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Legg Calvé Perthes Disease

The late occurence of coxarthrosis

BY

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Legg
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ABSTRACT

A clinical and radiological follow up examination was made in three formerly well examined and defined unilateral samples of Legg Calvé Perthes Disease: one group of 100 cases with an average age of 25 years, another of 33 cases with an average age of 35 years, and finally a group of 19 cases with an average age of 65 years.

The factors known to influence the shape of the head at the *primary* healing in childhood, sex, age and stage of the disease at time of diagnosis, together with shape of the head at *primary* healing, were examined concerning their influence on the *late* occurrence of radiological coxarthrosis, pain and mobility.

Sex and stage had no significant influence on the late fate of the diseased hip. Age at onset and shape at the primary healing showed significant influence on the late result.

At the 25 and 35 level less than 6 per cent had coxarthrosis, and in that case with a significantly higher frequency in irregular healed heads compared to normal and flattened ball shapes.

At the 65 level, in an untreated group, there was a high frequency of irregular heads and above 85 per cent coxarthrosis. Pain partly arose from the primary healing, partly between 20 to 40 years of age. During the decade from 25 to 35 years of age only the irregular shaped heads showed an increase in occurrence of coxarthrosis.

Key words

Coxa plana. Femur head necrosis. Legg-Perthes disease. Osteochondritis. Osteonecrosis.

CONTENTS

INTRODUCTION

In several previous works on Legg-Calvé-Perthes' Disease (LCPD), it has been stated that the *primary* shape of the femoral head, at the time of healing, was generally poor in cases not relieved from weight-bearing during the active phases of the disease, and also, that the results from treatment were the better the more efficient the non weight-bearing was performed (Helbo 1953, Mose 1964, Meyer 1966, Lauritzen 1975). The best results were obtained from prolonged bed rest combined with traction on both legs.

Many authors have pointed out identical prognostic factors for the shape of the head at the *primary* healing:

– Sex. Boys have generally been reported to have better results than girls. This was recently denied by the investigation of Lauritzen.

– Age at onset of the disease. The younger the better results.

– Stage of the disease at establishment of diagnosis and treatment. On early relief from weight-bearing, i.e. up to early fragmentation, the prospects for a good result were better.

– Other factors have been mentioned such as different types of course (Catterall) and the degree of destruction during the course of the disease in childhood. These factors seem, however, to depend on the stage of the disease when relief from weight-bearing took place.

Relatively few reports concern the *late* clinical and radiological results. The most important materials were presented by the following authors:

Sundt (1949): 153 hips reexamined 10 to 52 years after the onset of the disease.

Helbo (1953): 52 unilateral cases examined after more than 25 years.

Evans (1958): 52 patients with a follow up from 10 to 26 years with an average of 16 years.

Danielsson (1965): 35 patients at an average of 33 years from the onset of the disease to the follow up examination.

Ratliff (1967): 34 hips observed for an average of 30 years, variation from 25 to 40 years.

Eaton (1967): 88 cases comprising of 100 diseased hips, with a follow up averaging 19 years.

Gover & Johnston (1971): 36 cases at a mean age of 44.6 years.

Steinhauser (1971): 75 cases, among whom '54 had passed puberty'.

Brotherton (1977): 102 hips with an average follow up of 17 years.

Details of the reports will be mentioned later.

The general conclusions of these investigations were, that primarily *irregular* shape of the hip, resulted in a high frequency of late coxarthrosis, whereas *normal ball-shaped* heads never had radiological signs of coxarthrosis nor functional disablement. A group between the two mentioned, consisting of still ball shaped but clearly *flattened* heads, were estimated to manage well too.

It was *the purpose* of the present investigation to study the influence on the *late* fate of the affected hip by:

1. such factors that determine the primary shape of the head: sex, age at onset of the disease, stage of the destruction at the time of treatment, and

2. the shape of the head at the primary healing.

In the following, these factors will be related to late results, especially the occurrence of radiological coxarthrosis, pain, restriction of mobility, walking ability, and social consequences.

Finally it was attempted to estimate the age at which pain and other disablement commenced.

A comparison between methods of treatment was not intended.

PATIENTS

Patients were traced from three previous Danish theses on LCPD: Flemming Møller (1924), Sven Helbo (1953) and Knud Mose (1964).

Møller: This thesis was based upon a thorough examination of 72 children or young adults. At that time, the LCPD was a newly described condition, therefore, many of the cases comprised in Møller's work were diagnosed after the age of 10. In this way the material comprised several cases attacked before the year 1910.

The case histories were, unfortunately, not provided with sufficient data as to make it possible to trace the patients.

Only *8 unilateral cases* originally followed at the University Hospital and other hospitals in Copenhagen could be found by the indefatigable search by Dr. Johannes Meyer in the Rigsarkivet (Records Office at the Royal Library) in Copenhagen.

Helbo's work comprised a description and the results of the primary course of 66 cases treated between 1941 and 1951 at the Seaside Hospital at Refsnæs.

They were all treated for one year with bed rest.

Of this material *33 cases* could be traced for the present study.

In addition, *Helbo* made an evaluation of long term results in 52 cases, partly based on the patients of Møller, partly on former cases treated on the Seaside Hospital at the same time as Møller's cases.

From this second group *11 cases* with an observation time of more than 40 years, met for re-evaluation in the present study.

Mose presented three groups, 219 hips in all. One group was treated with 'strict bed rest' (78 hips), another with 'mobilizing bed rest' (70 hips) and the third group with a Thomas Splint type of walking calliper (71 hips). In every case the patient was treated through the whole period with presumed weakness of the epiphysis, i.e. for up to two or three years.

The cases were taken from the same period, 1953 to 1957. Only the first two groups mentioned were searched for the present study. Among these, *100 cases* met for re-examination.

In the 1964-evaluation there was found no statistical difference in the distribution of good, fair and poor primary radiological results between these two bed rest treated groups. Thus, in the present study they could be put together in one group.

The age distribution, mean age and time interval from the mean age at *primary healing* to the mean age at *follow up examination* was set up in *Fig. 1–3.*

The three groups prepared for comparison concerning the late fate of the diseased hips were mentioned thus:

