened. Acetabulum clearly shallower than in the preceding pictures. d) Roentgen photo 18 years after the operation.

of late operations on cases with a deformed caput, considerable disparity can result owing to the changed position of the caput in the acetabulum after an osteotomy. Such a disparity can give rise to pain and limitation in movement.

ROENTGENOLOGICAL CHANGES IN THE NON-OPERATED SERIES

It has been pointed out previously (page 2–3) how a pseudarthrosis can arise unless the treatment is commenced at the right time, and how a complete separation of caput from collum can result. In those cases where this occurs, a practically complete resorbtion of the collum has also resulted. The caput becomes heavily atrophic and deformed and without function. In this connection, the acetabulum becomes very shallow. The femur shaft is more or less pulled upwards (Fig. 1).—In certain cases, the collum fissure can heal, and a very marked varus position of the collum is often the consequence. In these cases also the caput is heavily deformed and the acetabulum shallow.

CLINICAL AND ROENTGENOLOGICAL AFTER-EXAMINATION OF THE OPERATED SERIES

The material operated on has, from the functional as well as the roentgenanatomic point of view, been divided into 3 groups.

Functionally. In the first functional group 19 patients have been placed with a total of 24 hips, subjectively entirely free from symptoms, and objectively without any trouble in walking whatsoever, and with a negative Trendelenburg. No limitation of the working capacity. In group II 19 patients have been placed with 23 hips; these have had slight subjective symptoms after exertions, but have been able to do even heavy work. No objectively obvious limping and no or slightly suggested positive Trendelenburg. In group III, finally, 2 patients have been placed, one bilateral with subjective symptoms even after minor exertions, and with objective limping and positive Trendelenburg.

It was pointed out above that all changes characteristic of coxa vara infantum increase with age. With regard to the size of the neck-shaft angle in various age groups, this can be easily shown (table 3). It is, therefore, probable a priori that the bad results are to be found in cases the treatment of which has commenced at a relatively late age. It is also evident that the average age on the occasion of the operation is lowest in group I, viz. 9.9 years, and somewhat higher in group II, viz. 12.0 years. (Group III contains only 2 operated cases, with an aver-

TABLE 3
Mean values of the neck-shaft angle before operation.

Age	Value of the angle
0– 6	88
7–12	74
13–18	57
19–30	56

TABLE 4
Functional Results.

Group	No (patients)	Average Age	
		At operation	At after-examination
I	19	9.9	24.9
II	19	12.0	27.0
III	2	16.5	33.3

TABLE 5
Mean values of the neck-shaft angle before operation and at after-examination in different functional groups.

Group	Value of the neck-shaft angle	
	Before operation	At after-examination
I	76.3	125.0
II	69.5	121.8
III	–	–

age age of 16.5 years). The corresponding conditions are established at the after-examination (table 4). When measuring the neck-shaft angle in the various functional groups, analogous conditions are, therefore, also found. For instance, the average value of the neck-shaft angle in group I before the operation was 76°, in group II 69°, and at the after-examination 124° and 121° respectively (table 5). There is, certainly, no statistically significant difference between the various groups, either as regards the average ages or the average values of the neck-shaft angle, but the tendency is obvious.

Naturally, several different factors affect the functional result. Among these, the restitution of the neck-shaft angle must be placed first. The presence and the absence respectively of the Trendelenburg sign is a good gauge of the extent to which this restitution has succeed-

TABLE 6

Trendelenburg's sign before and after operation in different functional groups.

	Group I		Group II		Group III	
	Before operation	At after-examination	Before operation	At after examination	Before operation	At after-examination
Positive Trendelenburg's sign ...	20	1	21	2	3	3
Doubtful Trendelenburg's sign ...	–	–	2	4	–	–
Negative Trendelenburg's sign ...	1	22	1	18	–	–
	21[1]	23	24	24	3	3

[1] In two cases in group I (34 a and 34 b) there was no information about Trendelenburg's sign before operation.

