INCIDENCE AND PROGNOSIS OF COXARTHROSIS

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I. INTRODUCTION

On October 11, 1859, FOCK in Magdeburg resected the head and neck of the femur in a case of osteoarthritis of the hip (coxarthrosis). This was the first recorded operative intervention for this condition. Now, a century later, operations for coxarthrosis are standard procedures in orthopaedic surgery. Opinions as to the merit of different operations vary widely; leading orthopaedic surgeons or schools may advocate operations which are in principle quite different, for one and the same patient. In few fields of surgery has there occurred such a rapid rise and fall of new or modified operative methods.

A survey of the continuing discussion of the treatment of coxarthrosis revealed at least one fundamental difficulty inherent in the choice of method: there is little knowledge of the natural history of coxarthrosis. The literature does not contain comparisons of results obtained in operated and unoperated series; objective comparisons of preoperative with postoperative conditions in well-defined groups of patients are virtually nonexistent.

In this investigation coxarthrosis was examined as a disease entity. The stable, homogenous population, centralized hospital system, and availability of census data in the city of Malmö provide good conditions for such a study.

To establish radiographic criteria, cases diagnosed on this basis in 1951 were after-examined in 1962 and the significance of minor joint changes determined.

Using these criteria, the incidence of primary coxarthrosis was calculated over a five-year-period, 1950 to 1954, permitting prediction of future trends in incidence in an aging population.

Changes in the course of the disease, evident on clinical and radiographic examination of a non-operated material after 10 years, permitted assessment of certain aspects of the natural history and prognosis of untreated coxarthrosis.

II. MATERIAL AND METHODS

A. POPULATION

The city of Malmö, situated in the southern part of Sweden, has a population of 225,660 (Census, January 1960). Detailed census data are recorded by city authorities about such items as age, sex, and migration, and predicted census figures have been published. Study of migration data by ALFFRAM (1964) has confirmed the stability of the older age groups in this population. The city is served by one general hospital, MGH (1585 beds), with a 156 bed orthopaedic department, one mental hospital, MMH (675 beds) and one geriatric hospital, GH (600 beds).

The centralized hospital system, a stable population, and the availability of detailed census data have made Malmö an ideal site for the epidemiologic study of diseases such as arteriosclerotic heart disease (BIÖRCK et al. 1957) and fracture of the proximal end of the femur (ALFFRAM 1964). The World Health Organization has recently selected Malmö as the site for an investigation of heart disease.

B. SELECTION OF PROBANDS

Coxarthrosis implies a chronic disease with change in the structure and function of the hip joint.

For the purpose of this investigation a distinction was made between *primary* and *secondary* coxarthrosis with the latter term referring to cases in which the disease was associated with a predisposing condition (Table 1).

In view of the relation between luxation and subluxation (ANDRÉN 1962) coxarthrosis due to subluxation should be ascribed to the secondary group. But in practice it proved much easier to distinguish between luxation and subluxation in advanced coxarthrosis than between subluxation and normal. All cases of coxarthrosis with subluxation were therefore regarded as primary.

Series A (214 patients) was chosen to allow evaluation of radiographic criteria for the diagnosis of coxarthrosis. Using these criteria, Series B (258 patients) was selected to permit estimation of incidence of primary coxarthrosis. The natural history of coxarthrosis over a ten-year-period was studied in Series C (168 patients).

Table 1. *Secondary Coxarthrosis*[1]

- Congenital
  - Anomalies of pelvis and femur
  - Congenital dislocation of the hip (7)
  - Alkaptonuria
  - Hemophilia
- Acquired
  - Developmental
    - Perthes' disease (3)
    - Slipped epiphysis (2)
    - Osteochondritis dissecans
    - Coxa vara
  - Infection (2)
    - Tuberculosis
    - Pyogenic arthritis
  - Rheumatic fever (1)
  - Rheumatoid arthritis
  - Metabolic
    - Rickets
    - Gout
    - Paget's disease
  - Trauma (3)
    - Fracture
    - Dislocation
  - Neoplastic
    - Chondromatosis
    - Tumors of bone and soft tissue
  - Neuropathy
    - Syphilis
    - Syringomyelia
    - Leprosy

1. Series A — Radiographic Diagnosis and Definition of Coxarthrosis

The records of the MGH Roentgen-diagnostic Department were reviewed to collect all cases attending the Orthopaedic Clinic during 1951, in which coxarthrosis had been diagnosed radiographically (Table 2).

Series A comprised 214 patients divided into two major groups (Table 3), Series A^+, those with structural and/or joint space changes, and Series A^-, those without structural or joint space changes. Series A^-, was then divided into 3 subgroups according to the osteophyte index (Table 10).

[1] Rheumatoid arthritis and fracture of the neck of the femur were not included in this investigation.
Coxarthrosis with subluxation or acetabular protrusion was regarded as primary. Figures within brackets denote number of patients (Series C).

Table 2. *Radiographic material from period 1950—1954*

	1950	1951	1952	1953	1954	1950—1954
Patients *registered as coxarthrosis*						
Total	759	895	883	708	651	3,896
Referred from the Orthopaedic Clinic	250	329	322	228	214	1,343
Referred from the Orthopaedic Clinic and living in Malmö at time of after-examination	—	214	—	—	—	—
Patients *with structural and/or joint space changes* referred from the Orthopaedic Clinic	33	43	36	38	39	189
Patients rediagnosed radiographically	—	1	3	8	9	21
Patients diagnosed for first time radiographically	33	42	33	30	30	168
Patients dead at time of after-examination	11	15	13	2+1[1]	9	50+1[1]
Patients alive at time of after-examination	22	27	20	27	21	117
Patients operated and alive at time of after-examination	3	6	4	7	6	26
Patients non-operated and alive at time of after-examination	19	21	16	20	15	91

[1] Emigrated

Table 3. *Radiographic material from 1951*

Radiographic appearance	Number of patients	
	Total	After-examined
Series A^+: Structural and/or joint space changes	27	27
Series A^-: No structural or joint space changes	187	86
Osteophyte index 2	20	17
index 1	84	42
index 0	83	27
Total	214	113

All cases in Series A^+ and samples of those in the subgroups of Series A^- were after-examined clinically and radiographically during 1962. The samples were representative of the original Series A^- groups by age and sex (Table 4).

Table 4. *Patients grouped according to age and osteophyte index*

Osteophyte	Total		After-examined	
	Number of patients	Age 1962 Mean S.E.M.	Number of patients	Age 1962 Mean S.E.M.
Index 2				
Male	16	63.8±2,85	14	64.9±2.67
Female	4	73.8±6.23	3	69.0±5.69
Index 1				
Male	45	61.4±1.59	23	59.2±1.90
Female	39	58.4±1.62	19	58.6±2.50
Index 0				
Male	31	54.7±2.01	9	52.9±2.57
Female	52	58.7±1,53	18	61.2±2.28

2. Series B — Incidence of Primary Coxarthrosis

This series included all cases (258 patients) of primary coxarthrosis with structural and/or joint space changes found by review of records at MGH, MMH and GH from the years 1950—1954. Cases of secondary coxarthrosis were excluded on the basis of clinical records and radiographs.

3. Series C – The Natural History of Primary and Secondary Coxarthrosis

This series included all cases (168 patients) who attended the Orthopaedic Clinic 1950—1954, because of hip complaints, and who had radiographically verified structural and/or joint space changes indicative of primary or secondary coxarthrosis (Table 2). Surviving patients were reexamined clinically and radiographically during 1962. Fourteen of the coxarthrotic patients in Series C were studied with external counting of Sr^{85} (DANIELSSON et al. 1964). Values are given in Table 35.

C. CLINICAL EVALUATION OF PROBANDS

The probands were evaluated on the basis of clinical and radiographic examinations. The clinical evaluation was made with regard to pain, range of motion, and restriction of function.

1. Pain.

Pain is the chief complaint in coxarthrosis. Earlier methods of grading pain in this disease are listed in Table 5. None of these systems made a distinction between types of pain, *e.g.* starting, walking or resting pain, and for this reason they were not regarded as suitable.

The method of grading pain used in this study is shown in Table 6, in which the sum of points from 0 to 5 gives a numerical value for the severity of pain.

2. Range of Motion.

JUDET and JUDET (1952) and STINCHFIELD et al. (1957) graded the range of motion of the hip according to the sum of degrees of motion in the different planes. MERLE D'AUBIGNE and CHABROL (1952) graded the range of motion according to flexion and abduction only. FERGUSON and HOWORTH (1931) and HALLOCK (1939) multiplied the angles of motion by factors which resulted in an index of 100 for a normal hip (*i.e.* flexion and abduction $\times 0.4$, plus adduction and internal rotation $\times 0.2$, plus external rotation and extension $\times 0.1$. GADE (1947) stated that the usefulness of the range of motion varied according to the plane considered (external rotation more useful than internal, abduction more useful than adduction) and that the first degrees of motion in each plane were of the most significance. He therefore introduced a modified index which was adopted by SHEPHERD (1954 a, 1954 b, 1960).

In this study Gade's system was employed with the exception that measurements of rotation were made with the hip flexed, preferably 90°, and not with the hip extended.

Table 5. *Classification of published systems for assessment of pain*

Shepherd (1954 a, 1954 b)	Judet and Judet (1952) Stinchfield et al. (1957)	Merle d'Aubigne and Chabrol (1952)
1 = severe — loss of sleep, 2 = severe when walking — unable to work, 3 = moderate — able to do light work, 4 = pain after effort, relieved by rest, 5 = slight and intermittent — able to do full work, 6 = absent.	1 = severe — loss of sleep, 2 = severe when walking — unable to do light work, 3 = moderate — able to do light work, 4 = pain after effort, relieved by rest, 5 = slight and intermittent — able to do full work, 6 = absent.	0 = douleur très vive et continue, 1 = douleurs très vives empêchant le sommeil, 2 = douleurs vives à la marche empêchant toute activité, 3 = douleurs vives mais tolérables avec activité limitée, 4 = douleurs seulement après la marche, disparaissant rapidement par le repos, 5 = douleurs très légères et intermittentes, n'empêchant pas une activité normale, 6 = indolence complète.

Table 6. *Assessment of pain*

		Index
Starting pain	No	0
	Yes	1
Pain when walking	No	0
	Slight	1
	Severe	2
Resting pain	No	0
	After walking, disappears during rest	1
	Spontaneous	2

As shown in Table 7, degrees of motion in each plane were multiplied by factors to give relatively greater value to the first degrees.

Table 7. *Assessment of range of motion*

		Index
Flexion	180°—135° multiply by 0,6	—
	135°— 90° multiply by 0.4	—
	90°— 30° multiply by 0.1	—
Abduction	0°— 15° multiply by 0.6	—
	15°— 30° multiply by 0.4	—
	30°— 60° multiply by 0.1	—
External rotation	0°— 30° multiply by 0.3	—
	30°— 80° multiply by 0.1	—
Adduction	multiply by 0.2	—
Internal rotation.....	multiply by 0.2	—

The normal index of patients above 60 years of age was found to be between 70 and 80 when calculated from values for range of motion published by SAARIO (1961). Therefore 70 was taken as the lower normal limit. A hip with a smaller index than the contralateral one was also said to be abnormal (SAARIO 1961).

3. Restriction of Function

JUDET and JUDET (1952) and STINCHFIELD et al. (1957) graded walking ability as 1 to 6; MERLE D'AUBIGNE and CHABROL (1952), as 0 to 6. SHEPHERD (1954 a) assessed restriction of function according to limp, Trendelen-

burg test, walking ability, and ability to perform such things as putting on shoes, climbing stairs, using a toilet, bathing, work and activities. SHEPHERD'S scheme appeared to be the most objective available (ADAM and

Table 8. *Assessment of restriction of function*

	Severity	Index
Limp	No	0
	Yes	1
Trendelenburg test	Negative	0
	Questionable	1
	Positive	2
Walking outside	Unaided	0
	Requires one stick	1
	Requires two sticks	3
	Requires two trestles	4
Distance walked without pain	> 1500 m	0
	400—1500 m	1
	100—400 m	2
	1 —100 m	3
	Not at all	4
Completely bedridden		10
Putting on own shoe and sock	Yes	0
	With difficulty	1
	No	2
Stair climbing	Yes	0
	With difficulty	1
	No	3
Toilet	Yes	0
	With difficulty	1
	No	3
Bathing	Yes	0
	With difficulty	1
	No	3
Work and activities	Heavy physical	0
	Moderate [1]	1
	Light [11]	2
	Slight [111]	3
	None	4

[1] Moderate: e. g. factory work, all work in large household (> 4 persons), all work in small household (< 4 persons) + extra work.

[11] Light: e. g. all work in small household, light manual labour.

[111] Slight: e. g. all work in small household except cleaning, clerical work.

SPENCE 1958) and permitted separate evaluation of various aspects of restriction of function. SHEPHERD's scheme was therefore adopted for this investigation (Table 8). A few modifications and changes in definition (as indicated in Table 8) were made in order to permit more stringent classification.

Advanced age and coexisting disease might have contributed to restriction of function in some cases (Table 9).

Table 9. *Restriction of function in nine patients with coexisting condition*

Coexisting condition	Restriction of function		
	Mild	Moderate	Severe
Possibly contributory	1	1	3
Slight cardiac symptom			
Dizziness			
Presenility			
Arthrodesis of contralateral knee			
Below knee amputation of contralateral limb			
Certainly contributory	—	1	3
Blindness			
Neural muscular athrophy of lower legs			
Postoperative lymphoedema of ipsilateral limb			
Above knee amputation of contralateral limb			

D. RADIOGRAPHIC EVALUATION OF PROBANDS[1]

Coxarthrosis has been classified using such parameters as the inclination of the neck of the femur, shape of the acetabulum, depth of the acetabulum, and the shape and size of the head of the femur (WIBERG 1939 a, 1939 b; FRANCON 1956). Some of the difficulties in using such measurements have been pointed out by HERMODSSON (1944) and FRANCON (1956). WIBERG (1939 a, 1939 b) has described the types and localisation of osteophytes as well as the anatomical explanation of the "double floor" appearance of the acetabulum.

[1] Radiograps interpreted in cooperation with Dr. B. Frost (Roentgen-diagnostic Department, Malmö General Hospital).

HERMODSSON (1944, 1948) classed coxarthrosis as upper or medial according to the localisation of narrowing of the joint space. LEQUESNE (1958) went further, classifying coxarthrosis into 4 subgroups (polaire supéro-externe, polaire supérieure, polaire axiale, and polaire interne).

1. Severity of Radiographic Changes

HERIPRET (DANIELSSON et al. 1964) has introduced a method for estimation of the severity of radiographic changes based upon presence of osteophytes, joint space changes, structural changes, and "double floor". This scheme, which was also used in the present investigation, is shown in Table 10.

Table 10. *Assessment of radiographic severity*

	Severity	Index
Osteophyte	None	0
	Visible on one pole (superior or inferior) of the joint	1
	Visible on both poles	2
	Bulky on both poles	3
Joint space	Normal	0
	Narrowed but larger than half normal width	1
	Smaller than half normal width	2
	Effaced over more than half femoral contour	3
Structure	Normal	0
	Hyperdensity or cysts in caput *or* acetabulum	1
	Hyperdensity or cysts in caput *and* acetabulum	2
	Grossly destroyed	3
Associated anomalies	None	0
	Double floor	1

2. Localisation of Radiographic Changes

In the present study HERMODSSON's and LEQUESNE's systems were modified, and radiographic changes were classified as *lateral*, *medial* or *mixed* in type.

The following definitions were used:

Lateral: Joint space changes mainly or solely in the upper, lateral part of the joint.

Medial: Joint space changes mainly or solely in the central, medial part of the joint.

Mixed: Changes not falling with certainty in either of the two above-mentioned groups.

Fig. 16, 19 and 23 illustrate typical lateral and medial structural changes.

3. Course between 1950—1954 and 1962

This was evaluated by comparing antero-posterior radiographs of the pelvis taken at the time of after-examination in 1962, with those taken in 1950—1954.

E. STATISTICAL CONNOTATION[1]

Conventional statistical methods were used (BAILEY 1961).

Statistical significance was described as follows:

$P > 0.05$ = not significant

$0.05 > P > 0.01$ = almost significant*

$0.01 > P > 0.001$ = significant**

$0.001 > P$ = highly significant***

S.E.M. = Standard error of the mean.

[1] Data treated statistically under supervision of Professor C-E.Quensel, Institute of Statistics, University of Lund.

III. RESULTS

A. RADIOGRAPHIC DIAGNOSIS AND DEFINITION OF COXARTHROSIS

1. Previous Studies

The presence of osteophytes originating from the femoral head or from the acetabulum has been considered a sign of coxarthrosis (HERMODSSON 1947). BRAILSFORD (1952) has challenged this view, stating that such small radiographic changes are not signs of coxarthrosis. JAQUELINE et al. (1950) and JACQUELINE and VERAGUTH (1954) have stated that osteophytes are probably part of the physiological process of aging.

It was therefore considered desirable to ascertain what radiographic changes justify a diagnosis of coxarthrosis.