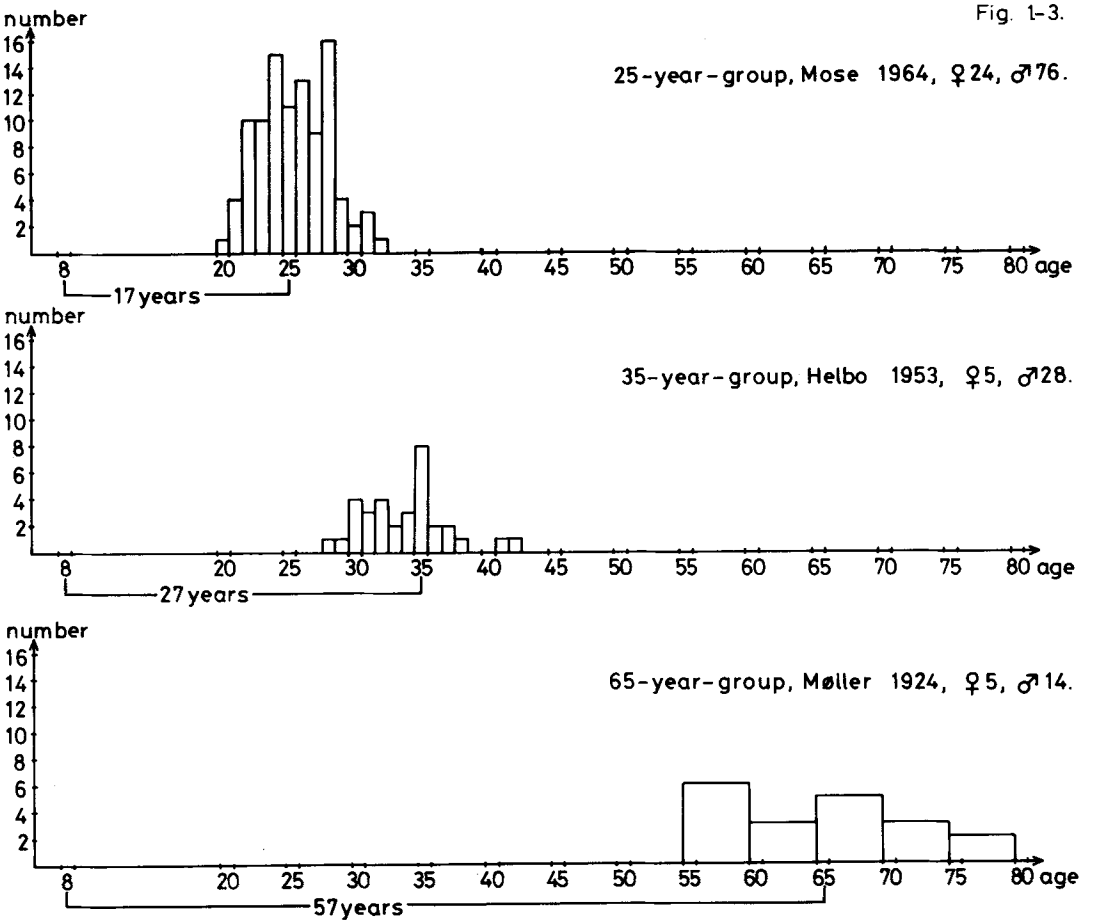
25 – group: 100 unilateral cases from the thesis of Mose

35 – group: 33 unilateral cases from the thesis of Helbo

65 – group: 19 unilateral cases, 8 from the thesis of Møller, 11 from the thesis of Helbo.

The data of all patients from Helbo's and Mose's groups could be found through the State Central Person Register. A comparatively large number of cases in these groups did not reply on the application form, probably due to the higher rate of activity in these age groups.

Fig. 1-3.



The 19 cases from the **65**-group were discovered through Rigsarkivet. All cases found met for the follow up examination.

Statistical notes on the groups

An examination was made concerning the homogeneity between the three test samples with respect to the three factors influencing the primary results, sex, age at onset of the disease and stage at treatment.

– Sex: homogeneity certified in the three groups
(χ^2 (2) = 1.3136, p>0,50)

– Age at onset of the disease: it was *not* likely to presume homogeneity between the three groups, as there was found relatively fewer observations in the young age groups and relatively more in the age group from 5–8 years in the **35**-group, than in the other two groups.
(χ^2 (4) = 13.0040), 0.01<p<0.025

– Stage at diagnosis and treatment: homogeneity certified in the two groups treated.
(χ^2 (1) = 0.7634, p>0.50)

The discovery of lack of homogeneity between the groups concerning age, may be due to slight differences in the estimation of the time of commencement, which was based on judgement partly on the time of the first complaint, partly on the stage of the disease at the first x-ray picture.

PROCEDURE AND METHODS

The follow-up-examination was carried out during the years 1973 and 1974.
Radiological and clinical examinations were made on the same attendance, but without the clinician having the opportunity to see the result of the x-ray examination before the clinical examination.

A. Radiology

Examinations were carried out and evaluated by RC and AJ. Conventional x-ray pictures were taken in frontal view and in frog-leg position (lateral view, Lauensteins projection).
Furthermore two oblique exposures in erect position were carried out. In the first the hip in question was projected anteriorly to the other hip, revealing the posterior part of the joint space. In the second, the examined hip was seen posteriorly to the non-examined, showing the anterior part of the joint space. (Ahlbäck 1971).
In this way the examination gave detailed information concerning early cartilage destruction.
The assessment of the degree of coxarthrosis is given on page 20.
Three cases, 2 from the **25***-group, 1 from the* **35***-group, refused x-ray examination.*

B. Clinical examination

The clinical examinations were carried out by MU and LH. They included a careful case history recorded in a *schedule,* comprising information necessary for assessment of pain, age at onset of pain, daily activities etc.
The classifications are shown in table 7 and on page 30.
The mobility of the hip joint was examined in the following way: – *Flexion* in supine position, the non-examined leg straight out. *Abduction* in supine position both hips being abducted at the same time. *Adduction* in supine position, one hip at a time. *Rotations* in prone position with knees flexed 90° using the legs as pointers. Inward rotation was done with both hips rotated at the same time, outward rotation with the legs one at a time.
Atrophy was measured in centimeters.
The asessment of the degree of restricted mobility is given on page 30.

C. Radiological measurements

After radiological and clinical examinations, measurements of the shape of the heads were undertaken by KM.
Measurements were taken from the exposures from the time of primary healing and from the follow up examination.
By means of a circle-templet, the shape of the hips could be divided into *irregular* and ball-shaped heads as described among others by Mose (1964). The latter group was divided into two subgroups by means of the templet: *flattened ball-shape* and *normal ball-shape* according to the radius quotient (RQ) described by Meyer (1966):

$$RQ = \frac{\text{radius of diseased head}}{\text{radius of normal head}} \times 100$$

In normal persons the RQ may amount to 115.
By this procedure three groups were defined:

1. irregular heads
2. flattened ball shaped heads, RQ above 115
3. normal ball shaped heads, RQ below 115

In Møller's cases the x-ray pictures from primary healing could not be traced; therefore, the estimation was restricted to ball shaped or irregular heads on the basis of informations given by Møller or by Helbo.

Fig. 4. Male. LCPD 6 years old. Control 65 years old: ball shape, RQ 113. No or slight radiological signs of coxarthrosis.

Fig. 5. Female, LCPD 6 years old. Control 56 years old: Flattened ball shape, RQ 130. No radiological signs of coxarthrosis.

Fig. 6 A and B. Male. LCPD 10 years old. Healed with irregular shape (6 A). Control 28 years old: Severe coxarthrosis. (6 B).

The RQ is a reliable and easily made estimation of the shape of the head.

Among the other methods described to evaluate the degree of flattening, the epiphyseal quotient (EQ) was excluded because the epiphyseal line has disappeared at the time of follow up examination.

The joint surface quotient (JSQ) requires the drawing of some construction lines, making it less practical for future clinical use, and endows it with some degree of estimation.

A combination of the three quotients, demanding the best result in each of the measurements for the single hip to be put into an ideal group, has been used in some works on the primary results. In the present work it was thought to be too strict a measurement to reflect upon the late clinical findings, which may be difficult to define with an equal accuracy.

Age group at follow up ex.	at primary healing			at follow up examination		
	25	**35**	**65**	**25**	**35**	**65**
Normel ball shaped	*35*	16	*3*	*63*	17	4
Flattened ball shaped	*39*	8		*12*	5	1
Irregular	*26*	*9*	*13*	*24*	*10*	*14*
	100	*33*	16	99	32	19

Table 1. Number of cases changing from RQ above 115 to RQ below 115 from primary healing to time of follow-up.