ed. In table 6, the existence of Trendelenburg's sign before the operation and at the after-examination has been statistically assembled for the various functional groups. It shows that in group I there was at the after-examination one case with a positive Trendelenburg's sign, and that in group II, two cases had a positive Trendelenburg. In 4 cases of group II the Trendelenburg symptoms were uncertain. In all, 45 cases[1] had a positive Trendelenburg before the operation, and at the after-examination 40 cases had a negative Trendelenburg. *The purpose of the operation, viz. to regain pelvic stability, has, consequently, been attained with nearly 90 % success.*

A potential caput deformation, a shallow acetabulum and an already developed arthrosis deformans also play a great part in the functional result, particularly when these changes give rise to pain on movement, malposition in the hip joint or limited mobility. It has been proved that only 10 patients with a total of 10 operated hips had limitation of mobility or malposition to a considerable extent. 3 of these belong to functional group I, 6 to group II and 1 to group III. The average age of these patients at the operation was 12 years, and at the after-examination somewhat more than 28 years. For all other patients, the corresponding average values were 10 and 26 years respectively. These figures point to an impairment risk increasing with the years.

Through the varus position and the shortening of the collum a leg shortening arises, which, in a more marked degree, can have a disturbing effect on the functional result. At the after-examination it proved that the two legs were equally long in 8 of the unilateral cases, and in

[1] In two cases (34 a and 34 b) there is no information on Trendelenburg's sign before the operation.

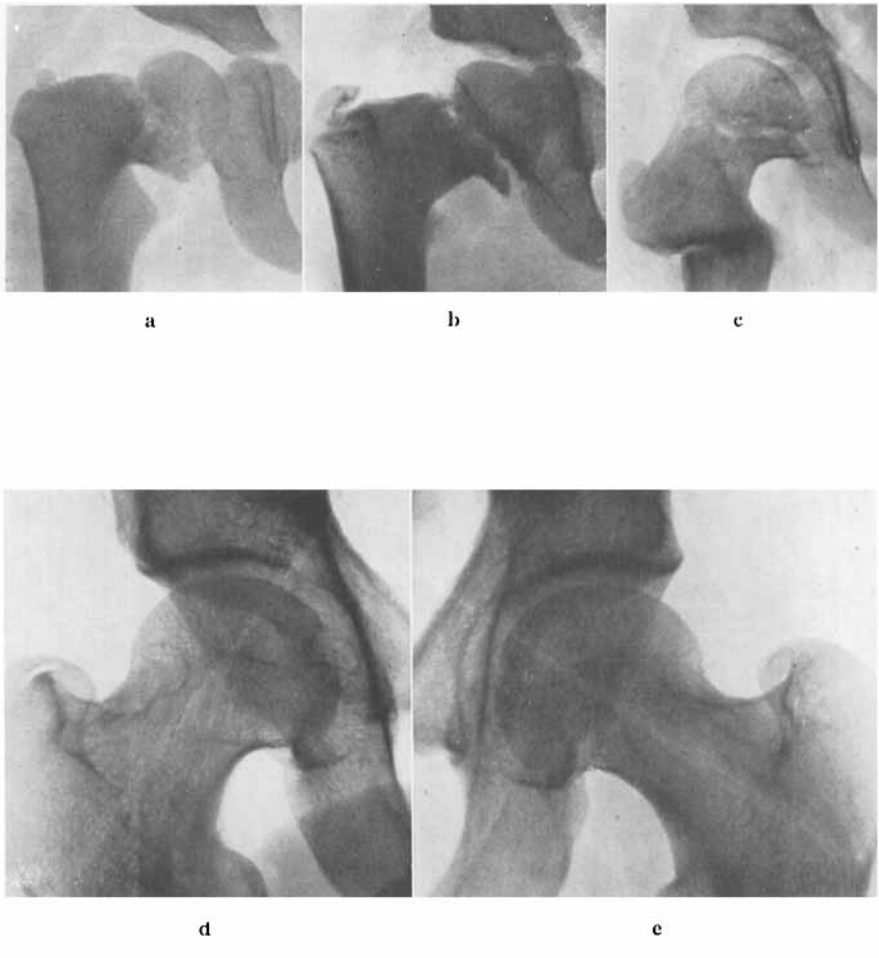

Fig. 5.