2. Present Study

a) *Series* A^+

This series included all patients with structural and/or joint space changes in 1951. The 27 surviving patients (6 males and 21 females) in this group were examined clinically and radiographically in 1962. In all cases such structural and/or joint space changes persisted in 1962. The range of motion was invariably reduced (Table 34).

b) *Series* A^-

This series included all patients in whom the diagnosis of coxarthrosis in 1951 had been based upon the presence of osteophytes without structural or joint space changes. Samples of three subgroups selected according to their osteophyte index were examined in 1962. The 5 patients in Series A^- who were not clinically normal in 1962 are listed in Table 33.

Osteophyte Index 2

None of the 17 patients (14 males and 3 females) examined in 1962 had developed structural or joint space changes. All were free from pain, and all except one (1390) had a normal range of motion. The index for restriction of function was 4 or less.

Osteophyte Index 1

Of the 42 patients (23 males and 19 females) examined, only one (1868) had developed joint space changes. This patient also had pain and a decreased range of motion. Two (1377 and 1503) patients had a decreased

range of motion, without pain. The index for restriction of function was 3 or less except for one (1503) patient with an index of 24.

Osteophyte Index 0

None of the 27 patients (9 males and 18 females) in this group had developed structural or joint space changes by 1962. All were free of pain and, with the exception of one (1142), had a normal range of motion. The index for restriction of function was 3 or less.

Osteophyte Index 1951 compared with Osteophyte Index 1962

Changes in osteophyte index in Series A⁻ over the eleven-year period are shown in Table 11. The occurrence of osteophytic changes in previously normal hips is apparent.

Table 11. *Hips with osteophyte index 2, 1 or 0, 1951 and 1962*

Number of hips 1951	Number of hips 1962		
	Osteophyte index 2	index 1	index 0
Osteophyte index 2 21	19	1	1
index 1 74	12	52	10
index 0 75	2	25	48
Total 170[1]	33	78	59

[1] Two patients examined on one side only.

Table 12 demonstrates the direct relation between osteophyte index and mean age in both sexes and that index 2 and index 1 were more common in males. After correction for age and sex distribution, osteophytes were more commonly seen in males.

3. Comments

Patients who had radiographic structural and/or joint space changes in 1951 had such changes at examination in 1962. Of the 86 patients in whom a radiographic diagnosis of coxarthrosis had been made in 1951 despite the absence of structural or joint space changes, only one had developed such changes by 1962. In most cases the diagnosis of coxarthrosis had been based upon the demonstration of osteophytic changes alone.

Hip joints with osteophytes but without structural or joint space changes were not, and did not become, arthrotic (Fig. 9, 10, 11, 12).

Table 12. *Age and sex distribution of osteophyte indexes (Series A⁻)*

Osteophyte	Number of patients		Age						Mean age difference Female minus Male
			Male		Female		Total		
	Male	Female	Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.	
Index 2	16	4	52.8	± 2.85	62.8	± 6.23	54.8	± 2.68	+ 10.0
Index 1	45	39	50.4	± 1.59	47.4	± 1.62	49.0	± 1.13	— 2.9
Index 0	31	52	43.7	± 2.01	47.7	± 1.53	46.2	± 1.22	— 4.1

4. Summary

Of 214 patients referred from the Orthopaedic Clinic in 1951 in whom a diagnosis of coxarthrosis had been made radiographically, 27 had structural and/or joint space changes, while the radiographic findings in the remaining 187 were confined to osteophytic changes.

The small group of 27 patients with structural and/or joint space changes when examined in 1962, showed the same radiographic changes and were clinically not normal.

The large group of 187 labelled "coxarthrosis" on the basis of osteophytic changes alone was divided into 3 subgroups according to the extent of such changes. Eighty-six patients representing samples of each subgroup were examined radiographically and clinically in 1962. Only one of these patients had developed joint space changes and was clinically not normal.

Hip joints with osteophytes but without structural or joint space changes were not, and did not become, arthrotic during the 11-year period. A diagnosis of coxarthrosis must therefore be based upon radiographic structural or joint space changes, and not on osteophytes alone.

B. INCIDENCE OF PRIMARY COXARTHROSIS

1. Previous Studies

The reported incidence of coxarthrosis varies widely, depending upon the method of selection of patients and the diagnostic criteria. HOLLANDER (1957) claimed that 90 to 95 per cent of all people above 60 years of age have had arthrotic pain. SILVERSTEIN (1961) believed that only 5 to 10 per cent of those with arthrosis ever sought medical advice. FRANCON (1956) was of the opinion that coxarthrosis is extremely common.

HERMODSSON (1947) reported radiographic evidence of coxarthrosis in 30 of 100 patients above 50 years of age who had subjectively normal hips. KELLGREN (1961) and KELLGREN and LAWRENCE (1961) noted such changes in 20 per cent of patients above 55 years. The figures given above include both primary and secondary coxarthrosis.

No data are available on the age and sex distribution and mortality of primary coxarthrosis.

2. Present Study

Series B included all cases of primary coxarthrosis diagnosed radiographically in Malmö during the five-year-period 1950—1954. Table 13 shows the number of cases by age, sex and source—whether referred from the Orthopaedic Clinic or other clinics and private physicians. Study of the mortality, and age and sex specific incidence in this series permitted a prediction of the number of cases of primary coxarthrosis in the population of Malmö in 1960.

a) *Mortality*

The observed mortality of Series B over the ten-year period prior to the after-examination was compared with that in sex and age matched groups of the general population of Malmö. The observed and expected numbers of deaths in series B were the same (101 deaths in 258 patients).

b) *Annual Incidence*

The system of registering patients according to diagnosis was begun at the MGH Roentgen-diagnostic Department in 1950. Some cases recorded from 1950 to 1954 might have been diagnosed prior to that time as well, but were probably few.

Table 13. *Patients with primary coxarthrosis in period 1950—1954 (Series B)*

Age at first diagnosis	No. of patients				No. of deaths				Mortality rate per 1000	
	Male		Female		Male		Female		Male	Fem
	a	b	a	b	a	b	a	b		
Diagnosed for first time in period 1950—1954										
<40	1	1	—	3	—	—	—	—	30	23
40—44	2	—	—	1	—	—	—	—	46	36
45—49	1	1	6	2	—	—	—	—	73	56
50—54	4	3	8	6	—	—	—	1	118	87
55—59	6	10	15	3	1	1	1	1	182	141
60—64	17	8	14	3	4	4	2	—	280	234
65—69	15	11	14	12	5	3	9	6	417	375
70—74	20	8	12	15	11	6	5	13	598	564
75—79	3	8	2	11	3	8	1	8	784	756
80—84	2	3	2	—	2	3	2	—	918	896
85—89	—	—	1	2	—	—	1	2	1000	1000
Total	71	53	74	60	24	25	21	31		
No. of expected deaths					29	23	23	26		
Diagnosed also before in period 1950—1954										
40—44	1	1	—	—	—	—	—	—	—	—
45—49	—	—	—	1	—	—	—	—	—	—
50—54	1	—	2	—	—	—	—	—	—	—
55—59	—	1	1	—	—	1	—	—	—	—
60—64	3	2	—	1	—	—	—	—	—	—
65—69	3	3	—	—	—	1	—	—	—	—
70—74	2	3	—	5	2	1	—	5	—	—
75—79	1	—	—	2	—	—	—	2	—	—
Total	11	10	3	9	2	3	—	7	—	—
No. of expected deaths					4	4	0.3	5	—	—

a) = Referred from the Orthopaedic Clinic.
b) = Referred from other clinics or private physicians.

The number of cases of primary coxarthrosis diagnosed during each of these five years ranged from 47 to 59 with a mean of 52 (Table 14).

c) *Age and Sex Specific Incidence*

In order to calculate the incidence of primary coxarthrosis per 10,000 inhabitants in various age groups, the mean population of Malmö during

Table 14. *Patients with primary coxarthrosis in period 1950—1954*

	Diagnosed for first time	Diagnosed also before in period
1950	52	1
1951	52	8
1952	59	7
1953	47	9
1954	48	8
Total	258	33

the period 1950—1954 was interpolated from census data compiled in 1950 and 1960. The age- and sex-specific incidence, calculated on this basis is shown in Table 15 and Fig. 1.

Table 15. *Patients with primary coxarthrosis diagnosed for first time in period 1950—1954*

Age groups	Absolute number		Number per 10,000 inhabitants		
	Male	Female	Male	Female	Total
35—39	2	3	0.5	0.7	0.6
40—44	2	1	0.5	0.2	0.4
45—49	2	8	0.5	2.1	1.3
50—54	7	14	2.4	4.2	3.4
55—59	16	18	6.9	6.4	6.6
60—64	25	19	12.5	7.6	9.8
65—69	26	26	15.7	12.2	13.7
70—74	28	27	23.9	16.5	19.5
75—79	11	13	15.6	13.4	
80—84	5	2	16.1	4.1	12.0
85—89	—	3	—	15.7	
>65	70	71	17.6	13.0	15.0
Total	124	134			

The incidence of *diagnosed* primary coxarthrosis increased with age up to 75 years. Possibly the *true* incidence continues to increase above this age, but this was not reflected here probably because old people are not so likely to seek advice or be examined for this disease. There was no significant difference in incidence between the sexes.

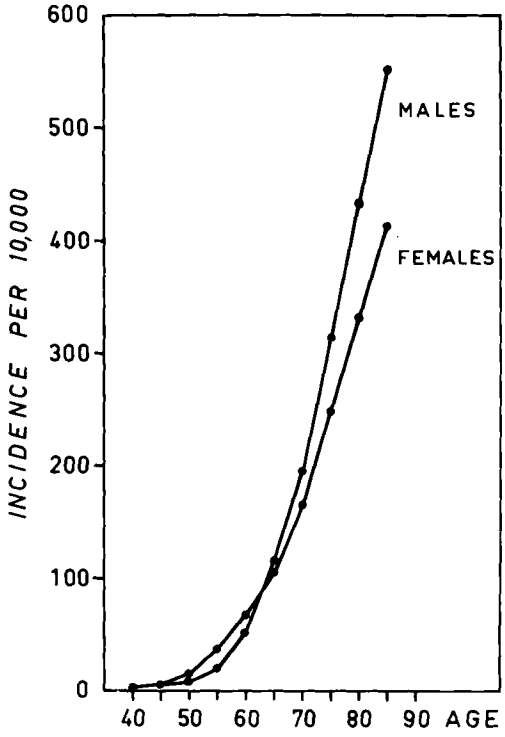


Fig. 1
Total incidence of patients with primary coxarthrosis per 10,000 inhabitants classified according to age and sex.

d) *Number of Patients with Primary Coxarthrosis in Malmö, 1960 and 1975 (Fig. 2 and 3)*

Age and sex specific incidence data were projected upon the population of Malmö and of Sweden to calculate the number of cases of primary coxarthrosis in 1960 and in 1975.

In Malmö the number for 1960 was 831 (368 males and 463 females), and for the whole of Sweden 28,964 (14,226 males and 14,738 females). The expected number for 1975 is higher than for 1960. The increase will start in the 55—59 year group but be most marked in the high age classes.

3. Comments

The high incidence in HERMODSSON'S series is explained by his acceptance of cases with osteophytic changes alone as coxarthrosis. In only one of one hundred cases were there structural changes. In comparison with

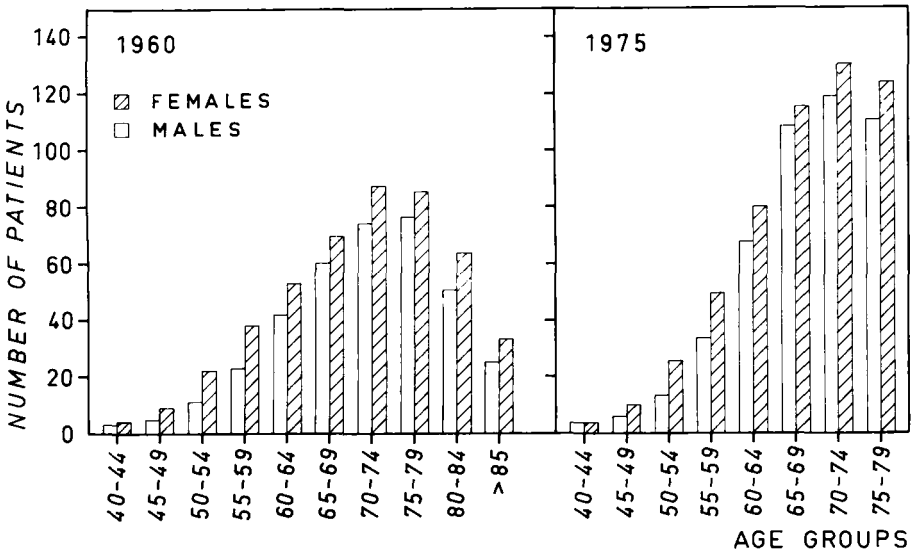


Fig. 2
Calculated number of patients with primary coxarthrosis in Malmö in 1960 and 1975 classified according to age and sex.

KELLGREN's figure of 20 per cent, the incidence of primary coxarthrosis above age 55 in this study was only 1.6 per cent. His higher figure resulted from use of the conventional radiographic definition of coxarthrosis; it was apparent from a study of series A that if all radiographically evident changes were accepted as signs of coxarthrosis, the incidence would be very high.

The average annual incidence of radiographically diagnosed primary coxarthrosis in Malmö in 1950—1954 was 52, and may be compared with the average annual number (94) of fractures of the proximal end of the femur in the same period (ALFFRAM 1964).

4. Summary

Study of the age and sex distribution of primary coxarthrosis diagnosed during the five-year period 1950—1954 gave values for the age- and sex-specific incidence of the disease in the city of Malmö. In both sexes, the incidence of diagnosed primary coxarthrosis increased markedly with age up to 75 years, and then dropped off somewhat, possibly because old people

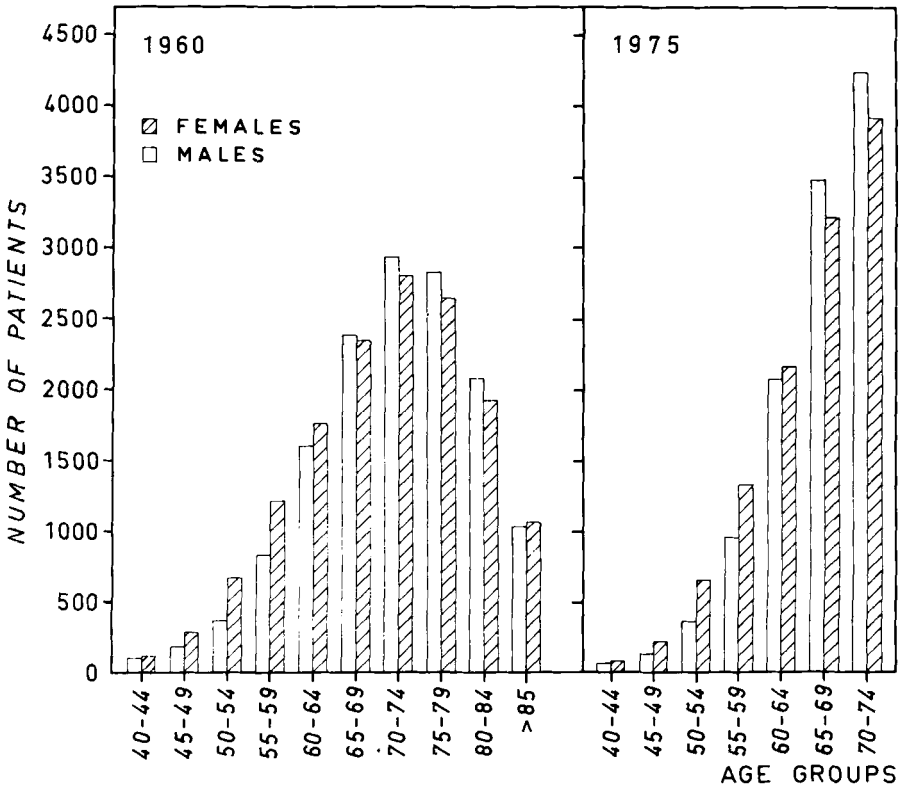


Fig. 3
Calculated number of patients with primary coxarthrosis in Sweden in 1960 and 1975 classified according to age and sex.

are not so likely to seek treatment. The annual incidence of diagnosed primary coxarthrosis was about half of that of fracture of the proximal end of the femur.

Forty per cent of the patients were dead within 10 years. This mortality is the same as that for sex and age matched groups of the general population.

C. NATURAL HISTORY OF COXARTHROSIS

1. Composition of material

Series C comprised the 168 patients who attended the Orthopaedic Clinic during 1950—1954 because of hip complaints and who had radiographically verified structural and/or joint-space changes (Table 2). It included both primary and secondary coxarthrosis. All surviving patients of series C (with the exception of one who emigrated) were after-examined clinically and radiographically during 1962. The after-examined group consisted of 117 patients, of whom 26 had undergone operation because of their disease.