Statistical notes:
In order to investigate the evolution of the RQ between the primary and the secondary examination a paired t-test (two-sided) was performed. The original observations were analysed by calculating the difference x = secondary RQ — primary RQ.

Only the **25** *and the* **35** *groups could be examined. The difference between the RQ evolutions in the two groups was investigated by performing a t-test (two-sided) on the two independent samples of differences.*

25-*group:* $n_1 = 75;\ \bar{x} = -8.03;\ s^2 = 66.7831.$ *An improvement in RQ was likely to occur.* $(t\ (74) = -8.51;\ p < 0.001).$

35-*group:* $n_2 = 22;\ \bar{x} = -3.00;\ s^2 = 58.7619.$ *A tendency to improvement in RQ was noted.* $(t\ (21) = -1.84;\ 0.05 < p < 0.10).$

Both groups: The same variance of x was noted in the two groups. $(F\ (74,21) = 1.1365;\ p \simeq 0.25).$ *Improvement in RQ was greater in the* **25**- *than in the* **35**-*group.* $(t\ (95) = -2.5730;\ p \simeq 0.01).$

In table 1 the grouping of the *primary* results was compared with the results of the measurements at the secondary examination after the end of growth.

Discussion: The following was noted:

- normal ball-shaped heads were still normal and did not change to flattened or irregular shapes.
- all primarily irregular heads were still irregular at the follow up examination (small differences were due to the few cases who refused x-ray examination).
- a significant improvement in RQ was noted among the ball-shaped heads especially in the 25-group: a fall in number of flattened ball-shaped heads and a rise in number of normal sphericity.

This must be due to an equal numerical growth in radius in the sound and diseased heads, thus leading to a more normal

proportion between their radii during the growth period up to closure of the epiphyseal line.

D. Preparation for statistics

The data obtained by the procedures mentioned were arranged in groups and put into KH-punch cards by KM. The comparisons between the frequencies of the different parameters were formulated by a statistician (EH). The χ^2 test was used in most instances. The limits of significance for the χ^2 test were stipulated in this manner:

$0.05 < p < 0.10$	: tendency
$0.01 < p < 0.05$	: possible significance
$0.001 < p < 0.01$	: significance
$p < 0.001$	: high significance

The p-values will not be repeated in the single schedules.

RESULTS IN PRESENT STUDY

Radiological coxarthrosis

1. Literature

Sundt (1949) Radiological signs of coxarthrosis was found in 65 hips. The primary shape of the heads was divided into four groups: spherical, (11, none showed coxarthrosis), oval (56, 16 had radiological coxarthrosis), cylindrical (78, 41 showed coxarthrosis) and angular (8, who had all coxarthrosis).

Helbo (1953) divided the results in whom both primary and late x-rays were available: spherical heads 4, (none had radiological coxarthrosis), 23 flattened (20 had coxarthrosis) and 11 angulated heads (coxarthrosis in every case).

Evans (1958) found coxarthrosis in all of 16 poor, i.e. angulated heads, while 21 fair and 15 good were not affected radiologically.

Danielsson (1964) found coxarthrosis in 17 of his 35 cases. 13 cases had healed with primarily severe deformities, 8 with moderate, while 14 had only slight or no deformity.

Ratliff (1967) gave his results in a summarized pointsystem including both clinical and radiolagical parameters, thus preventing comparison to the single parameters used in this work.

Eaton (1967) reported the late results of 100 hips as follows: 7 excellent, 54 good, 16 fair and 23 poor (or with arthrodesis).

Gower and Johnston (1971) found moderate and severe degress of coxarthrosis in 9 patients, all of whom had healed with flattened heads.

Brotherton (1977) used Ratliffs points system. According to this 90 per cent obtained good results at the follow up.

No one, except Eaton, dealt with the influence of other primary factors than that of a visual estimation of the primary shape of the head.

2. Method of estimation

The radiological examination and the number of projections in the single patient was mentioned in 'procedure and methods'.

The estimation of the degree of radiological coxarthrosis was carried through according to a modified Heripret's scheme (Danielsson 1964).

Osteophytes	none	points 0
	at one pole	1
	few	2
	many	3
Joint space	no narrowing	0
	1-2 mm -	1
	2-4 mm -	2
	above 4 mm -	3
Bone structure		
osteoporosis	according to estimate	points 0—3
hyperdensity	no	0
	slight acetabulum	1
	moderate in caput and acetabulum	2
	marked in caput and acetabulum	3
Cysts	none	0
	single, caput and acetabulum	1
	more -	2
	several -	3

The single case may obtain from 0 to 15 points.

For practical purposes the cases were finally grouped for statistical arrangement in three categories:

Coxarthrosis:	none	0	points
	slight	1–4	-
	severe	above 5	-

3. Present results

Total occurence of late radiologial coxarthrosis

In Tab. 2 the total number of cases with radiological coxarthrosis was drawn up.

age group at follow up ex.	points for radiol. arthr.	number	per cent of whole group
25			
(98 cases)	0	73	75%
	1—4	22	22%
	5—8	2	2%
	9—12	1	1%
	13—15	0	0
35			
(32 cases)	0	22	69%
	1—4	8	25%
	5—8	1	3%
	9—12	1	3%
	13—15	0	0
65			
(19 cases)	0	1	5%
	1—4	2	10%
	5—8	6	32%
	9—12	3	16%
	13—15	7	37%

Table 2. Number and percentage occurence of radiological coxarthrosis, was arranged according to age and degree of radiological coxarthrosis. (Three cases refused radiological examination).

Statistics: Within the single age group all points from 0—4 and from 5—15 were added. The following comparisons were done:

25 *versus* **35**: *no significant differences.*

25 *versus* **65**: χ^2 *(1) = 77.0, high significance.*

35 *versus* **65**: χ^2 *(1) = 31.7, high significance.*

Discussion: It appears that in the two younger groups, both relieved consistently during childhood, there was the same distribution of none, slight and more severe coxarthrosis.

For the **65**-group of untreated cases, the occurrence of radiological coxarthrosis, especially in the more severe types, was significantly higher.

Influence of sex on the late occurence of coxarthrosis was shown *in Tab. 3.*

Radiol. arthr. in points	Males		Females	
	number	per cent	number	per cent
0	75	65%	21	64%
1—4	25	21%	7	21%
above 5	16	14%	5	15%
	116		33	

Discussion: The three age groups were regarded as a whole, considering the small number of female cases. The distribution of no, slight and severe coxarthrosis was identical between the two sexes. Thus, a difference in *primary* results, females having worse results (Mose), had no bearing on the late occurrence of coxarthrosis.

Table 3. Occurence of radiological coxarthrosis arranged according to sex and degree of radiological arthrosis.
Three cases refused x-ray examination.
Statistics: χ^2 *(2) = 0.039. No significance.*

Influence of age at onset of LCPD on the occurrence of late radiological coxarthrosis.

In table 4 only cases from the **25**-group and the **35**-group were included and the cases regarded together as the two groups were not homogenous concerning age at onset of the disease. The mean age for this group as a whole was 27,5 years. In the **65**-group the age at onset of the disease was not sufficiently defined.

Age at onset	≦ 4			5—8			≧ 9		
Degree of radiol. coxarthrosis	**25** + **35**		**65**	**25** + **35**		**65**	**25** + **35**		**65**
None	31	86%	0	51	76%	1	13	48%	0
1—4	5	14%	0	15	22%	2	10	37%	0
above 5	0	0	5	1	2%	4	4	15%	7
	36			67			27		

Table 4. Influence of age at onset of LCPD on the late occurence of coxarthrosis. The 25- and the 35-groups were united and regarded together (mean age 27.5 years).