Case 11 (Table 2). a) Roentgen photo at the age of 5. Rather pronounced varus position with clearly triangular fragment. b) Roentgen photo 2½ years later. Varus position about the same as before. On the other hand, within its lateral area the triangular fragment has healed onto collum. A remainder of the fragment is the tap-shaped enlargement of the medial-lower part of collum. The fissure remains and converges entirely with the epiphysis line. c) Roentgen photo at the age of 8 and 2 months after the operation. Collum now stands in valgus. d) Roentgen photo 19 years after the operation. Collum short and increased in width. Initial deformation of caput clearly visible within its lower area. This typical deformation of the caput arises through the fusion of the tap-shaped enlargement on collum and caput. e) Roentgen photo of the sound side.

7 of the bilateral ones. There was an inconsiderable leg shortening (1–1.5 cm) in 9 cases (3 of which bilateral), and a moderate leg shortening (2–3 cm) in 9 cases, all of which were unilateral. Finally, in 6 cases, all of which were unilateral, there was a considerable leg shortening (in one case up to 13 cm). All of the last-mentioned cases are roentgenologically bad, all belong to roentgenological group III, and throughout they were operated on at a relatively late age, when considerable changes already existed.

ROENTGEN-ANATOMIC LATE STAGE RESULTS

As mentioned before, the material has also been divided into 3 groups with regard to the *roentgenological late stage result.* In the roentgenological group I have placed 21 hips which have had a normal or nearly normal collum shaft angle, the lower limit set at 110°. The caput has been without or with only very insignificant deformations, and there has been no deforming arthrosis. In group II 10 hip joints have been placed with the neck-shaft angle varying between 110° and 90°. The caput has been slightly to moderately deformed, and there have been slight signs of arthrosis deformans. To group III, finally, belong 17 cases, which have a coxa vara with an angle smaller than 90°, with a badly developed collum, and with a marked arthrosis deformans.—In respect of the roentgenological groups also, the cases belonging to group I have the lowest average age, the cases belonging to group II are somewhat higher, while those belonging to group III have the highest average age (table 7). With regard to the principle for dividing the cases into the different roentgenological groups, the neck-shaft angle at the after-examination was greater in group I than in the other groups. This, however, also refers to the values before the operation, and the differences between the values in the various groups are statistically significant.

TABLE 7

Average age at operation and at after-examination in different roentgen-anatomical groups.

Group	No.	Average Age	
		At operation	At after-examination
I	21	9.0	24.1
II	10	10.5	26.0
III	17	14.4	29.7