The average *age* of the patients in 1962 was 69.4 $\pm$ 0.91 years. No age difference was noted between sexes or between operated and non-operated groups. In 1962 the age of patients with primary coxarthrosis was higher*** than that of patients with secondary coxarthrosis (70.6 $\pm$ 0.84 versus 62.2 $\pm$ 3.41). This reflects the lower age at onset of secondary coxarthrosis.

a) *Sex Distribution*

Previous Studies

FISHER (1950) stated that coxarthrosis was more common in males. FRANCON (1956) and PEARSON and RIDDELL (1962) reported that coxarthrosis was equally common in both sexes. LEQUESNE (1958) found 40 per cent male and 60 per cent female. In surgical series, LLOYD-ROBERTS (1955) reported equal distribution, while ADAM and SPENCE (1958) found 30 per cent male and 70 per cent female.

Present Study

Series C consisted of 168 patients (83 males and 85 females). At after-examination in 1962, 117 (~~56~~ males and 61 females) were still alive. Coxarthrosis was equally common in both sexes at the time of diagnosis, but with increasing age females predominated, probably because of the higher mortality of males in high age groups.

b) *Incidence of Secondary Coxarthrosis*

In series C, 11 per cent had secondary coxarthrosis (11 males and 8 females). At after-examination 1962, 15 per cent (9 males and 8 females) had secondary coxarthrosis.

Comments

The somewhat higher incidence of secondary coxarthrosis in 1962 was probably related to the higher mean age and mortality of the primary group. Table 16 summarizes earlier series and this material classified as to etiology. In three series the incidence of secondary coxarthrosis is similar to that observed in this material. WIBERG's figures are higher, but they include fracture and rheumatoid arthritis.

c) *Incidence of Bilateral Coxarthrosis*

Fifty-seven patients (27 males and 30 females) of the total series of 168 had bilateral disease in 1950—1954. In 1962 forty (19 males and 21 females) had bilateral coxarthrosis of the 113 (56 males and 57 females) re-examined radiographically. Four (3500, 0056, 2145, 3625) patients with unilateral disease were excluded as they did not consent to radiographic examination in 1962. In one (2145) of these the disease was clinically bilateral in 1962. During the period 1950—1954 to 1962, five (0019, 1315, 1586, 4381, 4610) more bilateral cases appeared (Fig. 20) and one (1259) case, bilateral in 1950—1954, showed radiographic evidence of disease on only one side in 1962.

Thirty-four per cent of Series C and 35 per cent of those surviving in 1962 had bilateral coxarthrosis.

Comments

The occurrence of bilateral disease was not related to sex. The fact that coxarthrosis was bilateral in one third of the patients strongly supports the contention that this condition is a disease sui generis. If the chance of one patient having bilateral disease was not greater than that of 2 patients having unilateral disease, the incidence of bilateral disease would have been much lower***.

ADAM and SPENCE (1958) found that 34 per cent of their patients had bilateral disease, while DE SÉZE and LEQUESNE (1956) noted 45 per cent, and LLOYD-ROBERTS (1955) 50 per cent. These figures agree with those found in this investigation.

Table 16. *Classification of published series according to etiology*

Etiology	Danielsson[1] (1964) 168 cases	De Sèze Lequesne Barbannaud (1962) 200 cases	Ruelle (1961) 1000 cases	Coste Laurent (1958) 317 cases	Lequesne (1958) 200 cases	Wiberg (1939 b) 257 cases
Acetabular dysplasia, Subluxation, Congenital dislocation	—	41 %	22 %	31 %	40 %	25.7 % (only subluxation)
Acetabular protrusion	5 %	5 %	20 %	7 %	7 %	—
Other causes	11 %	10 %	8 %	—	11 %	21 %
"Primary coxarthrosis"	—	44 %	50 %	—	42 %	53.3 %

[1] In the present investigation: Primary coxarthrosis = "Primary coxarthrosis", Subluxation and Acetabular protrusion.
Secondary coxarthrosis = Other causes and Congenital dislocation.

2. Clinical Evaluation

a) *Pain*

All data about pain were obtained at the time of interview in 1962.

i. *Age at Onset of Pain* (operated and non-operated cases in Fig. 4)

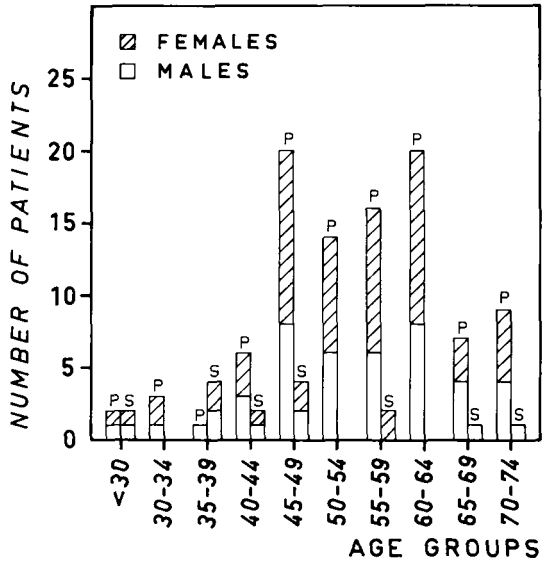


Fig. 4

Number of operated and non-operated patients classified according to age at onset of pain, sex and etiology of the disease.

P: Primary coxarthrosis.

S: Secondary coxarthrosis.

Previous Studies. The age at onset of hip pain has generally been taken as the age at onset of coxarthrosis. MATHIEU (1937) found that symptoms first appeared between 50 and 60 years of age. FISHER (1950) stated that the primary type began at 40 to 60 but that the secondary type began earlier. In LLOYD-ROBERTS' (1955) series, the onset was at 50 to 55 years of age. LEQUESNE (1958) noted that the mean age at onset of the primary type was 61; of the secondary type, below 40 years. PEARSON and RIDDELL (1962) found that age at onset of three fourths of patients with the primary type of disease was over 50 years.

Present Study. Patients were found to have a good recollection of when pain began, whereas decrease of range of motion or restriction of function was more difficult to date. Transient and diffuse types of pain were disregarded.

In bilateral cases only the first hip was considered. Three patients (4479, 1335, 2375), two (Fig. 13, 21) with bilateral and one with unilateral disease, denied ever having had pain, and were excluded from these calculations.

The mean age at onset was 53.1 ± 1.16 years and was independent of sex (53.3 ± 1.60 in males and 52.7 ± 1.48 in females). Age at onset of pain in primary coxarthrosis was higher*** than in secondary coxarthrosis (54.7 ± 1.08 versus 43.6 ± 3.57). In bilateral cases the age at onset of pain in the first hip, 52.3 ± 1.76 years, was independent of sex (49.7 ± 3.03 in males and 53.4 ± 2.01 in females) and not significantly different from the age at onset of unilateral cases.

The difference in age at onset of pain in first and second hip in bilateral cases was 6.1 ± 1.51 years and was independent of sex (8.8 ± 3.65 in males and 4.6 ± 1.20 in females).

The age at onset was independent of radiographic type of coxarthrosis (lateral type 53.7 ± 1.50 and medial type 53.2 ± 2.09).

Comments. The age at onset in this series agreed well with previous reports, including the finding that secondary coxarthrosis appeared at an earlier age than primary coxarthrosis. The range of age at onset in secondary coxarthrosis was wider, probably due to the heterogeneous composition of this group.

ii. *Pattern of Pain*

The localisation at onset, type, and severity of pain were examined.

Previous Studies. Pearson and Riddell (1962) found pain localised to the greater trochanter in two thirds of their cases, and to the knee, groin and thigh in the remaining third.

Voigt (1958) stated that pain became more severe with time. Francon (1956), Lequesne (1958) and Pearson and Riddell (1962), however, found that coxarthrosis was sometimes painless in the earlier stages, and that pain could disappear after some time.

Present Study. Changes in pattern of pain were studied in the non-operated group only. Non-operated patients were questioned about the *localisation of pain at onset* (Table 17). Fifty-four per cent localised such pain to the region of the greater trochanter, 24 per cent to the groin and 22 per cent to the knee. There was no sex difference. The *localisation of pain at the time of interview* (Table 17) in the same group was as follows: 43 per cent greater trochanter, 27 per cent groin, and 30 per cent knee.

Table 17. *Localisation of pain*

	Localisation of initial pain			*Localisation of pain at after-examination*		
Region	Male	Female	Total	Male	Female	Total
Greater trochanter	45	52	97	28	50	78
Groin	13	30	43	20	30	50
Knee	18	21	39	24	30	54
Total	76	103	179	72	110	182

On the basis of this interview the over-all pattern of the localisation of pain did not change appreciably during the interval between onset and after-examination.

Starting pain (Table 18), occurring when the patient begins to move about, was noted in 56 (25 males and 31 females) of 91 patients. Ten of those (3 males and 7 females) felt such pain bilaterally. The group with such pain totaled 66 of 125 arthrotic hip joints. The remaining 35 patients denied such pain so that 59 arthrotic hips had no starting pain.

Pain when walking (Table 18) was reported as severe by 19 patients (7 males and 12 females) in all together 23 hips; 5 of these patients had slight pain in the other hip. Forty-seven patients (20 males and 27 females) had slight pain in all together 59 hips. The remaining 30 patients (43 hips) had no pain when walking.

Pain during rest (Table 18). Spontaneous hip pain was reported by 5 patients (4 males and 1 female) in 8 hips. Pain after exercise (disappeared during rest) was reported by 18 patients (5 males and 13 females) in 21 hips. Sixty-eight patients (96 hips) had no pain during rest.

Table 18. *Incidence of pain in* 91 *patients with* 125 *arthrotic hips*

	Number of patients		Number of hips	
Starting pain	56		66	
Pain when walking	66		82	
Slight		47		59
Severe		19		23
Resting pain	23		29	
After walking, disappears during rest		18		21
Spontaneous		5		8

Severity of pain at time of the after-examination as indicated by index was not related to sex or to the etiology of the disease. Seventy-five per cent had a pain index of 2 or better with 35 painless hips out of 125 examined (Fig. 5; Fig. 15; 23). Two thirds of the hips had become less painful in 1962 compared with 1950—1954 (Table 19).

Fig. 5
Number of arthrotic hips classified according to pain, patients' sex and etiology of the disease.
P: Primary coxarthrosis.
S: Secondary coxarthrosis.

Table 19. *Severity of pain* 1950—1954 *compared with that at after-examination in* 119 *arthrotic hips*

	Male	Female	Total
More severe	10	10	20
Unchanged	3	11	14
Less severe	28	42	70
Always painless	11	4	15
Total	52	67	119

b) *Physical Examination*

An objective clinical evaluation of coxarthrosis was obtained by measurement of the range of motion, leg length, and circumference of the thigh, by the Trendelenburg test and body weight.

i. *Range of Motion*

The range of motion was recorded in 1962 in 124 hips. In one (3500) patient examined at home the range could not be assessed accurately. The findings are summarised in Fig. 6. The average range of motion in the different planes was flexion 60° (normal 110°), abduction plus adduction 20° (normal 45°) and total rotation 10° (normal 50°). Normal values are taken from SAARIO (1961).

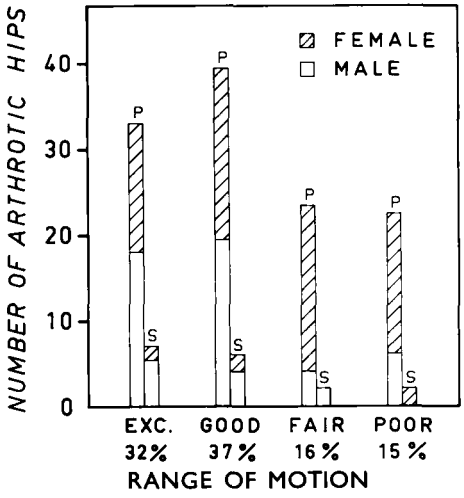


Fig. 6

Number of arthrotic hips classified according to range of motion, patients' sex and etiology of the disease.
P: Primary coxarthrosis.
S: Secondary coxarthrosis.

The mean range of motion in various planes was generally greater in secondary than in primary coxarthrosis, but significantly** greater only for internal rotation. The index of range of motion was higher* for males (42.4 ± 3.4) than for females (32.4 ± 2.9).

Flexion contracture was noted in 73 per cent of cases, external rotation contracture in 27 per cent, adduction contracture in 22 per cent, abduction contracture in 0.8 per cent (Fig. 24).

ii. *Relation of Contracture to Pain*

Previous Studies. A correlation between contracture and severity of pain has often been stated in the literature, but data for this conclusion are

lacking. KUHNS (1942) stated that patients with coxarthrosis and contracture had more severe pain than those without contracture. O'MALLEY (1959, 1962) suggested that contracture and severity of pain were related.

Present Study. Contractures in different planes were classified according to the deviation of the extended leg from normal.

Group	Angle (Degrees)
0 =	0
1 =	1—15
2 =	16—30
3 =	31—45
4 =	46—60

Data about severity of pain, and degree of contracture in 3 planes — flexion, adduction, and external rotation, were available for 123 hips (Table 20).

A correlation was found between severity of pain and degree of contracture in the various planes. The correlation was strongest for flexion contracture (Table 21). The number of painless hips decreased successively and severity of pain increased progressively (apart from flexion contracture group 3, which was noted in only 11 hips). The regression line for severity of pain on flexion contracture was obtained from the following equation:

$$P = 0.61 + 0.76\ F$$

(P = severity of pain, F = Flexion contracture group)

The severity of pain increased by 0.76 unit per group. The correlation coefficient found between pain and flexion contracture was 0.51.

The relationship between severity of pain and of contracture in adduction and external rotation, respectively, was not so close, and was probably due to correlation between flexion-, adduction- and external rotation contractures. This was apparent from data given in Table 22. The severity of pain increased with that of adduction- and external rotation contracture, but this was probably only due to the correlation between the different contractures. Good agreement was found between the observed and expected severity of pain. The expected severity of pain was calculated from the equation given above.

iii. *Leg Length*

Patients with secondary coxarthrosis or with primary coxarthrosis when leg length discrepancy may have been due to an injury, *e.g.* fracture, were excluded.

Table 20. *Arthrotic hips classified according to severity of pain and contracture*

Pain	Contracture												
	Flexion[1]					Adduction[11]			Lateral rotation[1]				
	0	1	2	3	4	0	1	2	0	1	2	3	4
0	27	9	5	3	—	41	2	1	36	3	5	—	—
1	1	4	7	2	—	8	6	0	6	5	3	—	—
2	5	16	13	1	—	26	7	2	19	4	8	4	—
3	1	4	7	2	—	10	2	2	7	2	4	—	1
4	—	3	4	1	1	5	1	2	5	2	1	—	1
5	—	—	5	2	1	6	2	0	4	—	3	1	—
Total	34	36	41	11	2	96	20	7	77	16	24	5	2

[1] 1 patient excluded (3500).

[11] 2 patients excluded (3500, 3571).

Table 21. *Arthrotic hips classified according to flexion contracture and mean severity of pain*

Flexion contracture	Number of arthrotic hips	Number of arthrotic hips always painless	Mean intensity of pain
0	33	27	0.4
1	35	9	1.6
2	41	5	2.3
3	11	3	2.2
4	3	0	3.7
Total	123	44	1.6

Table 22. *Arthrotic hips classified according to contracture, observed and expected severity of pain*

Contracture	Number of arthrotic hips	Mean		
		Observed severity of pain	Flexion contracture	Expected severity of pain
Adduction				
0	96	1.5	1.2	1.5
1	20	2.0	2.0	2.1
2	7	2.6	1.9	2.0
External rotation				
0	77	1.4	1.0	1.4
1	16	1.7	1.7	1.9
2	24	2.1	2.0	2.2
3	5	2.6	1.2	1.5
4	1	3.3	1.0	2.2

Shortening > 1 cm of the affected limb (anterior superior iliac spine to medial malleolus) was noted in 18 cases (14 lateral, 2 medial, 2 mixed type). On comparison with the total material considered (61 lateral, 28 medial, 36 mixed type), shortening was found to be more common* in the lateral than in the medial or mixed type of coxarthrosis.

iiii. *Thigh Atrophy*

Circumference of the thigh was measured 15 cm above the proximal end of the patella with the knee extended. One case was excluded because of an above-knee amputation. In 4 cases the circumference was greater on the affected side due to below-knee amputation, thrombosis, lymphoedema, or fracture involving the knee-joint. The remaining 86 patients are summarised in Table 23.

Table 23. *Arthrotic hips with or without associated thigh atrophy classified according to localisation of arthrosis*

Thigh atrophy	Male	Female	Total	Lateral	Medial	Mixed
None	11	15	26	2	9	8
1 cm	6	15	21	10	5	6
2 cm	9	9	18	11	2	5
3 cm	4	8	12	9	1	2
4 cm	5	4	9	7	0	2
Total	35	51	86	46	17	23

Disease was bilateral in 11 of 26 patients with equal thigh circumference.