Statistics:
below 4 versus 5—8: *no statistical difference.*
5—8 versus above 9: χ^2 *(1) = 6.9, Significance.*
below 4 versus above 9: χ^2 *(1) = 10.5, Significance.*

Discussion: If all degress of coxarthrosis, whether minor or major, were united, it would show that onset below 4 years involved 14 per cent late coxarthrosis, onset between 5-8 involved 24 per cent and onset above 9 as many as 52 per cent. The differences in occurrence of coxarthrosis between both of the two young groups compared to the group above 9 years, were significant. This late finding was in accordance with the finding that age at onset greatly influenced the primary result (Mose, Lauritzen).

Influence of stage at onset of treatment on the occurrence of late radiological coxarthrosis.

This subject was referred in *table 5.*

Stage at treatment	*Early*				*Late*			
Age group	**25**		**35**		**25**		**35**	
Points for coxarthr.	nos.	%	nos.	%	nos.	%	nos.	%
0	48	73%	15	83%	25	78%	7	50%
1—4	15	23%	3	17%	7	22%	5	36%
> 5	3	4%	0	0	0	0	2	11%
	66		18		32		14	

Discussion: No significant conclusions could be drawn from this study. Only in the **35**-group a possible difference was demonstrated between early and late treatment.

The fact that early treatment resulted in better *primary* results (Helbo, Mose, Lauritzen) found no reflection in the *late* results in the present study.

Table 5. Secondary radiological arthrosis arranged according to stage at relief from weight bearing. The 65-group was regarded as untreated and thus excluded from the list.

Statistics:
Early **25** *versus early* **35**, *early* **25** *versus late* **25**, *and late* **25** *versus late* **35**: *No significant difference. Early* **35** *versus late* **35**: χ^2 *(1)* = *4.07, Possible significance.*

Influence of the primary shape of the head on the late occurrence of coxarthrosis.

An all over view of the per centage distribution of none, slight and severe radiological coxarthrosis, related to primary shape and age groups was shown in the histogram in fig. 7.

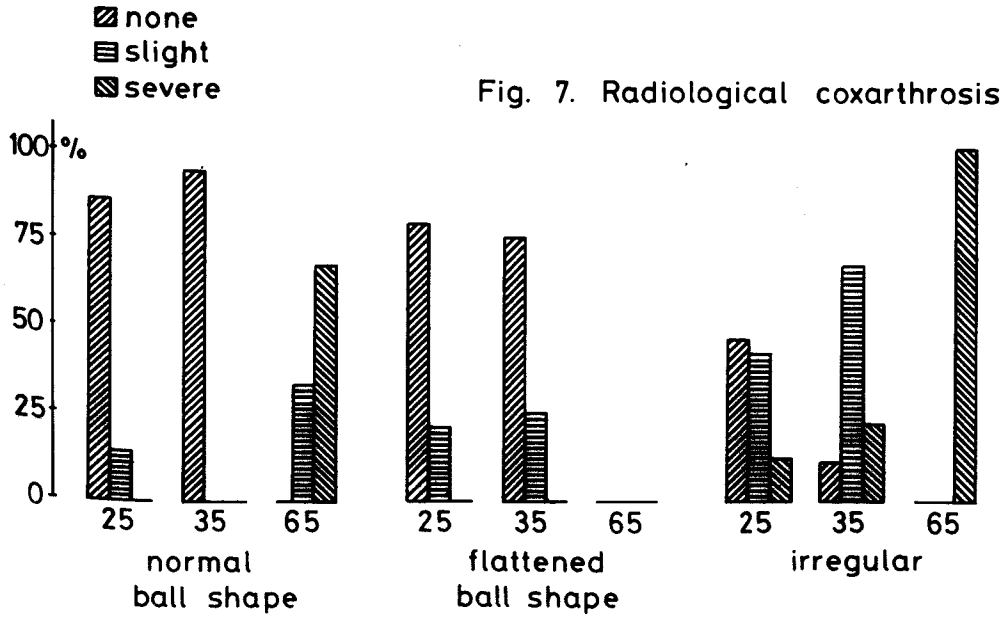


Fig. 7. Radiological coxarthrosis.

The single numbers and percentages from the histogram were given in table 6 A-C.

25-*group*

Points for coxarthr.	normal ballshape		flattened ballshape		irregular	
0	30	86%	31	84%	12	46%
1—4	5	14%	6	16%	11	42%
> 5	0	0	0	0	3	12%
	35		37		26	

Table 6 A.
Statistics: Normal versus flattened: No significance. Flattened versus irregular: χ^2 (1) = 9.97. Significance. Normal versus irregular: χ^2 (1) = 10.88. High significance.

35-*group*

	normal ballshape		flattened ballshape		irregular	
0	15	100%	6	75%	1	11%
1—4	0	0	2	25%	6	67%
> 5	0	0	0	0	2	22%
	15		8		9	

Table 6 B.
Statistics: Normal versus flattened: No significance. Flattened versus irregular: χ^2 (1) = 7.13. Significance. Normal versus irregular: χ^2 (1) = 20.00. High significance.

65-*group*

	normal ballshape		flattened ballshape	irregular	
0	0	0		0	
1—4	1	33%		0	
> 5	2	67%		13	100%
	3			13	

Table 6 C.
Statistics: Ballshape versus irregular: χ^2 (1) = 4.62. Possible significance.

Discussion: In the present study no difference in occurrence of late coxarthrosis was found between normal and flattened ball shapes.

Both in the **25**- and in the **35**-group, a significantly higher occurrence of coxarthrosis was found among irregular shapes as compared to normal and flattened heads.

Furthermore a study was made to see what happened to normal, flattened and irregular hips from a mean age of 25 to that of 35 (comparison vertically between tabel 6 A and 6 B).

Normal **25** versus **35**: no significant increase.

Flattened **25** versus **35**: no significant increase.

Irregular **25** versus **35**: χ^2 (1) 3.5. By one-tail test this was possibly significant. ($0.01 < p < 0.05$).

By two-tail test a tendency to increase was shown ($0.10 < p < 0.05$).

Discussion: No increase could be shown in occurrence of coxarthrosis from the age of 25 to 35 assuming normal or flattened ball shape. For the irregular heads a possible increase in coxarthrosis was demonstrated from 25 to 35 years in mean age.

Occurrence of pain

1. Literature

Pain was recorded in earlier investigations as follows:

Sundt (1949) reported 17 cases with reduced working capacity, and among them 9 with 'severe complaints' out of the material of 135 cases.

Helbo (1953) out of his 52 late cases, reported that only 8 were symptomfree, while the rest had some disability.

Evans (1958) found only 'trivial subjective complaints' among 52 cases.

Danielsson (1964) among 35 patients found 7 with pain, all of whom belonged to the most deformed cases.

Ratliff (1967) noted that four-fifths of his 34 hips were free from pain, while only two-fifths had good hips radiologically.

Eaton (1967) out of his 85 non-operated cases found 45 without pain, and 22 with slight, 15 with moderate and 3 with severe pain.

Gower and Johnston (1971) found 'absent or mild' pain among their 36 cases, only 3 cases having required operation.

Steinhauser (1971). 11 per cent who complained of pain were all in poor quotient-groups.

2. Assessment of pain

The grading of pain was carried through according to a modified Merle d'Aubigny statement.