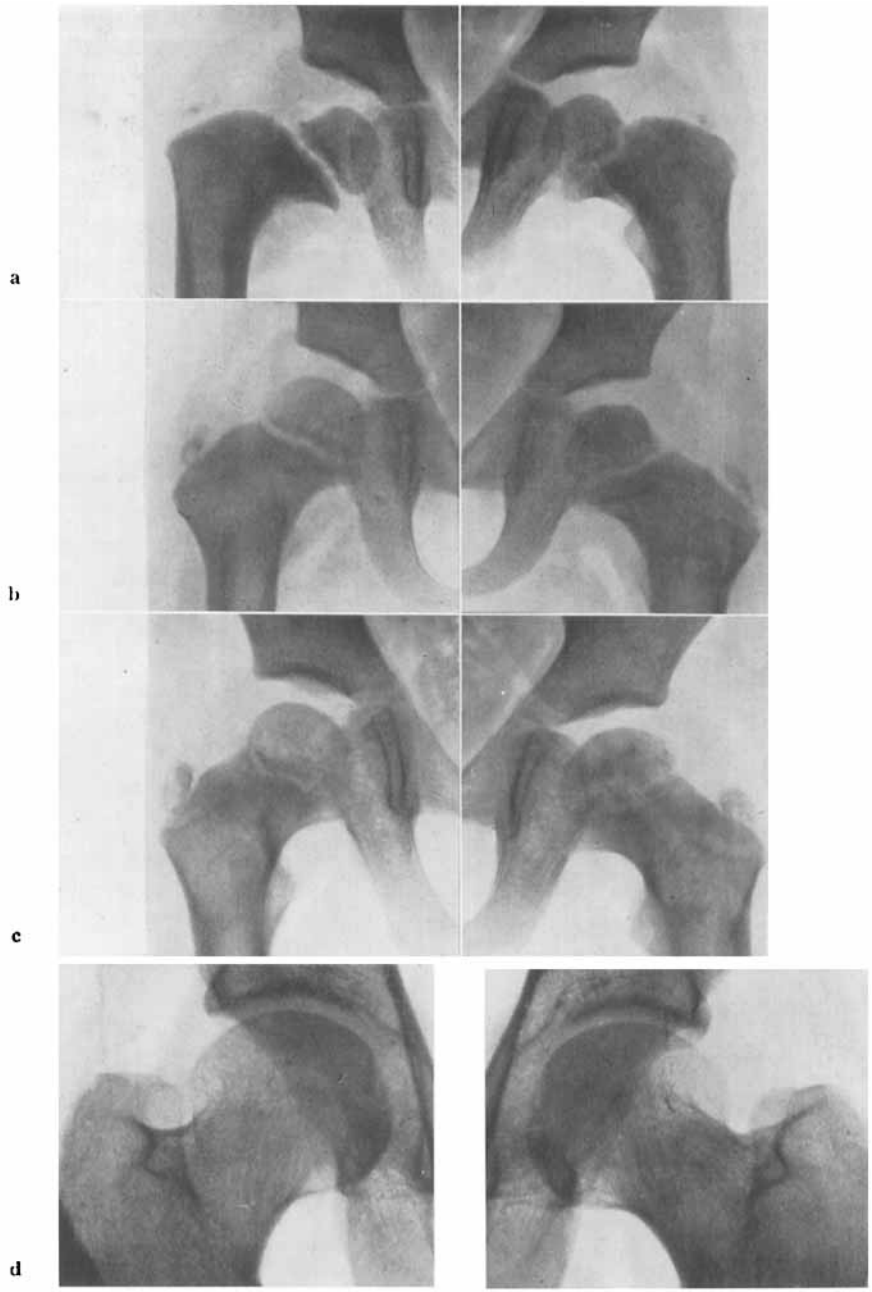

Fig. 6.

Case 12 (Table 2). Early operated case. a) Roentgen photo at the age of 3 (immediately before the operation). Rather pronounced varus position. Collum shorter than normal, especially pronounced on the left side. b) 4 months after the operation. Good reconstruction of the collum shaft angle. c) 2 years after the operation. d) 18 years after the operation. Short collum bilaterally. Well maintained shape of caput and almost normally deep acetabuli.

The average value of *the neck-shaft angle before the operation* was for all cases 73°, and *at the after-examination* 122°, thus a value that can be regarded as normal for a grown-up individual. When measuring on roentgen pictures taken *immediately on operation,* an average value of 126° is obtained. The difference between this value and the after-examination value (122°), however, lies within the limits of error of the measuring method. A detailed examination shows, however, that a certain reduction of the neck-shaft angle takes place during the period between the operation and the after-examination (table 8).— A more complete picture of the conditions before and after the operation, as well as at the after-examination, is obtained by indicating the quartile or median values (table 9). As is seen from the table, 50 % of the cases before the operation had a collum-shaft angle smaller than 74°, thus a considerable varus position, and at the after-examination 50 % of the cases had an angle smaller than 125°. The figures in table 9 also confirm that a reduction of the collum shaft angle takes place between the operation and the after-examination. The material does not give any exact information regarding the cause of this. Probably, the reduction takes place during the period after the patient is allowed to be out of bed postoperatively.

TABLE 8

Values of the neck-shaft angle before operation, immediately after operation and at after-examination.

Value of the angle	Before operation	Immediately after operation	At after-examination
30– 49	4		
50– 69	12		1
70– 89	19		1
90–109	8	4	6
110–129		17	17
130–149		16	16
150–169		3	

TABLE 9

Quartiles and median values of the angle of the neck with the shaft.

	q 1	Med	q 3
Before operation	62	74	83
Immediately after operation	120	129	138
At after-examination	113	125	136

There is no parallelism between the functional and the roentgenological results. It has been necessary to place no less than 7 cases of functional group I in roentgenological group III, and 7 cases of roentgenological group III have been placed in functional group II. That this is the case is due to the fact that the patients are relatively young, and, therefore, still have a rather good muscular function which allows them exertions that may perhaps be impossible in 5–10 years, when the changes, which appear on the roentgen picture as early as this age, have increased further.