Atrophy was more common and more advanced* in the lateral than in the medial or mixed type of coxarthrosis.

iiiii. *Trendelenburg Test*

The Trendelenburg test was positive in 28 hips (10 males and 18 females) negative in 79 (39 males and 40 females), and questionable in the remaining 16 hips (4 males and 12 females). One bed-ridden patient (1344) could not be tested. The Trendelenburg test was more frequently*** positive in lateral than in medial or mixed type of coxarthrosis.

iiiiii. *Body Weight*

Previous Studies. Obesity has been considered as an etiological factor in coxarthrosis (RASMUSSEN 1951, STECHER 1961) as a precipitating factor (WIBERG 1939 b) and as a factor accentuating pain (HOLLANDER 1957). DENHAM (1959) showed that reduction of body weight by one pound reduced the load on the hip joint by 3 pounds. The importance of weight reduction in the treatment of this disease has been stressed by MCFARLAND (1954), LOCKIE and TALBOTT (1957) and many others.

Present Study. "Ideal body-weight" in kilograms was defined as: (height in cm. minus 100) $\pm$ 10 per cent, over-weight $>$ ideal body-weight $>$ under-weight (WERNER and BERFENSTAM, 1960).

The heights and weights of 115 patients at time of examination in 1962 are shown in Table 24. Fifty-four (47 per cent) were over-weight while only 13 (11 per cent) were under-weight.

Table 24. *Coxarthrotic patients classified according to weight*[1] *and surgery*

	Male				Female				Total			
	Under-weight	Ideal-weight	Over-weight	Total	Under-weight	Ideal-weight	Over-weight	Total	Under-weight	Ideal-weight	Over-weight	Total
Non-operated												
Secondary	—	5	3	8	1	4	—	5	1	9	3	13
Primary	4	14	12	30	5	15	26	46	9	29	38	76
Total	4	19	15	38	6	19	26	51	10	38	41	89
Operated												
Secondary	—	1	—	1	—	1	1	2	—	2	1	3
Primary	2	5	5	12	1	3	7	11	3	8	12	23
Total	2	6	5	13	1	4	8	13	3	10	13	26
Total												
Secondary	—	6	3	9	1	5	1	7	1	11	4	16
Primary	6	19	17	42	6	18	33	57	12	37	50	99
Total	6	25	20	51	7	23	34	64	13	48	54	115

[1] Height and weight not given for two patients (3500; 1344).

Table 25. *Severity of pain in non-operated and operated patients grouped according to body-weight*

	Severity of pain	
	Mean	S.E.M.
Non-operated		
Under-weight	1.2	± 0.19
Over-weight	2.0	± 0.15
Operated		
Under-weight	1.3	± 1.25
Over-weight	1.7	± 0.33
Total		
Under-weight	1.2	± 0.32
Over-weight	1.9	± 0.11

Table 25 shows that the mean severity of pain was higher for over-weight than under-weight patients. This difference was significant* only in the unoperated group.

Comments. The results showed that patients with coxarthrosis were more often over-weight than under-weight, but probably not more often than in a control material (WERNER and BERFENSTAM 1960). Over-weight patients had more severe pain than under-weight patients.

c) *Restriction of Function*

An assessment was made according to Table 8. Two thirds of the patients found it difficult or impossible to put on shoes and socks (Table 26).

Table 26. *Ability to put on own shoe and sock*

	Number of coxarthrotic pats.			Number of arthrotic hips		
	Male	Female	Total	Male	Female	Total
Easily	15	13	28	22	16	38
With difficulty .	14	14	28	19	17	36
Not able.....	9	26	35	12	39	51
Total	38	53	91	53	72	125

Half of the patients could walk unaided, and one third used one stick (Table 27). Two thirds could walk more than 400 meters without pain.

Table 27. *Walking ability*

Walking outside	Male	Fem.	Total	Distance walked without pain	Male	Fem.	Total	Stair climbing	Male	Fem.	Total
Unaided	20	25	45	> 1500 m	19	19	38	Unaided	15	12	27
Requires 1 stick	13	20	33	400—1500 m	5	13	18	Requires stick			
Requires 2 sticks	3	5	8	100—400 m	3	3	6	*or* hand-rail	13	15	38
Requires 2 trestles	1	—	1	1 —100 m	10	15	25	Requires stick			
Not at all	1	2	3	Not at all	1	3	4	*and* hand-rail	9	14	23
Completely bed-ridden .	—	1	1					Unable	1	2	3
Total	38	53	91	Total	38	53	91	Total	38	43	91

Table 28. *Ability to manage personal hygiene*

	Ability to use toilet			Ability to take a bath		
	Male	Female	Total	Male	Female	Total
Easily	25	28	53	17	17	34
With difficulty ..	12	24	36	16	14	30
Not able	—	1	1	5	22	27
Total	37	53	90[1]	38	53	91

[1] One (4479) patient excluded because of colostomy.

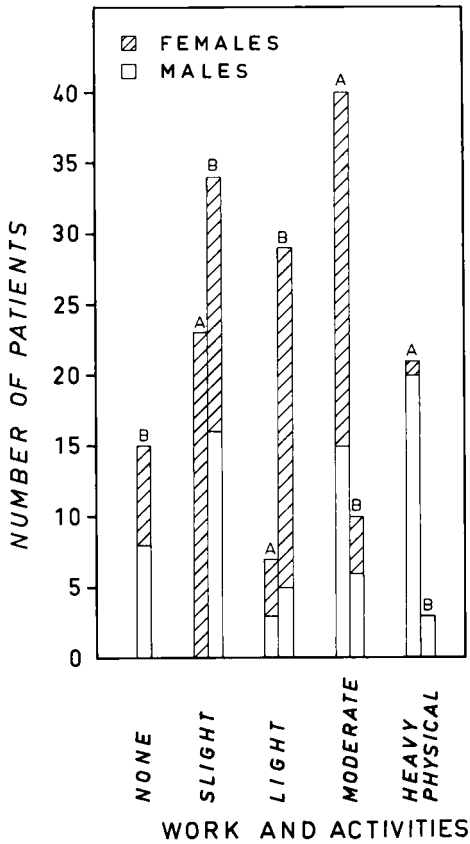


Fig. 7
Number of coxarthrotic patients classified according to work and activities and sex.
A. Before onset of coxarthrotic symptoms.
B. At the time of after-examination.

One third could not climb stairs unaided (Table 27). Two fifths of the patients reported difficulty in using a toilet, and one third were unable to take a bath without assistance (Table 28).

Twelve patients had received a disability pension.

The patients' work and activities before the onset of the disease and at the time of the after-examination are summarized in Fig. 7. Working ability decreased significantly*** and more for females (t = 8.8) than for males (t = 4.3). At the time of after-examination no difference was found between the sexes.

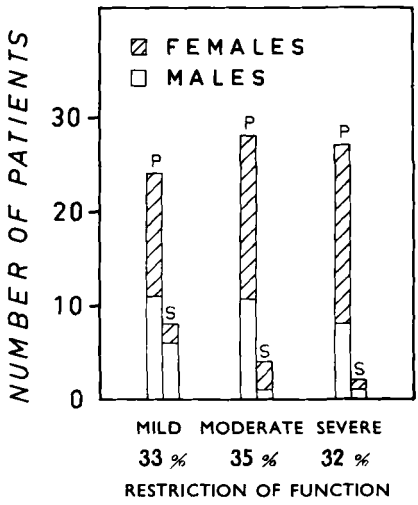


Fig. 8

Number of coxarthrotic patients classified according to restriction of function, sex and etiology of the disease.

Comments

In one third of the patients the restriction of function was severe (Fig. 8), which means that the patient "needs the assistance of other people for his day-to-day existence" (SHEPHERD 1954 a). The mean index for restriction of function was 9.6 $\pm$ 0.60 and did not differ significantly with sex or etiology (primary versus secondary coxarthrosis).

3. Radiographic Evaluation (1950—1954 and 1962)

a) *Previous Studies*

HARRISON et al. (1953) showed experimentally that the structural changes of coxarthrosis regressed when pressure on joint surfaces was reduced. Regression of changes seen radiographically in one hip follow-

ing operation upon the opposite hip has been noted by POUYANNE and HONTON (1960). Similar regression of radiographic changes in the operated hip following osteotomy and operations upon muscles has been reported by OSBORNE and FAHRNI (1950), WARDLE (1955), VOSS (1956), ADAM and SPENCE (1958), MCSWEENEY (1958), ROBINS and PIGGOT (1960), and PAUWELS (1961). ARDEN (1957) and HIRSCH (1960) pointed out that such radiographic changes may be due to difference in projection.

b) *Present Study*

i. *Severity of Radiographic Changes*

In 1950—1954 and/or 1962 coxarthrosis was diagnosed radiographically in 125 hips. Of these, 121 were radiographed again in 1962. Four patients with unilateral disease in 1950—1954 would not consent to radiographic examination in 1962.

The mean radiographic index was 4.8 $\pm$ 0.13 in 1950—1954, and 6.2 $\pm$ $\pm$ 0.13 in 1962. Neither in 1950—1954 nor in 1962 did the mean value differ significantly with sex or etiology (primary versus secondary coxarthrosis).

According to the system employed (Table 29) the radiographic changes progressed independent of sex in both primary and secondary coxarthrosis. Primary coxarthrosis progressed radiographically more* than secondary (1.7 $\pm$ 0.13 versus 0.7 $\pm$ 0.13).

Table 29. *Radiographic progress—regression classified according to table 10*

	— 3	— 2	— 1	0	+ 1	+ 2	+ 3	+ 4	+ 5	> + 5	Total
Secondary											
Male	—	—	1	4	3	3	—	—	—	—	11
Female	—	—	—	3	3	—	—	—	—	—	6
Total	—	—	1	7	6	3	—	—	—	—	17
Primary											
Male	1	—	2	14	8	9	1	3	2	2	42
Female	—	1	3	13	12	11	7	7	6	2	62
Total	1	1	5	27	20	20	8	10	8	4	104
Total											
Male	1	—	3	18	11	12	1	3	2	2	53
Female	—	1	3	16	15	11	7	7	6	2	68
Total	1	1	6	34	26	23	8	10	8	4	121

One third of the entire material, however, showed *no progression* and in eight (4649, 0053, 0165, 0320, 0364, 1259, 2052, 4414) hips *regression* was observed (Table 29, Fig. 14, 17, 18, 22). Of these patients 6 felt better, one unchanged, and one reported more severe pain.

ii. *Localisation of Radiographic Changes*

In 1950—1954, 33 per cent were lateral, 22 per cent medial and 45 per cent mixed types. In 1962, 48 per cent were lateral, 20 per cent medial, and 32 per cent mixed. There was no difference in sex distribution within these groups.

The change in the radiographic localisation was because 22 mixed cases had become lateral (4 male and 18 female) and 4 medial (1 male and 3 female), and because 20 lateral (12 male and 8 female) and 21 medial (12 male and 9 female) were lost because the patients had died. Three (2700, 3118, 3255) patients had lateral changes in one hip and medial changes in the other.

Acetabular protrusion was noted in 5.4 per cent (2 males and 7 females) of 168 patients in the 1950—1954 group and in 5.3 per cent (6 females) of the 113 patients after-examined in 1962 (Table 16).

iii. *Signs and Symptoms in Relation to Radiographic Localisation* (Table 30)

There was no difference between the types with regard to age at onset, sex, or proportion of primary versus secondary coxarthrosis.

The mean duration of pain was higher** in the lateral than in the medial or mixed type.

The mean severity of pain index was higher*** in the lateral than in the medial or mixed type.

The mean range of motion index was lower*** in the lateral than in the medial type, and lower** in the medial than in the mixed type.

The mean index for restriction of function was higher* in the lateral than in the medial type, and higher*** in the medial than in the mixed type.

The mean radiographic index in 1950—1954 was higher** in the lateral than in the medial or mixed type.

The progression of radiographic changes judged according to Table 10 was greater* in the lateral than in the medial or mixed type.

Table 30. *Coxarthrotic patients (P) and arthrotic hips (H) classified according to radiographic localisation, age, sex, etiology, severity of pain, range of motion, restriction of function, radiographic severity and progression*

Radiographic localisation	Age at onset (H)		Duration (H)		Sex (H)		
	Mean	S.E.M.	Mean	S.E.M.	Male	Female	Total
Lateral	52.2	± 1.62	19.2	± 1.47	21	40	61
Medial.....	52.8	± 1.90	13.2	± 1.23	11	17	28
Mixed	51.5	± 2.77	13.7	± 3.14	21	15	36
Total					53	72	125

Radiographic localisation	Etiology (H)			Severity of pain (H)		Range of motion (H)	
	Secondary	Primary	Total	Mean	S.E.M.	Mean	S.E.M.
Lateral	7	54	61	2.1	± 0.11	23.3	± 2.12
Medial.....	3	25	28	1.1	± 0.24	39.1	± 4.70
Mixed	8	28	36	1.2	± 0.21	57.0	± 3.93
Total	18	107	125				

Radiographic localisation	Restriction of function (P)		Radiographic severity 1950—1954 (H)		Radiographic progression (H)	
	Mean	S.E.M.	Mean	S.E.M.	Mean	S.E.M.
Lateral	12.1	± 0.68	5.7	± 0.28	2.0	± 0.25
Medial.....	8.6	± 1.36	4.0	± 0.19	1.1	± 0.28
Mixed	3.1	± 0.15	3.7	± 0.28	1.1	± 0.16

4. Bilateral Cases

Thirty-four patients had bilateral coxarthrosis.

a) *Pain*

In 13 patients one of the hips had always been painless. Of the remaining 21 with bilateral pain, 4 reported that pain had commenced on both sides at the same time. In the 17 patients where pain had started at different times, 9 had the same severity of pain on both sides, 5 had less pain in the hip in which it had started first and 3 in the hip in which it had started later.

The mean value found for severity of pain was 1.7 ± 0.14. This value did not differ significantly from that found for unilateral coxarthrosis. The mean value for the more painful side was 2.4 ± 0.25 against 1.1 ± 0.24 for the other side. The difference was significant***.

b) *Range of Motion*

Of the 17 patients in which hip pain had started at different times, 5 had the same range of motion on both sides, 9 had less on the first affected side, and 3 on the other side.

The mean range of motion was 34.9 ± 3.27. This value did not differ significantly from that found for unilateral coxarthrosis. The mean value for the hips affected most was 24.6 ± 4.03 and for those affected less 45.3 ± 4.52. The difference was significant***.

c) *Restriction of Function*

The mean value (11.7 ± 1.06) was higher** than that found for unilateral coxarthrosis (8.4 ± 0.67).

d) *Severity of Radiographic Changes*

The mean index in 1962 (6.2 ± 0.26) did not differ significantly from that found for unilateral coxarthrosis.

5. Operated Cases

Twenty-eight patients of Series C had undergone operation for their coxarthrosis. Two of these died before 1962. The surviving 26 patients (28 hips) were after-examined in 1962. Coxarthrosis was primary in 23 patients (12 males and 11 females) and secondary in 3 (1 male and 2 females).

a) *Operative Methods*

The methods employed were varied and seven hips had been re-operated once or more (Table 34).

The mean interval between the first operation and the after-examination in 1962 was 6.8 ± 0.69 years.

b) *Pain*

Pain was evaluated in the 28 operated hips examined in 1962. Fourteen patients (7 males and 7 females) or 15 hips had starting pain. Pain when walking was classed as severe in 8 patients (3 males and 5 females), 9 hips, and as slight in 10 patients (7 males and 3 females), 11 hips. Three patients

(1 male and 2 females) or 3 hips had pain appearing spontaneously during rest. Pain after exercise (disappeared during rest) was reported by 4 patients (3 males and 1 female), 5 hips.

Six patients (3 males and 3 females) or 6 hips, were free from pain. One (0680) patient had an 11-year-old Smith-Petersen-cup with good range of motion and moderate restriction of function, two (2495, 4464) patients had 11- and 8-year old arthrodesis with moderate restriction of function, two (1837, 4540) patients had 6 and 3 years previously undergone a Voss-operation with excellent respectively good range of motion and moderate restriction of function. One (2495) patient had 6 years previously had a broken Judet-prosthesis removed. At the after-examination he had an excellent range of motion and a mild restriction of function.

Six patients with bilateral coxarthrosis had been operated upon on one side only. On the non-operated side 3 hips had never been painful, and 3 hips had less pain following the operation.

c) *Restriction of Function*

None of the patients could manage moderate or heavy physical work; nine (4 males and 5 females) had light work; ten (6 males and 4 females) slight work, and seven (3 males and 4 females) could not manage any work at all. Seven of the patients operated upon had after operation received a disability pension.

The Trendelenburg test was positive in 21 hips (12 male and 9 female), questionable in 4 hips (3 male and 1 female) and negative in 3 hips (all female). In the negative group the three operations had been cup-arthroplasty, arthrodesis, and division of the obturator nerve with synovectomy.

d) *Severity of Radiographic Changes*

Regression was noted in two (4582, 4540) patients, both with congenital dislocation. One had had an osteotomy, and the other a Voss-operation. In the latter patient, who had bilateral disease, the structural changes regressed also in the non-operated hip.