1. No pain.
2. Pain when starting. Capable of moderate work and sport.

Requiring treatment:

3. Starting pain and pain again after 1500 metres walking. Rarely analgesics. Demanding periodic treatment (heat etc.).
4. Starting pain and pain after 400—1500 metres walking. Frequently analgesic and antirheumatic drugs. Demands often physical-medicine treatment.
5. Resting pain and pain before 400 metres walking. Analgesics daily.
6. Strong persistent pain preventing sleep.

Table 7. Assessment of pain.

In the present study with its comparatively small number of cases with secondary disablement, distinguishments were only made between three groups:

1. No pain.
2. Slight pain (group 2).
3. Severe pain, corresponding to pain requiring treatment.

3. Present results

Localisation of pain

Pain was complained of in 60 cases, solely in the adductor region in 26 cases, in the trochanteric region in 19 cases, and in both regions in 15 cases, among whom 3 also complained of low back pain. The localisations were analysed and showed no specific and statistically significant relation to other parameters, *especially not to radiological coxarthrosis.*

Total occurrence of pain

An all-over view of the 60 cases having pain was arranged in *table 8.*

Age group	**25**-group		**35**-group		**65**-group	
pain:	slight	severe	slight	severe	slight	severe
nos.	22	10	11	4	2	11
%	22%	10%	33%	12%	10%	58%

Table 8. 60 cases complaining of pain recorded according to age group and degree of pain.
Statistics:
25 *group versus* **35** *group: No significant diff.*
35 *group versus* **65** *group:* χ^2 *(1) = 9.40. Signific.*
25 *group versus* **65** *group:* χ^2 *(1) = 10.57. Signific.*

Discussion: Between the **25**- and the **35**-groups no increase in pain, nor difference in severity of pain could be demonstrated. The **65**-group had a significantly higher occurrence of pain especially in the group of severe pain.

Influence of sex on the late occurrence of pain was shown in table 9.

Sex	male		female	
number	118		34	
no pain	76	64%	16	47%
slight pain	28	24%	7	21%
severe pain	14	12%	11	32%

Table 9. Occurence of pain related to sex.
Statistics: χ^2 (1) = 8.16. Possible significance.

Discussion: The females comprised 22 per cent of the whole material, which was in accordance with other materials published. The three groups were looked upon as a whole, because of the small number of females compared to males. A possible significant preponderance of more severe complaints of pain was noticed.

Influence of age at onset of LCPD on the late occurrence of pain.

In the **25**-, **35**- and **65**-groups there was found absence of homogeneity concerning age distribution at the onset of LCPD.

Comparison (table 10) was therefore made only between the united **25**- *and* **35**-groups. The **65**-group, which was in itself small and difficult to compare to the others, was merely added in brackets.

Age group at onset	≦ 4			5—8			≧ 9			
group at follow up ex.	**25+35**		(65)	**25+35**		(65)	**25+35**		(65)	
no pain	31	82%	(1)	43	64%	(4)	12	43%	(7)	
slight-	4	11%	(1)	19	28%	(1)	10	36%	(0)	
severe-	3	7%	(3)	5	8%	(2)	6	21%	(6)	86%
	38		(5)	67		(7)	28		(7)	

Table 10. Distribution of patients complaining of pain related to age at onset of LCPD.
Statistics: »No pain« compared to »slight and severe pain« combined.
< 4 versus 5—8: χ^2 (1) = 3.5, not significant.
5—8 versus > 9: χ^2 (1) = 3.6, not significant.
< 4 versus > 9: χ^2 (1) = 10.6, significant.

Discussion: There was found to be decrease in percentage occurrence of painless hips with increasing age at onset of the disease (82–64–43 per cent). At the same time slight and severe pain increased in percentage occurrence (18–36–57 per cent). These findings were, however, only significant when comparing the group below 4 to that above 9 at onset of LCPD. The **65**-group showed, as expected, a high frequency of pain in the group attacked late (86 per cent). The numbers were too small for statistical comparisons.

Influence of stage at relief from weight bearing on the late occurrence of pain.

It was attempted to elucidate this subject in *table 11.*

Age group	Early 25		Early 35		Late 25		Late 35	
no pain	46	70%	11	58%	22	65%	7	50%
slight-	13	20%	5	19%	9	26%	6	43%
severe-	7	10%	3	16%	3	9%	1	7%
	66		19		34		14	

Table 11. Influence of stage at onset of treatment on the late occurrence of pain. The 65-group was regarded as untreated.

Discussion: The influence of early or late commencement of treatment on the late occurrence of pain seemed insignificant. This was in accordance with the findings of Eaton (1967).

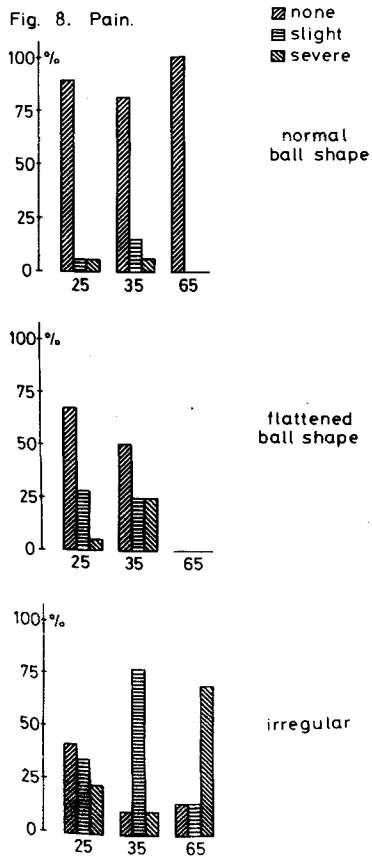
A clear influence of stage on the *primary* result did not bring its influence to bear on the late result in this study.

Statistics: All comparisons between the columns showed no significance.

Influence of the primary shape of the head on the late occurrence of pain.

In the histogram, fig. 8, the percentage occurrence of cases complaining of pain was arranged according to primary shape and age groups.

Fig. 8. Pain.



Details were given in *table 12.*

25-*group*

	normal ballshape		flattened ballshape		irregular	
no pain	31	89%	26	67%	11	42%
slight-	2	5%	11	28%	9	35%
severe-	2	5%	2	5%	6	23%
	35		39		26	

Table 12 A. Slight and severe combined.
Statistics: Normal versus flattened ball shape: no significance. Flattened ball shape versus irregular: no significance. Normal ball shape versus irregular: χ^2 (1) = 14.8, high significance.

35-*group*

no pain	13	81.5%	4	50%	1	11%
slight-	2	12.5%	2	25%	7	78%
severe-	1	6 %	2	25%	1	11%
	16		8		9	

Table 12 B.
Statistics: Slight and severe combined. Normal ball shape versus flattened: no significance. Flattened ball shape versus irregular: no significance. Normal ball shape versus irregular: χ^2 (1) = 11.5, high significance. The numbers were very small.

65-*group*

no pain	3	100%	2	15%
slight-	0		2	15%
severe-	0		9	70%
	3		13	

Table 12 C.
Statistics: Numbers very small. Slight and severe combined. Ball shape versus irregular: χ^2 (1) = 8.12, significant.

Discussion: A clear change in occurrence of pain from normal to irregular heads was established.

For the **25**-group (tab 12 A) there was a gradual fall in 'no pain' from group to group (89–67–42 per cent) and a corresponding rise in occurrence of 'slight and severe pain' (10–33–58 per cent). But only comparisons between normal and irregular shapes were statistically significant.