CONCLUSIONS

1) Besides the long familiar and characteristic roentgenological changes, there can be found at coxa vara infantum even at a relatively early stage of the development of the disease: a) deformation of caput, b) a shortened collum, and c) a shallow acetabulum.

2) The subtrochanteric cuneiform osteotomy is the logical form of treatment. The earlier the operation is performed, the less progress the changes reported above can make, and the better will be both the functional and the roentgenological late stage result.

SUMMARY

At the Orthopaedic Clinic of the Caroline Institute in Stockholm, 67 patients with coxa vara infantum, totalling 85 affected hips, were treated during the years 1927–1941. 51 patients with a total of 65 changed joints were examined clinically and roentgenologically, from which 47 hips were operated on by subtrochanteric cuneiform osteotomy (table 1). The most important results of the examination appear to show that even at an early stage there are, in addition to varus position and possibly a vertical fissure, roentgenologically probable deformations of the caput, a shortened collum and a shallow acetabulum. The deformation of the caput may progress with increasing age, and so may the shallowing of the acetabulum. These changes are most marked in the non-operated cases, where a complete resorbtion of collum and a complete separation of caput from femur may result.

At the after-examination, the cases operated were divided into 3 functional and 3 roentgenological groups. In the functional group I placed 19 patients with 24 hips, who were subjectively entirely free from symptoms and objectively without limping, and also had a negative Trendelenburg's sign; in group II 19 patients with 23 hips were placed. These had slight subjective symptoms after exertion, but

were able to do even heavy work. In the functional group III, I placed only 2 patients, with subjective symptoms even after slight exertion, and with a positive Trendelenburg sign.—In the roentgenological group I placed 21 hips which had normal or nearly normal collum-shaft angle, the lower limit set at 110°. The caput has been without or with very insignificant deformations, and there was no arthrosis deformans. In group II I included 10 hip-joints with a collum-shaft angle varying between 110° and 90°. The caput was slightly to moderately deformed, and there were slight signs of arthrosis deformans. To the roentgenological group III, finally, 17 cases were assigned which had coxa vara with an angle smaller than 90°, with badly developed collum and with a marked arthrosis deformans.—In 90 % of the cases operated, the positive Trendelenburg's sign existing before the operation became negative.

It is important that the cases are operated on as early as possible, since the above-mentioned changes in collum, caput and acetabulum are thus prevented.

RESUME

A la Clinique Orthopédique de l'Institut Caroline à Stockholm 67 malades atteints de coxa vara infantum avec 85 hanches malades ont été en traitement entre 1927 et 1941. 51 malades, avec au total 65 articulations modifiées ont été réexaminés cliniquement et radiologiquement. Parmi ceux-ci 45 hanches ont été opérées par ostéotomie cunéiforme subtrochantérienne (tableau 1). Le plus important résultat de cet examen a été la constatation que déjà à un stade précoce il y a, en plus de la position varus et d'une éventuelle fissure verticale, des déformations de la tête, apparentes à la radiographie et une cavité plus profonde. La déformation de la tête peut progresser avec l'âge et il en est de même de la profondeur de la cavité. Ces modifications sont particulièrement marquées dans les cas non opérés et peuvent aboutir à une résorption du col et à une complète séparation de la tête et du corps de l'os.