6. Comparison between Patients Operated upon, Offered but Refused Operation and Not Offered Operation

The relatively good results regarding pain, range of motion and restriction of function in the conservatively treated cases were remarkable. It might be objected that this was due to selection of the patients operated upon, *i.e.* that those patients operated upon were presumably those in whom the disease was more advanced. In order to check this possibility the

Table 31. *Coxarthrotic patients (P) and arthrotic hips (H) classified according to surgery, age, sex, etiology, severity of pain, range of motion, restriction of function, and radiographic localisation and severity*

	Age (P)		Sex (P)		
	Mean	S.E.M.	Male	Female	Total
I. Operated	70.5	±1.95	13	13	26
II. Refused operation	67.7	±1.44	11	24	35
III. Operation not offered ...	69.9	±1.41	27	29	56
Total			51	66	117

	Etiology (P)			Severity of pain (H)	
	Secondary	Primary	Total	Mean	S.E.M.
I. Operated	3	23	26	1.5	±0.22
II. Refused operation	5	30	35	1.7	±0.13
III. Operation not offered ...	9	47	56	1.6	±0.13
Total	17	100	117		

	Severity of pain 1950—1954 compared with that at after-examination (H)				
	More severe	Unchanged	Less severe	Always painless	Total
I. Operated	4(12%)	6(17%)	21(62%)	3(8.8%)	34
II. Refused operation ..... III. Operation not offered ..	20(17%)	14(12%)	70(59%)	15(12%)	119

	Range of motion (H)		Restriction of function(P)		Radiographic localisation 1950—1954 (H)			
	Mean	S.E.M.	Mean	S.E.M.	Lateral	Medial	Mixed	Total
I. Operated	38.8	±3.98	14.0	±1.18	14	2	18	34
II. Refused operation..	33.7	±3.48	9.0	±0.73	17	12	19	48
III. Operation not offered	39.0	±3.04	10.8	±0.79	24	14	33	71
Total					55	28	70	153

	Radiographic severity 1950—1954 (H)	
	Mean	S.E.M.
I. Operated	5.3	± 0.32
II. Refused operation	4.7	± 0.25
III. Operation not offered	5.1	± 0.19

material was divided into three groups: (I) operated, (II) refused operation, (III) operation not offered (Table 31). In the operated group all values were noted for all coxarthrotic hips and not only for those operated upon. No significant difference was found regarding age, etiology, pain, range of motion, or radiographic severity. Females tended to refuse operation more often than males. The difference was, however, not significant. Restriction of function was more severe for the group that accepted operation than for the group that refused*** or that which was not offered operation*. Among those operated upon, medial coxarthrosis was less common* than statistically expected. Of the patients offered operation the observed number with medial coxarthrosis who refused operation was higher* than the expected.

Comments

The fact that the observed number of patients with medial coxarthrosis who refused operation was higher than statistically expected, and that the observed number of medial coxarthrosis was lower in the surgical series than expected suggests that medial coxarthrosis is clinically less severe than lateral. The fact that no further differences between the three groups were primarily demonstrable suggests that the indication for operation was uncertain or questionable. Operation appeared to restrict function.

7. Summary

Series C (168 patients) comprised all cases of primary and secondary coxarthrosis diagnosed in the Orthopaedic Clinic, Malmö in the five-year-period 1950—1954. While the sexes were equally common at the time of diagnosis, females predominated slightly at the time of after-examination in 1962 because of the relatively higher mortality of males in older age groups. Secondary coxarthrosis, accounting for 11 per cent of the cases at diagnosis, rose to 15 per cent in 1962 because of the higher mean age and hence higher mortality of the primary group.

The occurrence of bilateral disease in one third of the patients was independent of sex, and strongly suggested that coxarthrosis is a disease sui generis.

To study the natural history of coxarthrosis, pain, range of motion, restriction of function and radiographic appearance were evaluated in 1962 and compared whenever feasible with the status of the patient at the time of diagnosis. In this way some information was obtained regarding the course of untreated coxarthrosis. A small operated group was evaluated in the same way.

Pain was regarded as the chief symptom of coxarthrosis and its onset as an indication of the onset of joint disease. The mean age at onset of primary coxarthrosis was 55 years, and of secondary coxarthrosis 44 years. Pain was felt on the first side in bilateral cases at the same age as in unilateral cases. The age at onset was independent of sex and localisation of radiographic changes.

Localisation of pain was unchanged from the time of onset to the after-examination. About one half of the patients reported pain in the region of the greater trochanter, one quarter in the groin and one quarter in the region of the knee.

Starting pain was noted in half of the cases, pain when walking in two thirds and resting pain in one quarter. Spontaneous pain occurred in 5 per cent of the cases. At the time of after-examination two thirds of the patients felt that their pain had decreased.

Restricted range of motion was invariably noted and thus more common than pain. The degree of contracture, particularly flexion contracture, bore a direct relation to severity of pain.

Leg length discrepancy and thigh atrophy were more marked in the lateral type of coxarthrosis. Over-weight was not more common among patients with coxarthrosis than among the population in general. Hip pain was more common among over-weight than among under-weight patients with coxarthrosis.

One third of the patients required help in their daily life. The restriction of function was not related to sex or to etiology of the disease.

Radiographic changes usually progressed but regressed in 8 cases. Progression was more marked in primary coxarthrosis. Improvement of radiographic changes was not necessarily accompanied by improvement in the clinical status. From the time of diagnosis until the after-examination there was a tendency for the lateral type of coxarthrosis to increase (from one third to one half of cases) at the expense of the mixed cases.

A comparison of lateral type of coxarthrosis with medial type showed that on the whole, the lateral type had a higher mean age, greater severity of pain, greater restriction of joint motion and function and a higher rate of progression than the medial type.

IV. GENERAL DISCUSSION

A. COMPARISON BETWEEN THE PRESENT NON-OPERATED SERIES AND PUBLISHED OPERATED SERIES

To what extent does the selection of patients for operation effect the composition of operated and non-operated series? Whether a given patient is operated upon depends on the attitude of the surgeon and of the patient. Indications for operation vary widely from surgeon to surgeon, from one department to another, and from year to year (WIBERG 1958). For a number of reasons the effect of the selection by the surgeon cannot be eliminated by operating upon alternate patients.

Operation introduces two factors difficult to evaluate, namely the psychological effect of the operation and bedrest after the operation. It cannot be denied that patients and surgeons have a strong belief in the value of surgery. The progressive recovery after operation (bed rest, trestles, crutches, sticks) gives the patient a feeling of improvement even in the absence of any true improvement compared with his condition before operation. The postoperative regimen involves weeks and months of bed rest. The question that then arises is how much any postoperative improvement is due to the operation and how much to rest. It is difficult to prescribe such a long period of strict rest and immobilisation without operation. Is operation only a means of forcing the patient to accept an extremely strict conservative regimen?

1. Difficulties in Comparison of Clinical Materials

The value of any comparison between operated and non-operated series is limited by the fact that two strictly comparable series are not available. With this limitation in mind the present non-operated material was compared with surgical series described in the literature. Strict comparison is not possible because the criteria used for the diagnosis, clinical and radiographic evaluation of the published series were not uniform. Published operated series and the present non-operated series are summarized in tabular form (Table 32). The operated series are classified according to the surgical method used. In the osteotomy material the authors did not always distinguish between displacement, valgus or varus osteotomy.

Objections that may be raised against the materials are:

a) The Present Non-operated Series

Twenty-eight (17 per cent) of the 168 original patients had been operated upon. In spite of the fact that the localisation of the radiographic

changes was the only difference found between those who were subjected to operation, those who refused operation, and those who were not offered operation, it is tempting to assume that the patients with the most severe pain were operated upon.

In the present material, 13 per cent of the arthrotic hips had always been painless.

b) *Operated Series*

The results have not been judged by uniform criteria.

The results are based partly on after-examination and partly on the personal opinions of the authors.

Some authors do not state the size of the original material compared with that presented and others give only approximate figures. Unless all surviving patients are afterexamined and accounted for, any conclusions drawn may be unreliable. SHEPHERD (1960) showed that the patients in whom operation had given least relief refused to consent to an after-examination.

The interval between the operation and the after-examination varied widely within and between series. It is not possible to say to what extent this affected the results described.

2. Pain

Only arthrodesis guarantees freedom from pain. In none of the series was this always achieved. Partial or complete freedom from pain was, however, reported after all types of therapy, conservative and surgical, whether technically successful or unsuccessful operations (prostheses that had been removed, attempted arthrodesis without bony union). An analysis of the data in published series (not including arthrodesis) showed that 56 per cent were painless while 12 per cent had severe pain. In the non-operated series the corresponding figures were 35 per cent and 14 per cent.

It appears that operation provides complete freedom from pain more frequently than conservative treatment, while the incidence of severe pain is the same for both methods.

Decrease in pain was somewhat more often reported in the surgical series (87 per cent) than in the present unoperated series (71 per cent).

3. Range of Motion

While surgical methods aim either at increasing or preserving range of motion of the hip, or at arthrodesis such results cannot be consistently obtained.

Only resection of the femoral head and neck will give permanent improvement of range of motion. Arthroplasty, such as Smith-Petersen-cup and Judet-prosthesis gives early, but not permanent, improvement of range of motion (SHEPHERD 1954 b). Osteotomy is usually followed by unchanged or reduced range of motion (HIRSCH 1960, KING and DOOLEY 1962). CAMPBELL and JACKSON (1956) reported 43 per cent and NICOLL and HOLDEN (1961) 34 per cent ankylosis following osteotomy. The incidence of ankylosis (15 per cent) in the present unoperated material was thus lower.

Operations to secure arthrodesis in the series on record resulted in bony union in somewhat more than half of the cases. If all attempts at arthrodesis of the hip joint were known, it would probably reveal that 50 per cent of the operations did not result in bony union and that the operation and postoperative immobilization reduced the range of motion not only of the hip but also — and probably to an equal extent — of the knee.

4. Restriction of Function

Single cases have been described in which the patient could return to heavy work, but none of the publications state whether the average working capacity was improved. It is very probable that the restriction of function increased. MOVIN (1957) reported a positive Trendelenburg test in 70 per cent of an alloplastic series and STEIN and COSTEN (1962) twenty-three patients of 32 in a series treated with metal prosthesis. KERSSEMAKERS (1961) found that 63 per cent of a series treated with arthroplasty could not manage without a stick. The difficulties following successful arthrodesis (using toilet, climbing stairs, putting on shoes and socks) as well as the increased frequency of knee stiffness and back pain are well known.

In series on record the results have been judged as poor in 34 per cent of a series treated with a Smith-Petersen-cup (SHEPHERD 1960), in 11 (34 per cent) of a series treated with a metal prosthesis (STEIN and COSTEN 1962), in 6 per cent treated with arthrodesis (MCKEE 1957), in 38 per cent (ADAM and SPENCE 1958), 17 per cent (ROBINS and PIGGOT 1960) and 37 per cent (SHEPHERD 1960) in series treated with osteotomy. No figures are available for the results of valgus osteotomy or muscle release operations.

In the present non-operated material Trendelenburg test was positive or questionable in 36 per cent, which means less often than in operated series. The relative number of patients who could not walk unaided (49 per cent) was lower than in the operated series. The incidence (32 per cent) of poor results was roughly the same as in operated series. Only patients with arthrodesis showed results better than those in the present non-operated series.

5. Conclusion

The comparison showed that:

Complete relief of pain can only be expected with certainty after successful arthrodesis, but complete or partial relief of pain is probably obtained more often after surgical than after conservative treatment.

Range of motion is unchanged or decreased after operation.

Restriction of function is unchanged or increased after operation.

The investigation does not warrant any conclusion whether coxarthrosis should be treated surgically and, if so, which cases and by which methods. Such a conclusion would require that all patients, those treated surgically and those treated conservatively, be continually examined with a uniform system at various hospitals. Data could then be pooled to provide comparable series large enough to permit conclusive comparisons.

V. GENERAL SUMMARY

A. RADIOGRAPHIC DIAGNOSIS AND DEFINITION OF COXARTHROSIS

In order to define radiographic criteria, the radiographs of all patients diagnosed as coxarthrosis during the year 1951 were reviewed. Structural or joint space changes, evident radiographically in one out of every 7 cases in 1951, persisted at the time of review in 1962. In the remaining cases the diagnosis had been based upon the presence of osteophytic changes alone. In only one of 86 such cases reviewed in 1962 had structural or joint space changes developed.

Osteophytes had no clinical significance and did not progress to coxarthrosis. Osteophytes appear to be a part of normal age changes in the hip-joint.

The radiographic diagnosis of coxarthrosis must be based upon the demonstration of structural or joint space changes.

B. INCIDENCE OF PRIMARY COXARTHROSIS

To estimate the incidence of primary coxarthrosis the age- and sex-specific incidence was determined in the series of cases diagnosed in Malmö during the five-year-period 1950—1954. Morbidity was equal in both sexes. Mortality was the same as in the general population. The slightly higher number of female cases in older age groups was related to the higher mortality of males at these ages.

The incidence of new cases of primary coxarthrosis was about half that of fracture of proximal end of the femur. The total number of cases in the population will increase as a result of the trend to aging of the population, since this is a disease in which incidence increases markedly with age.

C. NATURAL HISTORY OF COXARTHROSIS

The natural history of coxarthrosis was studied by observing the course of the disease over a 10-year-period in all patients with primary and secondary disease diagnosed during the five-year-period 1950—1954 (168 patients).

About one in 9 cases in this series was classed as secondary, and the sexes were equally represented. The occurrence of bilateral disease in one third of the patients strongly suggested that primary coxarthrosis is a disease sui generis.

Four out of 10 patients died within 10 years of diagnosis of the disease.

To determine the prognosis in this disorder, and to provide a standard of comparison for operated cases, 91 non-operated cases were evaluated clinically and radiographically. One in 8 of all arthrotic joints had always been painless. At after-examination one third were painless and one quarter had severe pain; two thirds of the patients reported a decrease of pain. A correlation was noted between pain and degree of joint contracture. Pain tended to be more severe in over-weight patients.

All cases had some restriction of range of motion, which occurred most often with regard to internal rotation. Two thirds of the cases had good or excellent range of motion.

Restriction of function increased over the 10 year period. Only a few patients could do heavy work. One third required assistance for their day-to-day existence.

The radiographic changes were evaluated by comparing the radiographs with those taken at the time of after-examination in 1962. In 7 per cent of cases there was real or apparent regression of arthrotic changes.

Lateral coxarthrosis defined radiographically has a poor prognosis: radiographic changes progressed more rapidly; range of motion and function became more restricted; and pain was more severe than in the medial type.

The over-all late prognosis is good for two-thirds of non-operated cases.

Attempts to compare the results in this non-operated series with those in published operated series indicate the need for a uniform system of classification and examination.

VI. APPENDIX

A. RADIOGRAPHIC REPRODUCTIONS

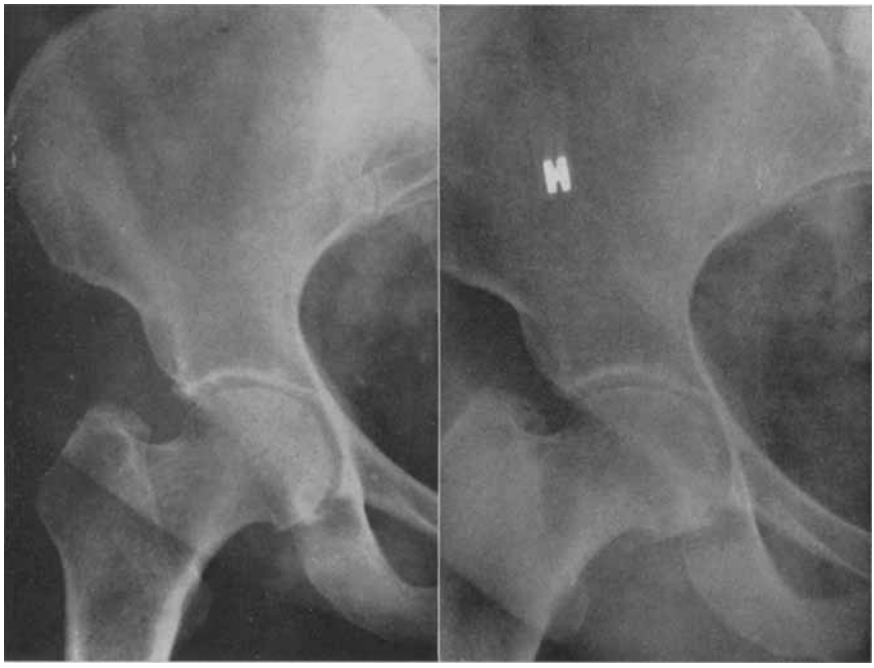
Fig. 9 (1083)

Female, aged 72. Radiographic examination in 1951 because of accident. Hips always painless. *1962:* No pain. Range of motion normal (72/72). Restriction of function mild (2).
Radiographic appearance.
1951 Osteophytes on both poles. Joint space normal. Structure normal. No double floor.
1962 As in 1951.
Interpretation. Osteophytes unchanged. No structural or joint space changes developed.

Fig. 10 (1381)

Male, aged 74. Radiographic examination in 1951 because of minor trauma. Hips always painless.
1962 No pain. Range of motion normal (79/79). Restriction of function mild (2).
Radiographic appearance
1951 Osteophytes on both poles. Joint space normal. Structure normal. No double floor.
1962 As in 1951.
Interpretation. Osteophytes unchanged. No structural or joint space changes developed.