For the **35**-group the same tendencies were demonstrated. (tab. 12 B).

In the **65**-group a total of 85 per cent of the irregular shapes were estimated to have slight and severe pain. The nine cases complaining of severe pain all appeared in the groups above 4 points (see tab. 7).

A study was made concerning a possible change from the age of 25 to that of 35 (columns in tab. 12 A and 12 B read vertically).

Neither normal nor flattened ball shaped heads showed any significant increase in occurrence of pain during the decade mentioned.

In the group of irregular heads there was a tendency towards an increase in occurrence of pain from the mean age of 25 to that of 35.

(χ^2 (1) = 2.89, 0.05 < p < 0.10).

Secondary pain was finally correlated to *secondary radiological* coxarthrosis in tab. 13.

Radiological coxarthrosis	no (96)		slight (32)		severe (21)	
No or slight pain (125)	90	95%	27	84%	8	38%
severe pain (24)	6	5%	5	16%	13	62%
	96		32		21	

Discussion: Convincing correlation was found between radiological coxarthrosis and complaints of pain at the follow up examination.

Table 13. Correlation between degree of radiological coxarthrosis and pain at the time of follow up 149 out of 152 cases accepted radiological examination.

Statistics:
No radiol. coxarthrosis versus slight: No signif.
Slight- versus severe-: χ^2 (1) = 12.10, high. signif.
No - versus severe-: χ^2 (1) = 39.23, high signif.

Age at onset of pain

1. Literature

Sundt (1949) reported only 22 per cent symptomfree at the primary healing.

Max Ruelle (1961) made a survey of one thousand cases of coxarthrosis with the aim to find the proportion between primary and secondary osteartrosis, and define the time in life when pain arose.
All patients were referred to a rheumatological clinic, and the indication for the starting points of complaints was simply the 'need for treatment'.
271 cases had osteartrosis secondary to diseases or traumas during childhood and youth. Among these 113 might be like LCPD-cases according to the description of Ruelle.

The mean age for beginning *secondary* coxarthrosis was found to be 40–44 years, the majority of cases occurring between 30 to 50 years of age. (76 cases out of 113).

The mean age for beginning *primary* coxarthrosis was 57 years, with a span from 50 to 70 years.

Ratliff (1967) found signs of deterioration in pain and movement in 6 patients out of 34, during a period of observation of 12 years from his first to his second examination. In the latter the maximum age was 40 years.

Present study

60 patients complaining of pain were arranged according to their own statement on the age at onset of pain. (table 14).

Age:	below 10		10—20		20—40		above 50 years	
degree:	slight	severe	slight	severe	slight	severe	slight	severe
	11	*9*	7	*1*	17	*11*	0	*4*

Table 14. Age at onset of pain according to the pat ients own recollection.

Discussion: The age at onset of complaints was difficult to establish with accuracy in a questionnaire.

The pain in the present cases was not as severe as in Ruelles 'cases in need of treatment'. This may explain the fall in age group to about 10 years younger in the present material as compared to Ruelles.

Cases with severe pain occurred partly from the primary healing in childhood, like the findings of Sundt, partly from the decades from 20 to 40 years of age.

In the years from 10 to 20 pain seldom arose.

Both below 10 and from 20 to 40 years of age, severe degrees of pain occurred mainly among irregularly shaped heads.

Further reference was made to table 12. A statistical tendency to a reversal in occurrence of pain from the **25**- to the **35**-group was shown in the irregular heads only.

The same tendency was shown concerning occurrence of radiological coxarthrosis (table 6 A and B), and of mobility (table 20 A and B).

Thus, the present study seemed to support the indications of Ruelle concerning age at onset of pain caused by LCPD in childhood. Also Meyer (1977) was of the same opinion. Possibly a somewhat earlier beginning for the complaints was demonstrated in the present work. This early onset of complaints was, however, limited to irregular heads.

Restriction of mobility

1. Literature

Different authors have estimated movement of the hip by a variety of methods, that prevent comparison.

Sundt (1949) grouped all degrees of restriction from the slightest to the completely ankylosed hips in one group, and completely free movements in the other.

51 cases showed restriction of flexion, 109 of abduction, 45 of adduction, 59 of supi-

nation, 75 of pronation and 65 of hyperextension.

A percentage specification of restriction of movement could not be tabulated, as a summing up of the above mentioned figures did not balance with the total.

Evans (1958) regarded a direction of movement as being limited when it showed a restriction of 10 degrees or less as compared to the normal hip.

14 cases showed limitation in one direction, 3 in two directions, and 10 in three or more directions. 25 hips were completely free. The movements restricted were: abduction (17 cases), lateral rotation (17 hips), extension (11 hips) and medial rotation (10 hips).

Danielsson (1964) according to an index system found excellent and good mobility in all cases, whereas none were fair or poor.

Ratliff (1967) found movement full or with terminal limitation in 20 of his 34 cases.

Eaton (1967). In 97 hips not operated upon, 54 were found to have free movement; 23 hips showed 75 per cent reduction in mobility, 13 hips had 50–75 per cent reduction, and 7 hips had below 50 per cent mobility left.

Steinhauser (1971) among 75 cases, referred 7 per cent with limited mobility and 93 per cent completely free.

Gower and Johnston (1971) in their case report referred 4 cases with a total mobility above 260 degrees, 9 cases from 211–260 degrees, and 23 below 210 degrees.

2. Method of estimation

According to the degrees of movement noted at the clinical examination described in page 13, the patients were grouped in the following two ways:

1. Sum of movements above 260 degrees
   - 211 – 260 –
   - 161 – 210 –
   - 101 – 160 –
   - 61 – 100 –
   - 0 – 60 –

(This classification was indicated by Harry K. Sørensen).

2. Limitation of movement in the diseased hip amounted to 50 per cent of the movement in the normal hip in:

   no direction, 1, 2, 3, 4, 5 or 6 directions.

This quite rough 50 per-cent-estimate was given in order to avoid such errors as limitation caused by pain, by mental aggravation or by different estimates by the single examiner, etc.

The two methods were correlated in table 15. It is evident that there was accordance between the two criterias of classification (χ^2 (2) = 32.65, $p < 0.005$).

For practical purposes only three mobility groups were used in the following:

Free : sum above 260 degrees.
Slight restriction: sum 211 – 260 degrees.
Severe – : sum below 210 degrees.

No attempt was made to assess the value of the restriction of a single movement by an index system (Danielsson 1964).

Number of directions restricted more than 50% of the normal	none	1 direction	2 or more
sum of movements			
above 260 (105)	90	15	0
211—260 (20)	2	14	4
below 210 (27)	0	3	24
	92	32	28

Table 15. Comparison between two methods of estimation of restriction of movement.
Statistics: χ^2 *(2) = 32.6, significance.*

3. Present results

A complete review of the occurrence of limitation of movement was arranged in *tab. 16.*

Age group	**25**		**35**		**65**	
movement						
above 260	79	93%	22	79%	4	31%
211—260	14		4		2	
below 210	7	7%	7	21%	13	69%
	100		33		19	

Table 16. 152 cases arranged according to range of movement in degress and age group at follow up examination.
Statistics: free and slight combined.
25 *versus* **35** *group:* χ^2 *(1) = 5.32, possible signif.*
35 *versus* **65** *group:* χ^2 *(1) = 9.11, significant.*
25 *versus* **65** *group:* χ^2 *(1) = 37.92, high signif.*
Excess of severe restriction in the **65***-group.*

Discussion: Restriction of movement to below a sum of 210 degrees occurred with increasing frequency with increasing age.