A la réexamination, les cas opérés ont été divisés en 3 groupes fonctionnels et 3 groups radiologiques. Dans le groups fonctionnel I ont été placés 19 malades avec 24 hanches, ceux-ci étant libres de symptômes subjectifs et objectifs, sans boîterie et avec le signe de Trendelenburg négatif. Dans le groupe II ont été placés 19 malades avec 23 hanches, ressentant quelques symptômes après les exertions, mais cependant capables de fournir un travail même dur. Dans le groupe fonctionnel III n'ont été placés que deux malades présentant

des symptômes subjectifs même après de légères exertions, et avec le signe de Trendelenburg positif. — Dans le groupe radiologique I, se trouvaient 21 hanches chez lesquelles l'angle col-corps de l'os était normal ou presque normal, la limite inférieure ayant été fixée à 110°. La tête était sans déformation ou avec des déformations insignifiantes. On avait placé dans le groupe II 10 articulations de la hanche chez lesquelles l'angle col-corps de l'os variait entre 110 et 90°. La tête était légèrement ou modérément déformée et il y avait des signes de légère arthrose déformante. Enfin, dans le groupe radiologique III se trouvaient 17 cas de coxa vara avec un angle inférieur à 90°, au col mal développé et montrant une arthrose déformante prononcée. Dans 90 % des cas opérés, le signe positif de Trendelenburg, qui existait avant l'opération, est devenu négatif.

Il est important que ces cas soient opérés le plus tôt possible afin de prévenir les modifications ci-dessus mentionnées dans le col, la tête et la cavité.

ZUSAMMENFASSUNG

An der orthopädischen Klinik des Karolinen Institutes in Stockholm wurden in den Jahren 1927–1941 67 Patienten mit coxa vara infantum, insgesamt 85 erkrankte Hüften behandelt. 51 Patienten mit insgesamt 65 pathologisch veränderten Gelenken wurden mittels subtrochäntarer Keilosteotomie operiert (Tabelle 1). Als das wichtigste Ergebnis der Untersuchung geht hervor, dass bereits in einem frühen Stadium der Erkrankung, abgesehen von der Varusstellung und möglicherweise einer vertikalen Fissur, röntgenologisch Deformierungen des Femurkopfes, eine Verkürzung des Halses und ein flaches Acetabulum nachweisbar sind. Die Veränderung des Kopfes kann ebenso wie die Abflachung des Acetabulums mit fortschreitendem Alter zunehmen. Diese Veränderungen sind am meisten ausgesprochen in den nicht operierten Fällen, wo es zu einer vollständigen Aufsaugung des Collums und einer vollständigen Abtrennung des Kopfes vom Femur kommen kann.

Bei der Nachuntersuchung wurden die operierten Fälle in 3 funktionelle und 3 röntgenologische Gruppen eingeteilt. In die 1. funktionelle Gruppe wurden 19 Patienten mit 24 Hüften einbezogen, die subjektiv gänzlich frei von Symptomen waren und objektiv kein Hinken und ein negatives Trendelenburg Symptom zeigten. In die 2. Gruppe wurden 19 Patienten mit 23 Hüften eingereiht, die leichte subjektive Beschwerden nach Anstrengungen hatten, aber dennoch imstande waren selbst Schwerarbeit zu leisten. In der 3. funktionellen Gruppe be-

fanden sich nur 2 Patienten mit subjektiven Beschwerden selbst nach leichten Anstrengungen und mit einem positive Trendelenburg Zeichen. — In die 1. röntgenologische Gruppe wurden 21 Hüften eingereiht, die einen normalen oder beinahe normalen Hals-Schaftwinkel hatten. Die untere Grenze wurde bei 110° festgesetzt. Der Kopf zeigte keine oder nur sehr geringe Veränderungen und keinerlei Arthrosis deformans war sichtbar. Die 2. Gruppe wies 10 Hüftgelenke mit einem Hals-Schaftwinkel von 110°–90° auf. Der Kopf war leicht oder mässig deformiert und geringere Zeichen einer Arthrosis deformans waren vorhanden. Zu der 3. röntgenologischen Gruppe gehörten endlich 17 Fälle mit coxa vara und einem Winkel kleiner als 90° mit schlecht entwickeltem Collum und ausgesprochener Arthrosis deformans. — In 90 % der operierten Fälle, wurde das vor der Operation bestehende positive Trendelenburg Zeichen nach derselben negativ.

Es ist von grosser Wichtigkeit, dass die Fälle frühzeitig operiert werden, da man in dieser Weise die oben erwähnten Veränderungen im Collum, Caput und Acetabulum verhindern kann.

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