Fig. 9



1951 1962

Fig. 10

1951 1962

Fig. 11 (1578)

Male, aged 58. Radiographic examination in 1951 because of back weakness. Hips always painless. *1962:* No pain. Range of motion normal (83/83). Restriction of function mild (2).

Radiographic appearance.

1951 Osteophytes on both poles. Joint space normal. Structure normal. No double floor.

1962 As in 1951.

Interpretation. Osteophytes unchanged. No structural or joint space changes developed.

Fig. 12 (1740)

Male, aged 57. Radiographic examination in 1951 because of lumbar pain and sciatica. Hips always painless. *1962:* No pain. Range of motion normal (82/82). Restriction of function mild (2).

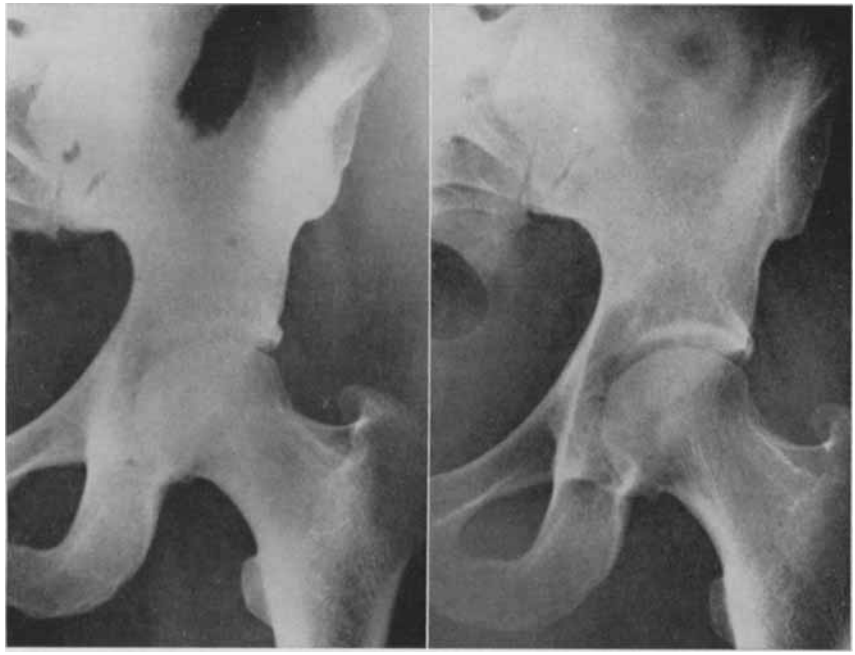
Radiographic appearance

1951 Osteophytes on both poles. Joint space normal. Structure normal. No double floor.

1962 As in 1951.

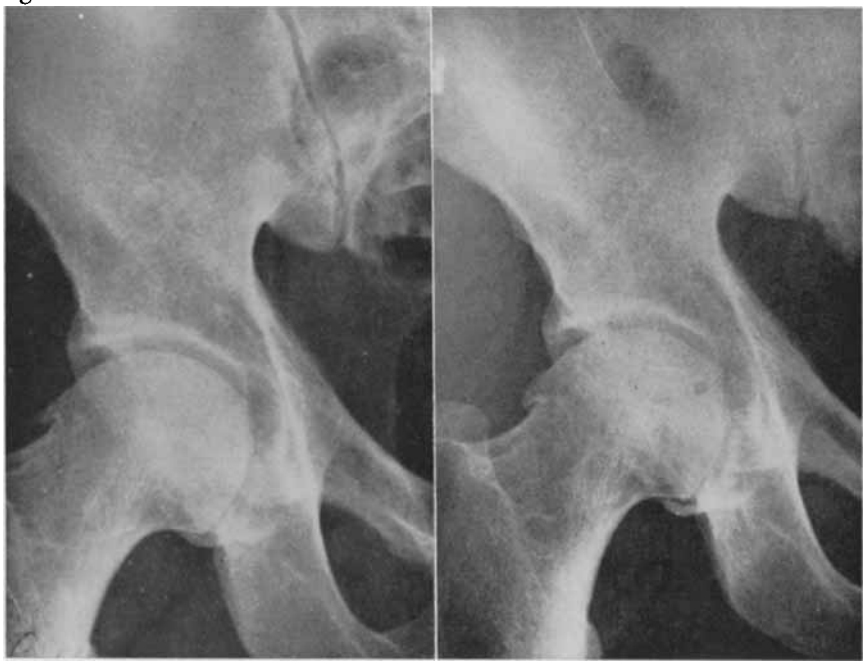
Interpretation. Osteophytes unchanged. No structural or joint space changes developed.

Fig. 11



1951 1962

Fig. 12



1951 1962

Fig. 13 (4479)

Male, aged 68. Bilateral congenital dislocation. Disability pension during shipping depression, afterwards returned to usual occupation (stower). Hips always painless. *1962:* No pain. Range of motion excellent (66/89) on both sides. Restriction of function mild (6).

Radiographic appearance

1954 Right: Localisation mixed. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum (grossly destroyed). Double floor.

Left: Localisation mixed. Joint space "normal". Structural changes in femoral head. No double floor.

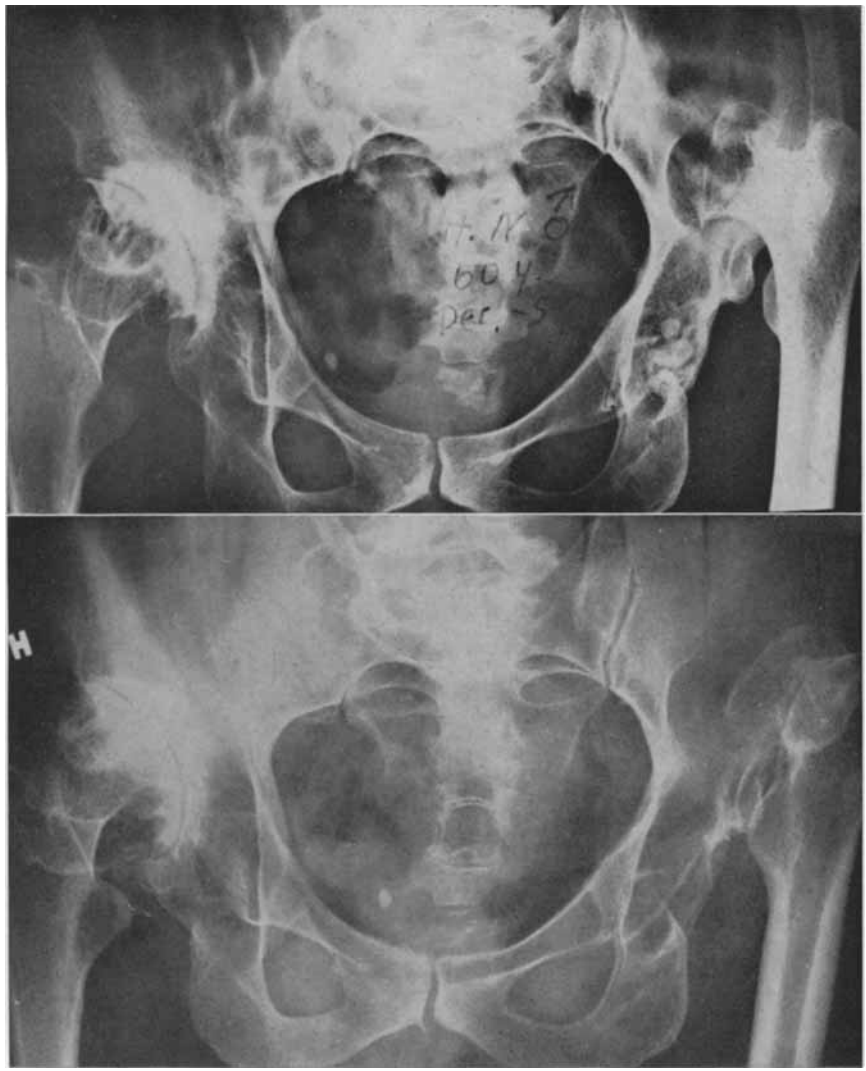
1962 Right: Localisation mixed. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum (grossly destroyed). Double floor.

Left: Localisation mixed. Joint space "normal". Structural changes in femoral head. No double floor.

Interpretation. Largely unchanged radiographic appearance.

Fig. 13

1954



1962

Fig. 14 (0053)

Male, aged 71. Right-sided primary coxarthrosis. Onset of pain at 51 years. Judet-prosthesis offered in 1950 but refused. Pain slowly but steadily decreased during last 10 years. *1962:* Very slight starting pain, very slight pain when walking, no resting pain (2). Ankylosis. Restriction of function moderate (7), walked at least 10 km a day.

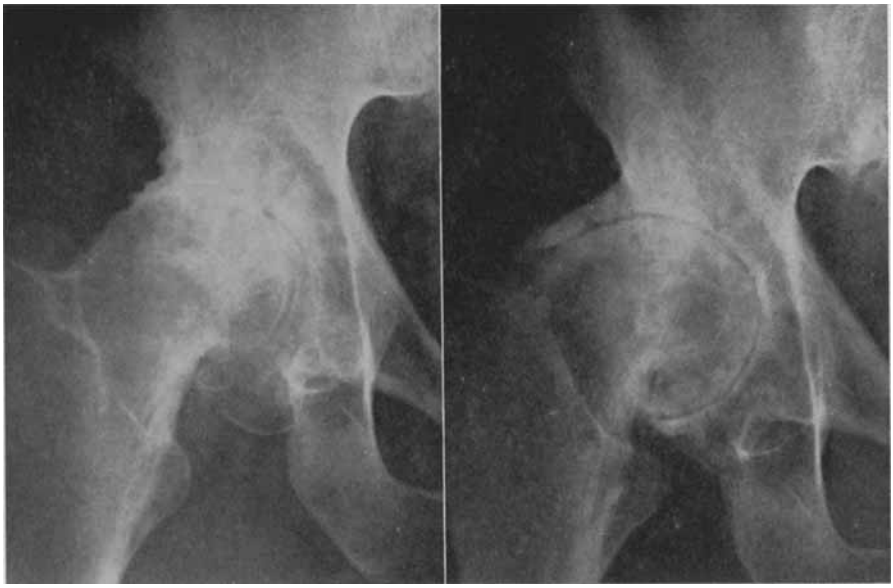
Radiographic appearance

1950 Localisation lateral. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor.

1962 Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor questionable.

Interpretation. Radiographic regression (effect of projection?).

Fig 14



1950 1962

Fig. 15 (0168)

Female, aged 75. Bilateral primary coxarthrosis. Onset of bilateral pain at 57 years. Refused operation. Pain slowly but steadily decreased on both sides. *1962:* Both hips painless. Range of motion good (17) on right side, fair (23) on left. Restriction of function mild (4).

Radiographic appearance

1950 Right: Localisation lateral. Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head and acetabulum, no double floor.

Left: Localisation lateral. Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head and acetabulum. Double floor.

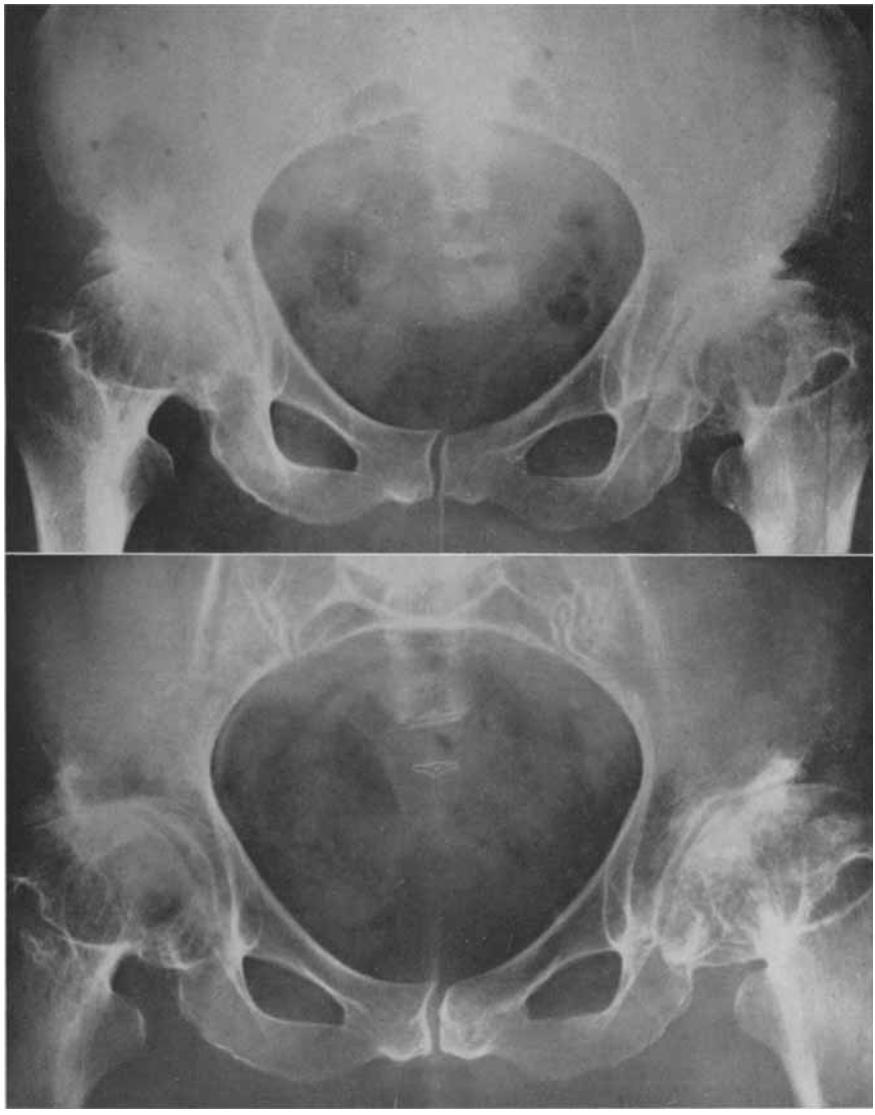
1962 Right: Localisation lateral. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor.

Left: Localisation lateral. Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head and acetabulum. Double floor.

Interpretation. Right: Slight but definite radiographic progress. Left: Largely unchanged.

Fig. 15

1950



1962

Fig. 16 (0174)

Female, aged 68. Right-sided primary coxarthrosis. Onset of pain at 55 years. Arthrodesis offered but refused. Pain slowly but steadily decreased. *1962:* Very slight starting pain, no pain when walking, no resting pain (1). Ankylosis. Restriction of function moderate (8), managed her housework alone (7 members of family).

Radiographic appearance

1950 Localisation mixed. Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head. No double floor.

1962 Localisation lateral. Osteophytes on both poles. Joint space effaced over more than half femoral contour. Structural changes in femoral head and acetabulum (grossly destroyed). Double floor questionable.

Interpretation. Marked radiographic progress.

Fig. 17 (0320)

Female, aged 71. Bilateral primary coxarthrosis. Onset of pain at 36 years on right side and at 41 on left. Pain slowly but steadily decreased on right side, unchanged on left. *1962:* Right: Slight starting pain, severe pain when walking, no resting pain (3). Left: Starting pain, slight pain when walking, no resting pain (2). Ankylosis on both sides. Restriction of function severe (15).

Radiographic appearance

1950 Left: Localisation lateral. Osteophytes on both poles. Joint space effaced over more than half femoral contour. Structural changes in femoral head and acetabulum (grossly destroyed). No double floor.

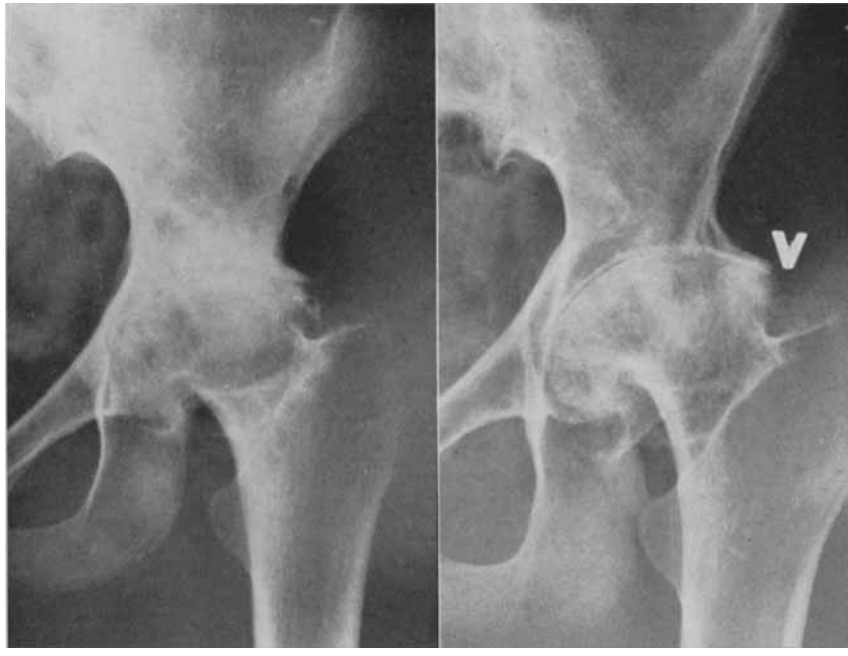
1962 Left: Localisation lateral. Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

Interpretation. Radiographic regression of structural and joint space changes.