The occurrence of the *single directions* recorded as reduced to less than 50 per cent of the normal side, was shown in tab. 17.

Age group	**25**	**35**	**65**	sum
flexion	2	0	5	7
abduction	4	2	11	17
adduction	3	3	8	14
outward rot.	17	10	11	38
inward rot.	22	7	14	43
hyperextension	0	0	1	1
				160

Table 17. Directions of movement restricted more than 50% recorded in age groups.

From tab. 17 it appeared, that rotations were far the most frequent movements to be limited.

The following observations may be added:

- In cases of *no pain*, 20 directions were limited, all of which were rotations.
- In cases with *slight pain* 37 directions were limited. Of these 29 were rotations. (78 per cent).
- In the case of *severe pain*, 63 directions were reduced.

  Among these 32 (51 per cent) were rotations, 14 (22 per cent) abduction, 11 (17 per cent) adduction, 5 (8 per cent) flexion, and 1 (2 per cent) hyperextension.

Influence of sex on late occurrence of limitation of mobility was shown in *table 18.*

	male		female	
above 260	83	70%	22	65 %
211—260	14	12%	6	17.5%
below 210	21	18%	6	17.5%
	118		34	

Table 18. 152 cases arranged according to range of movement and sex.
Statistics: Three age-groups combined because of the small number of females. Homogeneity in distribution between the two columns.

Discussion: The influence of sex on the *primary* result could not be confirmed concerning the *secondary* result in this study.

Influence of age at onset of LCPD on the late occurrence of limitation of movement, was shown in *table 19.*

Age at onset age group	≦ 4			5—8			≧ 9		
	25+35		**65**	**25+35**		**65**	**25+35**		**65**
above 260	33	87%	1	52	78%	3	16	57%	0
211—260	4	11%	0	10	15%	1	4	14%	1
below 210	1	2%	4	5	7%	3	8	29%	6
	38		4	67		7	28		7

Table 19. Restriction of movement arranged according to age at onset of LCPD and age group at follow up examination.

Statistics: The **25-** *and* **35-***groups combined. The* **65-***group was inserted for comparison. Slight and severe added.*

< 4 versus 5—8: No significance.

5—8 versus > 9: χ^2 *(1) = 4.06, possible significance.*

< 4 versus > 9: χ^2 *(1) = 7.43, significance.*

Discussion: There was found an apparent rise in occurrence of reduced mobility with increasing age (13 – 22 – 43 per cent). This was significant when comparing the youngest with the oldest, and the middle with the oldest group. An influence of age at onset of disease on the *primary* result was stated for the *late* result too.

Influence of the primary shape of the head on the late occurrence of limitation of movement.

From the histogram in *fig. 9* there appeared to be a clear tendency towards good mobility in groups with primary normal and flattened ball shaped heads. Among primarily irregular heads the frequency of reduced mobility increased.

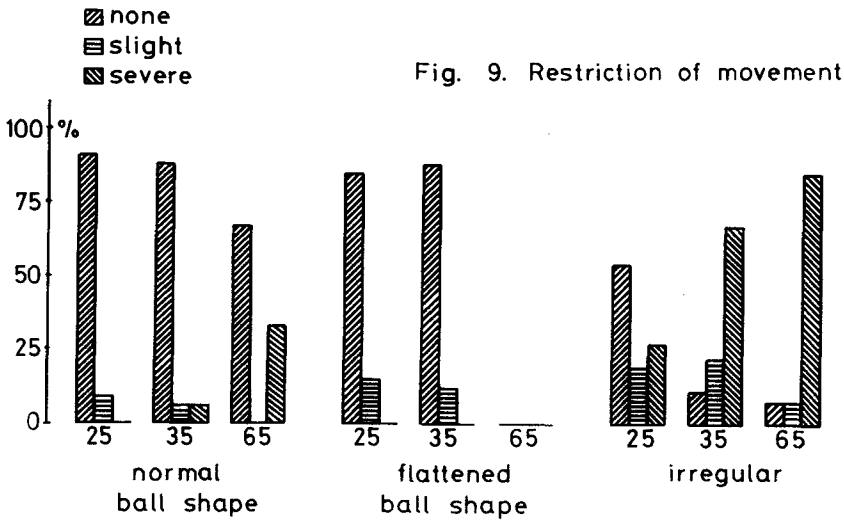


Fig. 9. Restriction of movement.

The figures from the histogram were tabulated in *table 20.*

25-*group*	normal ball shape		flattened ball shape		irregular	
range of motion						
above 260	32	91%	33	85%	14	54%
211—260	3	9%	6	15%	5	19%
below 210	0	0	0	0	7	27%
	35		39		26	

Table 20 A. Mobility related to primary shape.
Statistics: Normal versus flattened ball shape: No significance. Flattened versus irregular: χ^2 (1) = 7.37, significance. Normal ball shape versus irregular: χ^2 (1) = 11.36, high significance.

35-*group*						
above 260	14	88%	7	88%	1	11%
211—260	1	6%	1	12%	2	22%
below 210	1	6%	0		6	67%
	16		8		9	

Table 20 B. Mobility related to primary shape.
Statistics: Numbers of patients very small. Normal versus flattened ball shape: No significance. Flattened versus irregular: χ^2 (1) = 9.91, significance. Normal ball shape versus irregular: χ^2 (1) = 14.00, high significance.

65-*group*						
above 260	2	67%			1	7,5%
211—260	0				1	7,5%
below 210	1	33%			11	85,0%
	3				13	

Table 20 C. Mobility related to primary shape.
Statistics: Very small numbers of patients. Ball shape versus irregular: χ^2 (1) = 5.56, possible significance.

Further statistical calculations were made in the vertical columns in table 20 A. to 20 B., concerning changes in mobility between the age of 25 to that of 35:

Normal shapes: no significance.

Flattened shapes: no significance.

Irregular **25** group versus irregular **35** group: χ^2 (1) = 4.98, possible significance.

Discussion: No difference could be demonstrated in mobility between normal and flattened ball shaped heads. In the **25**-group as well as in the **35**-group irregular heads showed a significantly higher frequency of limitation of movement, compared to normal and flattened ball shaped heads.

Among normal and flattened ball shapes no changes were traced from the age of 25 to that of 35. On the contrary, the irregular heads showed a possible significant increase in limitation of mobility during that decade.

Secondary mobility compared to secondary radiological *coxarthrosis* (table 21) and to *pain* (table 22).

Mobility	> 260	211—260	< 210
no radiological arthrosis	82 80%	12 69%	1 4%
slight - -	19 18%	5 26%	8 30%
severe - -	2 2%	1 5%	18 66%
total 149	103	19	27

Table 21. Secondary mobility related to radiological arthrosis. Three cases refused x-ray examination.
Statistics: Criterias of classification. χ^2 (4) = 85.46, $p < 0.001$. No independance between the two criterias of classification.

Mobility	> 260		211—260		< 210	
no pain	83	79%	6	30%	3	11%
slight pain	16	15%	11	55%	8	31%
severe pain	6	6%	3	15%	16	59%
total	152	105		20		27

Table 22. Secondary mobility related to secondary pain.
Statistics: Criterias of classification. χ^2 *(4) = 69.5,* $p < 0.001$. *No independance between the two criterias of classification.*

Discussion: There was found to be good correlation between on the one side mobility, and on the other side, radiological coxarthrosis and on pain at the follow up examination.

Atrophy

PRESENT STUDY

Atrophy was measured in centimetres at the level of the distal belly of the vastus medialis. Differences above 2 centimetres were registered at the follow up examination in the **25**-group in 18 cases (18 per cent), in the **35**-group in 5 cases (15 per cent) and in the **65**-group in 13 cases (68 per cent).

Within each of the three age groups the occurrence of atrophy at the follow up examination was compared to the primary shape and to the secondary occurrence of radiological coxarthrosis, pain and mobility.

In the **25**-group atrophy was related to the primary occurrence of deformed heads (flattened ball shape + irregular heads) with possible significance.

Likewise the **25**-group showed accordance between secondary atrophy and secondary walking difficulties. (possible signifiance).

For both the **35**- and the **65**-groups no statistical significant correlation of these parameters could be demonstrated. Nor was atrophy in the **25**-group statistically correllated to any other parameters than the above mentioned.

Discussion: The **25**- and **35**-groups were both treated with bed rest followed by a period of walking with crutches and the diseased leg bound up in a Snyders sling. It might have been expected that this terminal treatment had resulted in a severe and long standing atrophy. This was not the case. In the two young groups atrophy occurred with equal frequency (18 and 15 per cent respectively), whereas the untreated group showed 68 per cent atrophy. It seems, thus, to be the degree of deformity and of coxarthrosis that determine the atrophy rather than the treatment.

In the **25**-group, atrophy was correlated to primary shape of the head. This finding was not repeated in the other groups, possibly caused by the small numbers in these samples.

Functional capacity and ability to walk

LITERATURE

Sundt (1949) mentioned 'lameness and limping' in 31 cases among 149 examined for this matter. In the rest of the cases impairment of functional capacity was imperceptible.

Danielsson (1964) used the walking distance together with other parameters in an accumulated index for functional capacity. This index was set up for the assessment of severe coxarthrosis in old age groups.

PRESENT STUDY

An attempt was made to code the present cases into a scheme for functional capacity like that of Danielsson. However, nearly all cases fell into the best groups with an absence of overflow to other groups, which made statistical comparisons impossible.

For that reason it was attempted to extract the walking ability alone. It was arranged in *three groups* according to a procedure of estimation resembling that for pain and mobility.

Discussion: The results of this study were so close to the findings concerning radiological coxarthrosis, pain and mobility that it was found needless to repeat the same conclusions regarding on the one hand walking disability, and on the other 1) lack of treatment (**65**-group), 2) high age group at commencement of treatment, 3) primary shape of the head, and 4) severe secondary radiological coxarthrosis.

Social conditions

A brief history of social and allied conditions was taken in all cases. They could be outlined in a scheme as follows.

	25	**35**	**65**
- Taken the hip - condition into account - in choice of occupation	33 33%	5 15%	2 11%
- later change in occupation	8 8%	4 12%	5 26%
- applied for rehabilitation	21 21%	6 18%	1 5%
- obtained disablement pension	1 1%	(1)	5 26%

Table 23. Social conditions. One case in **35***-group received pension for causes other than LCPD.*

Discussion: Differences between the groups were merely an expression for their different possibilities, according to changes and improvements in social legislation. Allotment of pension and change in occupation was more frequent among the 65-group, whereas the younger groups had the opportunity to be helped in choice of occupation or for rehabilitation measures.

Rejection for military service was stated in the following manner:

Age group	**25**		**35**		**65**	
number of men	76		28		14	
rejection	57	75%	17	61%	10	71%

Table 24. Military service.

Discussion: Rejection must depend on traditions as the frequency of non-fitness for service in the young groups far exceeded that of signs and symptoms for disablement.

Finally questions were asked as to whether the patients from the **25**- and **35**-groups called to mind their prolonged stay in hospital as disagreeable.

Age group		≦ 4	5—8	≧ 9
all cases treated with bed rest	133	38 29%	67 50%	28 21%
recalled hospital stay as disagreeable	17	4 24%	8 47%	5 29%

Table 25.

Discussion: 13 per cent (17 out of 133 patients) recollected their hospital stay as disagreeable. One case recalled that it was disagreeable to come home.

The 17 cases were distributed on the age groups approximately as the age groups on the whole material.

GENERAL CONCLUSIONS

The present three samples of LCPD were reexamined at a mean of 25 and 35 years (primarily treated) and 65 years (untreated) of age.

The two former samples were comparable concerning composition of *sex* and *stage* at time of diagnosis.

A slight difference in *age* at onset of treatment was eliminated by combining the two groups in the comparisons.

The following could be concluded:

1. At 25 as well as 35 years of age a very low frequency of severe radiological coxarthrosis was found (less than 6 per cent) (Tab. 2).

2. The 65-group was untreated. It comprised a very high percentage of irregularely healed heads. The frequency of severe radiological coxarthrosis was above 85 per cent.

3. At 25 and 35 years of age the occurrence of radiological coxarthrosis was nearly equal, as regards the whole group. (Tab. 2).

Regarding only the irregularly healed heads in the same two groups, a 'possible significant' rise in occurrence of coxarthrosis was demonstrated during the decade from 25 to 35 years. (Tab. 6).

4. Severe pain was recalled to have started partly from the time of primary healing (before the age of 10), partly during the decades from 20 to 40 years of age. (Tab. 14).

The irregularly healed heads showed a 'possibly significant' rise in occurrence of pain from the age of 25 to 35. (Tab. 12).

Thus, the '*secondary* coxarthrosis' arose 20 to 30 years before the pain at '*primary* coxarthrosis', according to the statements of Ruelle.

5. A few normal (and flattened) ball shaped cases complain of pain (tab. 12) and show slight restriction of mobility. (Tab. 20).

This may be due to chance. However, possibly other unknown factors than purely mechanical may play a role in the development of disablement in a few cases. Slight fissures in the cartilage are supposed to give rise to the beginning of coxarthrosis. Such slight fissures might be supposed to be the result of the primary deformation in some cases.

6. *Sex* played no role for the late clinical or radiological result in the present samples.

7. The *stage* at onset of treatment gave no reflection on the late results.

8. *Age* of the child at establishment of diagnosis and treatment had a significant influence on late occurrence of radiological coxarthrosis, pain and mobility.

The younger the patients the better the late results.

9. *Primary shape* of the head had a significant influence on the late occurrence of radiological coxarthrosis, pain and mobility.

a) primary normal versus flattened ball shaped heads showed no significant difference in late complications. Thus,

flattened ball shaped heads had, up to the present examination of the samples, the same good prognosis as had the normal ball shapes.

b) irregular shapes had a very high frequency of secondary troubles.

10. The above statement (9 a) might be explained by the fact that primarily 'ball shaped heads', according to the present definitions and methods turn to 'normal ball shape' during growth from primary healing up to adult age. (Tab. 1).

11. The clinical examination of mobility showed that

a) rotations were the characteristic and first direction of movement to be reduced.

b) atrophy was rare in the young groups even if they had been finally treated with a period of weight bearing on one leg. Atrophy was frequent in the 65-group with its high incidence of irregular heads with coxarthrosis.

12. Treatment. The primarily untreated **65**-group showed a significantly higher frequency of severe coxarthrosis and late troubles than did the **25**- and **35**-groups, that were consistently relieved from weight bearing during the active phases of the disease.

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