Fig. 16

1950 1962

Fig. 17



1950 1962

Fig. 18 (0364)

Female, aged 87. Right-sided primary coxarthrosis. Onset of pain at 73 years. Pain slowly but steadily decreased. *1962:* Hip painless. Range of motion excellent (61). Restriction of function moderate (12) (due partly to blindness).

Radiographic appearance

1950 Localisation lateral. Bulky osteophytes on both poles. Joint space effaced over more than half femoral contour. Structural changes in femoral head and acetabulum. Double floor.

1962 Localisation lateral. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor.

Interpretation. Regression of joint space changes (effect of projection?).

Fig. 19 (0608)

Male, aged 81. Left-sided primary coxarthrosis. Onset of pain at 61 years. Pain slowly but steadily decreased. *1962:* Very slight starting pain, very slight pain when walking, no resting pain (2). Range of motion good (41). Restriction of function moderate (8).

Radiographic appearance

1950 Localisation lateral. Osteophyte on one pole. Joint space narrowed but more than half normal width. Structural changes in femoral head. No double floor.

1962 Localisation lateral. Osteophytes on both poles. Joint space effaced over more than half femoral contour. Structural changes in femoral head and acetabulum (grossly destroyed). Double floor.

Interpretation. Marked radiographic progress.

Fig. 18

1950 1962

Fig. 19

1950 1962

Fig. 20 (1315)

Female, aged 70. Bilateral primary coxarthrosis. Onset of pain at 53 years in right hip, at 56 years in left. Pain slowly but steadily decreased in right and increased in left hip. *1962:* Right hip: No starting pain, slight pain when walking, no resting pain (1). Left hip: Starting pain, severe pain when walking, resting pain after walking (4). Right hip: Range of motion excellent (56). Left hip: Ankylosis. Restriction of function severe (16).

Radiographic appearance

1951 Right: Localisation mixed. Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

Left: Localisation mixed. No osteophytes. Joint space normal. Structure normal. No double floor.

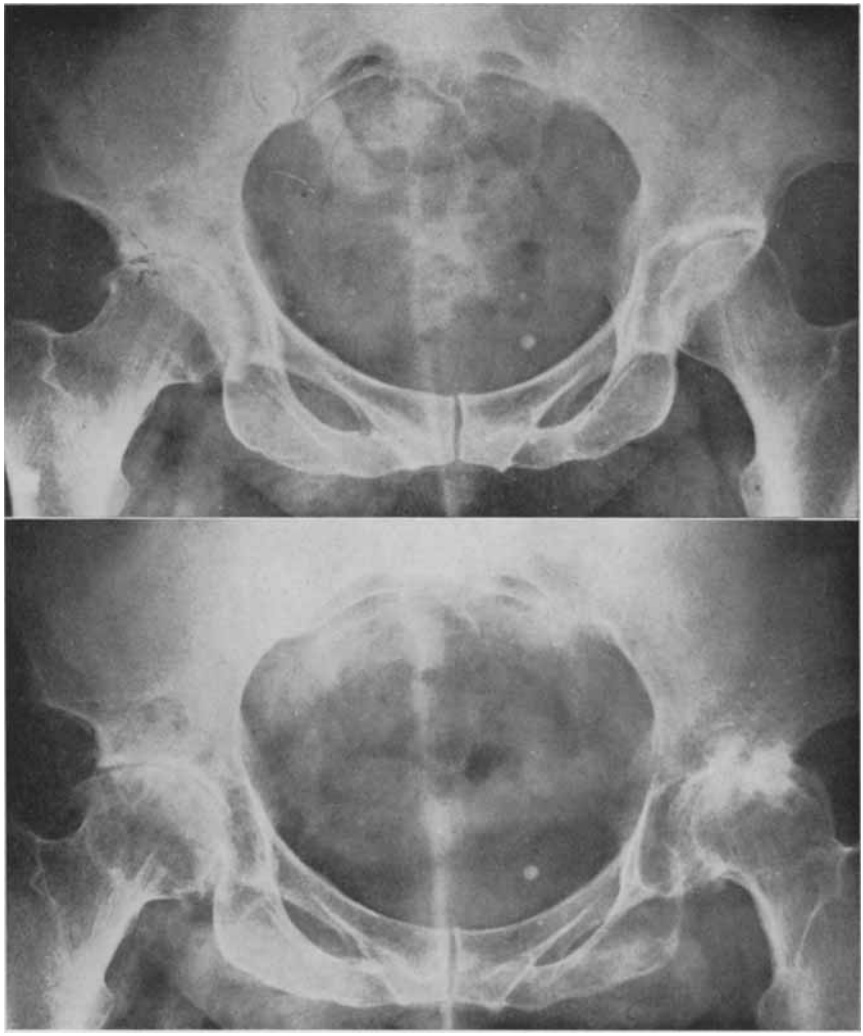
1962 Right: Localisation mixed. Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

Left: Localisation lateral. Osteophytes on both poles. Joint space effaced over more than half femoral contour. Structural changes in femoral head and acetabulum. Double floor.

Interpretation. Right: Largely unchanged radiographic appearance. Left: Development of coxarthrosis. Marked radiographic progress.

Fig. 20

1951



1962

Fig. 21 (1335)

Male, aged 74. Bilateral primary coxarthrosis. Radiographic examination because of minor trauma. Both hips always painless. *1962:* No pain. Range of motion excellent on both sides (63/63). Restriction of function mild (3).

Radiographic appearance

1951 Right: Localisation medial. Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head. No double floor.

Left: Localisation medial. Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head. No double floor.

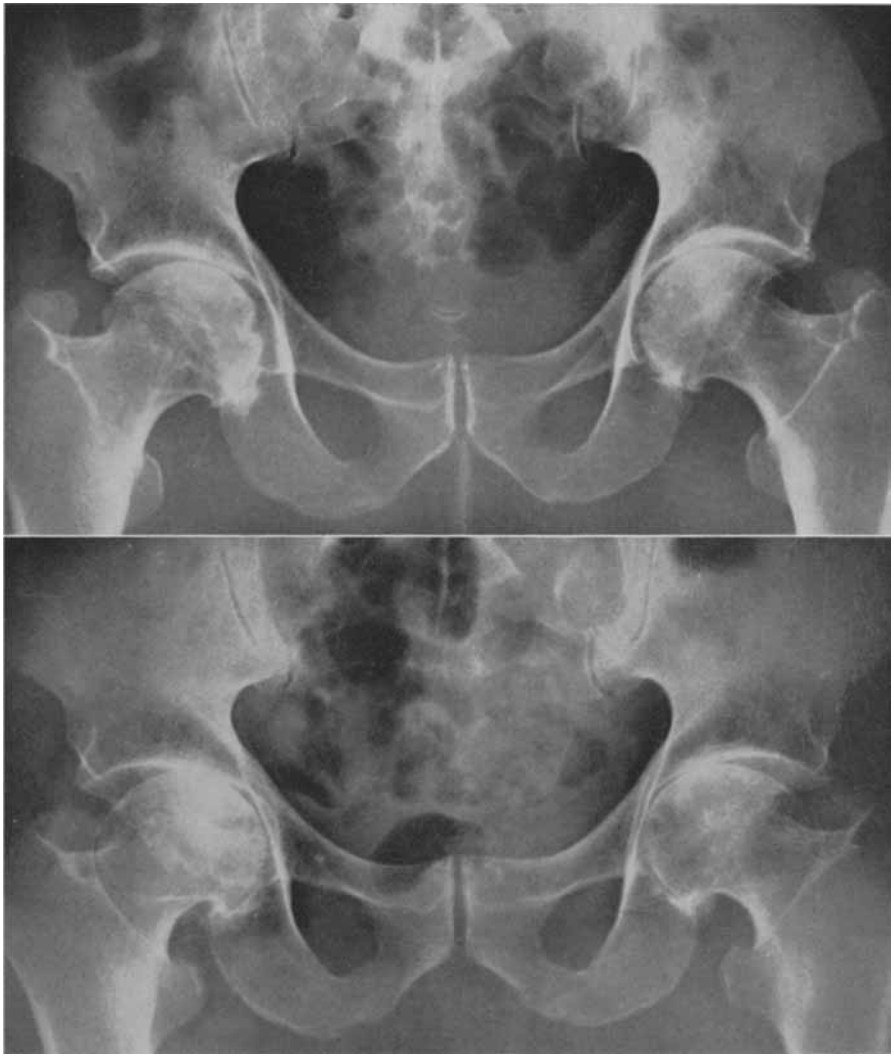
1962 Right: Localisation medial. Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head. No double floor.

Left: Localisation medial. Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head. No double floor.

Interpretation. Slight but definite radiographic progress on both sides.

Fig. 21

1951



1962

Fig. 22 (1607)

Female, aged 83. Right-sided primary coxarthrosis. Onset of pain at 68 years. Pain unchanged. *1962:* No starting pain, slight pain when walking, pain during rest after walking (2). Range of motion good (35). Restriction of function severe (15).

Radiographic appearance

1951 Localisation lateral. Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor.

1962 Osteophytes on both poles. Joint space narrowed but more than half normal width. Structural changes in femoral head and acetabulum (grossly destroyed). Double floor.

Interpretation. Regression of joint space changes.

Fig. 22

1951 1962

Fig. 23 (2524)

Female, aged 84. Bilateral primary coxarthrosis. Onset of pain in right hip at 74 years, left hip always painless. Operation refused. Pain slowly but steadily decreased. *1962:* Both hips painless. Range of motion fair (18) on right side, good (42) on left. Restriction of function mild (5).

Radiographic appearance

1952 Right: Localisation medial (acetabular protrusion). Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

Left: Localisation medial (acetabular protrusion). Osteophyte on one pole. joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

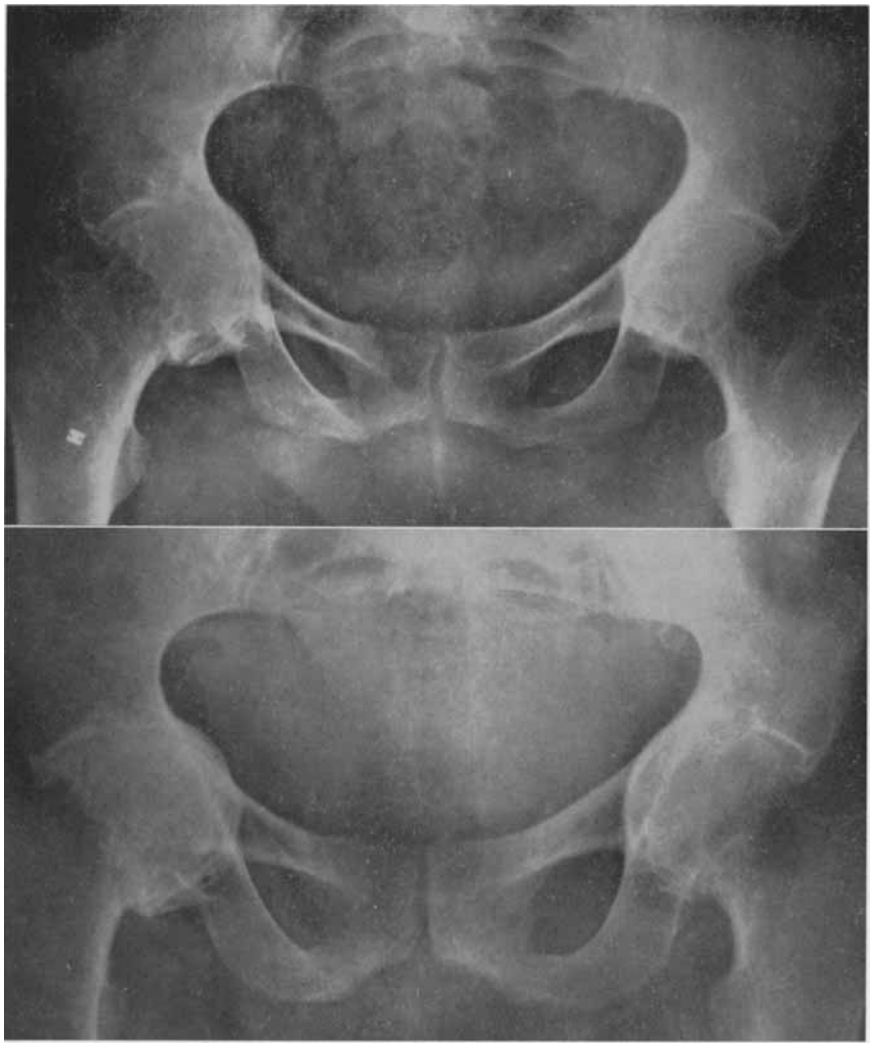
1962 Right: Localisation medial (acetabular protrusion). Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

Left: Localisation medial (acetabular protrusion). Osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. No double floor.

Interpretation. Largely unchanged radiographic appearance on both sides.

Fig. 23

1952



1962

Fig. 24 (3571)

Male, aged 73. Right-sided primary coxarthrosis. Onset of pain at 58 years. Pain slowly but steadily increased. *1962:* Starting pain, severe pain when walking, pain during rest after walking (4). Range of motion fair (18). Abduction contracture. Restriction of function severe (14).

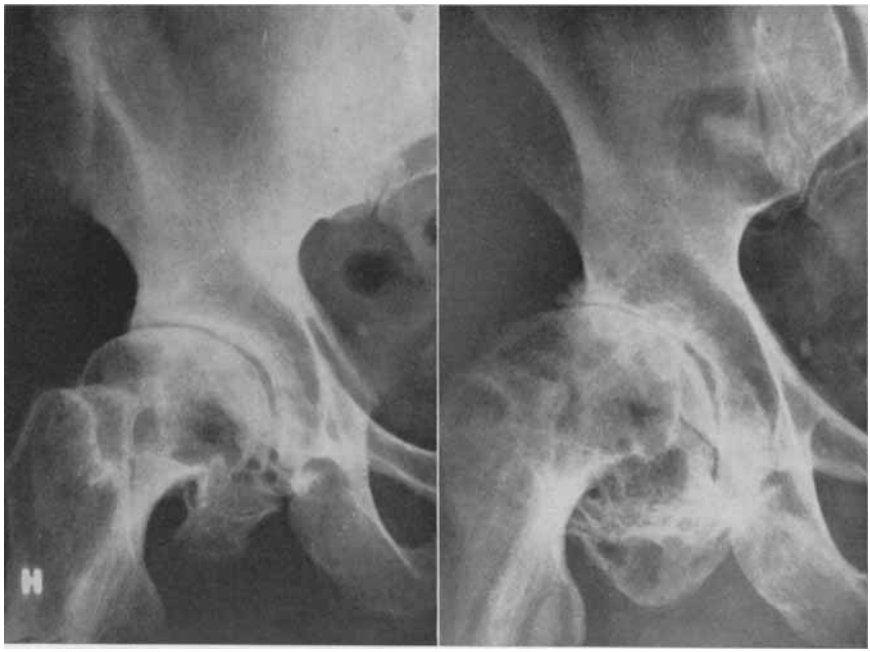
Radiographic appearance

1953 Localisation medial. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor.

1962 Localisation medial. Bulky osteophytes on both poles. Joint space less than half normal width. Structural changes in femoral head and acetabulum. Double floor.

Interpretation. Marked progress of capital drop. Radiographic appearance otherwise largely unchanged.

Fig. 24



1953 1962

B. TABLES

Table 32. *Survey of literature*

Treatment	Number of cases		Interval between operation and after-examination	Severity of pain	Range of motion	Restriction of function	Patient's own assessment
	Operated	After-examined					
Femoral head resection Murray et al. (1963)	—	34	< 8 years	No pain 32 Required salicylates 2	—	—	
Arthroplasty a) Calf fascia or calf myocard Kerssemakers (1961)	125	119	1/2—5 years	No pain 74 Some pain 33 Severe pain 12	—	Walked without stick 44 Walked with one stick 57 Walked with two sticks 18	Very pleased 60 Reasonably content 45 Discontented 14
b) Smith-Petersen cup Shepherd (1960)	—	176	> 4 years		*Conclusion* Including mobility Exc. ..... 9 % Good .....27 % Fair .....30 % Poor and failed ..34 %		
c) Metal prosthesis Stein and Costen (1962)	48	32	1—9 years	No pain 7 Slight pain 8 Moderate pain 13 Severe pain 4	> 180° 2 175°—125° 10 120°— 75° 9 < 70° 10	Trendelburg test Pos.: 23 Neg.: 9	*Conclusion* Exc..... 3 Good ..... 5 Satisfied ... 13 Poor ..... 7 Failure 4

Treatment	Number of cases		Interval between operation and after-examination	Severity of pain	Range of motion	Restriction of function	Patient's own assessment
	Operated	After-examined					
Arthrodesis							
Gade (1947)	27	26		No pain 25	Bony ankylosis 23	—	
Gardiner (1953)	53	49		—	Bony ankylosis 32	—	
Charnley (1955).....	158	105		—	Bony ankylosis 18	—	
Watson-Jones and Robinson (1956)	—	120		—	Bony ankylosis 113	—	
Lindström (1957)	41	40		—	Bony ankylosis 38	—	
Debeyre (1958)	—	125		—	Bony ankylosis 52	—	
Kirkaldy-Willis et al. (1958)	—	37		—	Bony ankylosis 20	—	
McKee (1957).....	—	50		No pain 34 Slight pain 12 Moderate pain 1 Unrelieved 1 Died 2	Bony ankylosis 47	Exc. 20 Good 23 Fair 4 Failed 1 Bad 2	
Mortens and Jensen (1960)	43	39		No pain or relieved 33	Bony ankylosis 17	—	
Piggot (1960)	98	91		No pain 81	Bony ankylosis 74	—	
Axer (1961)	19	19		—	Bony ankylosis 14	—	
Lipscomb and McCaslin (1961)	371	347		—	Bony ankylosis 271	—	

Treatment	Number of cases		Interval between operation and after-examination	Severity of pain	Range of motion	Restriction of function	Patient's own assessment
	Operated	After-examined					
Osteotomy a) Displacement and/or valgus osteotomy Osborne and Fahrni (1950).....	93	75	1—12 years	Relieved 61 Not relieved 14	—	—	
Campbell and Jackson (1956).....	—	46	1—20 years	No pain 25 Slight pain 15 Severe pain 6	No movement 6 Rock 9 5°—19° 11 20°—39° 9 > 40° 11	—	
Adam and Spence (1958)	87	57	9 m.—18 years	No pain 26 Mild ache 20 Made concessions 7 Disabling pain 1 Crippling pain 3	*Conclusion* Including Mobility Exc. 14 % Good 29 % Fair 19 % Poor 38 % Excluding Mobility Exc. 33 % Good 33 % Fair 14 % Poor 20 %		Satisfied 48 Disatisfied 9
Hirsch (1960)	54	54	< 4 years	Complete relief 30 % Relieved 80 %	In no case better than before	Activity hardly increased. A great number forced to use a stick	

Treatment	Number of cases		Interval between operation and after-examination	Severity of pain	Range of motion	Restriction of function	Patient's own assessment
	Operated	After-examined					
Robins and Piggot (1960).....	58	49	—	*Conclusion* Including mobility Exc. 23 % Good 38 % Fair 22 % Poor 17 % Excluding mobility Exc. 40 % Good 37 % Fair 12 % Poor 11 %			
Nicoll and Holden (1961).....	—	195	> 1 year (48 % > 5 years)	Abolished 101 Relieved 71 Same or more 23	Ankylosis 66	—	
Shepherd (1960).....	—	134	> 4 years	*Conclusion* Including mobility Exc. 7 % Good 28 % Fair 28 % Poor 37 % Excluding mobility Exc. 25 % Good 18 % Fair 35 % Poor 22 %			
King and Dooley (1962)	—	45	2—20 years	No pain	Stayed much the same as before op.	—	

Treatment	Number of cases		Interval between operation and after-examination	Severity of pain	Range of motion	Restriction of function	Patient's own assessment
	Operated	After-examined					
Ottolenghi and Frigerio (1962).....	—	103	1—17 years	No pain 88 Occasional pain 9 No relief 6	Equal to or more than before op. 75 Less than before op. 28	No restriction of activity 75 Some restriction of activity 13 Definite restriction of activity 9 No increase 6	Satisfied 97 Dissatisfied 6
b) Varus osteotomy Pauwels (1961).....	>300	—	< 27 years	"Alle wurden die Beschwerden auf die Dauer beseitigt."	"Die Beweglichkeit nahm in Regel zu."	"Die Leistungsfähigkeit wurde weitgehend gesteigert."	
Muscle release op. Voss (1956).....	72	—	< 4 years	"Je länger der Eingriff zurückliegt, um so besser ist das subjektive und objektive Befinden. Keine Rezidive."			
Küntscher (1958)	>100	—	—	All but one "schlagartige Schmertzfreiheit."	—	—	

Treatment	Number of cases		Interval between operation and after-examination	Severity of pain	Range of motion	Restriction of function	Patient's own assessment
	Operated	After-examined					
Voigt (1958).....	32	30	< 1 1/2 year	Kaum noch verhanden 6 Deutlich gebessert 15 Etwas erträglicher 8 Unverändert oder verschlechtert 1	Fast frei 4 Deutlich gebessert 11 Wenig verändert 10 Unverändert oder verschlechtert 5	—	
Voss (1959).....	> 300	—	< 7 years	"Recht befriedigende Dauerresultate"			
Conservative (present material).....	92	91	8—12 years	No pain at all 35 % Exc. 47 % Good 28 % Fair 11 % Poor 14 %	Exc. 32 % Good 37 % Fair 16 % Poor 15 %	Mild 33 % Moderate 35 % Severe 32 %	More severe 17 % Unchanged 12% Less severe or painless 71 %

Table 33. *Patients with osteophytes but without structural or joint space changes in 1951 and not clinically normal in 1962*

Code No.	Age (years)	Sex	Pain	Range of motion	Restriction of function	Radiographic severity		Diagnosis
						1951	1962	
1142	74	F	0	74	02	0000	0000	Lumbar sciatica on right side. Clinical and radiographic arthrosis of right knee.
			0	76		0000	0000	
1377	55	M	0	87	01	1000	1000	Old tuberculosis of left greater trochanter.
			0	67		1000	1000	
1390	53	M	0	85	01	2000	2000	9 year old fracture of left pelvis.
			0	81		0000	1000	
1503	72	M	0	57	24	1000	1000	Senile arteriosclerosis.
			0	57		0000	1000	
1868	60	M	0	87	06	1000	1000	Coxarthrosis.
			3	50		1000	1100	

Symbols

Code number:

195-/—.

Etiology:

0 = Unknown disease of hip in childhood.
1 = Congenital dislocation.
2 = Perthes disease.
3 = Epiphyseolysis.
4 = Coxitis.
5 = Rheumatic fever.
6 = Fracture of acetabulum and/or traumatic dislocation.
7 = "Primary coxarthrosis".

Radiographic localisation:

0 = Mixed.
1 = Lateral.
2 = Medial.
+ = Acetabular protrusion.

Surgery and vital statistics:

1 = Unoperated. Still alive.
2 = Unoperated. Dead.
3 = Operated. Still alive.
4 = Operated. Dead.
5 = Emigrated
a = Smith-Petersen-cup
b = Prosthesis: Judet, Thompson
c = Arthrodesis
d = Osteotomy: Subcapital, intertrochanteric, subtrochanteric
Wedge with base medially or laterally
With or without displacement
e = Voss-operation
f = Drilling
g = Division of the obturator nerv with synovectomy
h = Removal of prosthesis

Table 34. *Total material of coxarthrosis. (Series C)*

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
4171		63	F	0	00	0	80	07	0	1000	1000	1
					08	2	39		2	2130	2230	
1380		68	M	1	28	1	29	09	1	2010	2210	1
					32	1	25		1	3220	3320	
1424		74	M	1	—	—	—	—	0	3331	—	2
					—	—	—		0	3331	—	
3500		77	F	1	00	0	—	24	0	1000	—	1
					20	1	—		1	2231	—	
4479	13	68	M	1	00	0	66	06	0	3231	3231	1
					00	0	87		0	1010	1010	
4540		48	F	1	00(03?)	0	38	07	0	2221	2121	3 e —
					03	0	38		0	1111	1020	
4582		83	M	1	13	1	18	08	0	3330	3230	3 d —
					00	0	77		0	0000	1000	
4647		54	F	1	00	0	85	08	0	0000	0000	1
					14	2	25		0	2120	2120	
1324		65	F	2	26	1	03	06	1	2230	2230	1
					00	0	82		0	1000	1000	
2725		54	M	2	09	0	38	01	0	2120	2230	1
					00	0	70		0	1000	1000	
4481		35	M	2	09	0	59	01	0	1010	1010	1
					00	0	82		0	0000	0000	
1683		48	M	3	00	0	87	01	0	1000	1000	1
					11	0	78		0	1100	2100	
4649		75	M	3	30	5	17	23	1	3330	3230	1
					06	5	11		1	2220	3230	
0319		74	F	4	00	0	80	12	0	0000	1000	1
					61	0	00		1	3230	3330	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
1261		48	F	4	13	1	43	03	0	3221	—	3[a]
					00	0	82		0	0000	0000	—
2509		58	F	5	12	2	68	05	0	1010	1110	1
					12	0	82		2+	0110	0110	
0082		82	M	6	—	—	—	—	1	3221	—	4[c]
					—	—	—		0	1000	—	—
0157		52	M	6	11	0	41	05	2	0110	1110	1
					00	0	78		0	0000	0000	
3236		85	M	6	00	0	69	03	0	2000	2000	1
					17	0	65		0	2011	2101	
0017		80	F	7	—	—	—	—	2	1110	—	2
					—	—	—		2	2210	—	
0019		66	F	7	18	1	23	17	1	1211	3331	1
					01	4	39		1	0000	2210	
0053	14	72	M	7	20	2	03	07	1	3221	3220	1
					00	0	81		0	2000	2000	
0056		72	F	7	32	0	49	13	1	1211	—	1
					00	0	71		0	0000	—	
0081		74	F	7	32	1	37	15	1	2321	3321	1
					00	0	83		0	1000	2000	
0129		79	M	7	00	0	65	09	0	—	2000	1
					20	2	51		1	2100	2221	
0148		69	F	7	—	—	—	—	0	1000	—	2
					—	—	—		0	2100	—	
0165		66	F	7	18	2	42	10	1	2231	2131	1
					00	0	81		0	0000	0000	
0166		78	M	7	00	0	72	02	0	2000	2000	1
					12	0	66		0	2110	3110	
0168	15	75	F	7	18	0	17	04	1	2120	3221	1
					18	0	23		1	2121	2121	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
0174	16	68	F	7	13	1	02	08	1	2110	2330	1
					00	0	77		0	0000	0000	
0189		75	F	7	—	—	—	—	0	1000	—	2
					—	—	—		1	1100	—	
0201		74	F	7	13	5	37	18	1	1100	2221	1
					27	5	37		1	1100	2221	
0231		86	M	7	—	—	—	—	1	2221	—	2
					—	—	—		0	0000	—	
0278		64	F	7	13	0	32	04	2	1110	2120	1
					00	0	68		0	0000	0000	
0320	17	71	F	7	30	3	03	15	1	2231	3331	1
					35	2	03		1	2330	2220	
0337		86	M	7	—	—	—	—	0	0000	—	2
					—	—	—		2	2210	—	
0364	18	87	F	7	14	0	61	12	1	3321	3221	1
					00	0	79		0	2000	2000	
0385		85	F	7	—	—	—	—	1	2220	—	2
					—	—	—		0	2000	—	
0471		63	M	7	14	2	04	11	2	2100	3330	1
					14	0	21		2	3120	3230	
0474		72	M	7	—	—	—	—	2+	2120	—	2
					—	—	—		2	2100	—	
0549		94	F	7	—	—	—	—	0	1000	—	2
					—	—	—		2	2110	—	
0568		84	M	7	—	—	—	—	2	3120	—	2
					—	—	—		0	1000	—	
0569		69	M	7	00	0	78	09	0	1000	2000	1
					24	2	20		1	2210	3331	
0608	19	81	M	7	00	0	57	08	0	1000	1000	1
					20	2	41		1	1110	2331	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
0648		85	M	7	00	0	66	19	0	0000	1000	3^{-}_{f}
					14	2	33		1	1220	2321	
0651		60	F	7	14	3	38	21	2	2210	—	3^{bh}
					14	1	$51^{1}/_{2}$		2	2210	2210	—
0680		70	M	7	00	0	80	07	0	0000	1000	3^{-}_{b}
					13	0	43		1	2220	—	
0737		78	M	7	00	0	67	15	0	2000	2000	1
					25	2	06		1	2110	2220	
0745		82	F	7	—	—	—	—	0	2000	—	2
					—	—	—		0	2120	—	
1004		63	F	7	21	1	71	02	2+	2010	2010	1
					00	0	82		0	2000	2000	
1031		78	F	7	18	2	44	13	1	2331	—	3^{b}
					00	0	76		0	0000	2000	—
1036		64	M	7	10	5	41	11	0	2010	2010	1
					15	5	21		2	2110	2110	
1043		68	F	7	11	3	11	16	0	2121	3220	1
					15	3	11		1	1120	1321	
1054		69	F	7	00	0	76	14	0	0000	1000	3^{-}_{e}
					17	1	$62^{1}/_{2}$		0	1010	1110	
1136		72	F	7	—	—	—	—	0	0000	—	2
					—	—	—		1	2121	—	
1259		54	M	7	11	0	$68^{1}/_{2}$	00	0	1110	1110	1
					00	0	85		0	2010	2000	
1290		61	F	7	00	9	57	06	0	1000	2000	1
					15	2	20		2	2120	2320	
1305		80	F	7	—	—	—	—	1	2220	—	2
					—	—	—		0	1100	—	
1311		77	M	7	12	5	27	13	0	2120	3321	1
					00	0	60		0	1100	1100	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
1315	20	70	F	7	17	1	56	16	0	2220	2220	1
					14	4	03		1	0000	2321	
1334		70	F	7	20	3	17	12	1	2231	2231	1
					00	0	78		0	0000	0000	
1335	21	74	M	7	00	0	63	03	2	2110	2210	1
					00	0	63		2	2110	2210	
1344		69	F	7	12	0	00	28	2	1110	2220	1
					11	0	00		2	0010	2320	
1347		76	F	7	—	—	—	—	0	2000	—	2
					—	—	—		2+	2110	—	
1350		77	F	7	—	—	—	—	0	2000	—	2
					—	—	—		2	3330	—	
1398		79	F	7	00	0	$68^1/_2$	26	0	1000	1000	3^-_e
					17	2	39		1	2110	2221	
1407		69	F	7	18	4	19	15	2+	2110	3220	1
					12	4	03		0	2220	3320	
1411		70	F	7	11	0	67	02	2	2110	2120	1
					00	0	73		0	2010	2110	
1426		44	F	7	11	0	83	02	0	1110	2111	1
					00	0	91		0	0000	0000	
1436		75	F	7	13	3	15	10	1	2220	2320	1
					00	0	80		0	0000	0000	
1456		83	F	7	—	—	—	—	2+	3320	—	2
					—	—	—		0	0000	—	
1475		82	M	7	—	—	—	—	1	3210	—	2
					—	—	—		0	2100	—	
1493		75	F	7	12	0	70	02	0	1010	2100	1
					00	0	76		0	1000	1000	
1496		79	M	7	—	—	—	—	0	1000	—	2
					—	—	—		2	2110	—	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
1506		96	M	7	—	—	—	—	0	2100	—	2
					—	—	—		0	0100	—	
1541		84	M	7	—	—	—	—	0	3320	—	2
					—	—	—		0	2110	—	
1554		68	M	7	—	—	—	—	0	2000	—	2
					—	—	—		0	2120	—	
1586		82	F	7	11	2	19	12	1	2110	2321	1
					00	0	73		0	1000	1100	
1607	22	83	F	7	21	2	35	15	1	2221	2131	1
					00	0	82		0	—	0000	
1637		83	F	7	—	—	—	—	2	2100	—	2
					—	—	—		0	2000	—	
1761		95	M	7	—	—	—	—	0	2000	—	2
					—	—	—		0	1100	—	
1806		81	M	7	—	—	—	—	0	2000	—	2
					—	—	—		1	2220	—	
1810		72	F	7	11	1	51	07	0	1110	2221	3[e]
					00	0	77		0	1000	1000	—
1837		60	F	7	06	0	83	08	0	0110	2121	3[e]
					00	0	83		0	0000	0000	—
1867		83	M	7	—	—	—	—	0	2000	—	2
					—	—	—		1	2320	—	
1868		60	M	7	00	0	82	06	0	1000	1000	1
					11	3	50		0	1000	1100	
2048		79	F	7	—	—	—	—	0	1000	—	2
					—	—	—		0	2110	—	
2052		82	F	7	00	0	80	13	0	0000	0000	1
					15	0	50		1	3221	3220	
2081		81	M	7	—	—	—	—	1	3330	—	4[b]
					—	—	—		1	3321	—	[b]

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
2134		73	F	7	13	2	03	21	1	1220	3330	1
					00	0	74		0	0000	0000	
2145		83	F	7	10	0	57	12	0	0000	—	1
					15	2	39		1	2220	—	
2185		89	M	7	—	—	—	—	0	1000	—	2
					—	—	—		1	2210	—	
2239		77	M	7	24	4	24	22	1	3231	—	3 fb
					15	4	13		1	2210	2330	ddd
2262		64	M	7	17	2	56	06	0	2110	2220	1
					00	0	82		0	2000	2000	
2297		84	M	7	—	—	—	—	0	2320	—	2
					—	—	—		0	0000	—	
2355		81	F	7	—	—	—	—	2	2110	—	2
					—	—	—		0	1000	—	
2365		74	M	7	00	0	63	04	0	1000	1000	1
					13	2	35		1	2220	2321	
2375		68	F	7	00	0	73	01	0	2010	2010	1
					00	0	83		0	0000	0000	
2397		65	M	7	00	0	67	19	0	2000	2000	3 —
					14	2	06		2	2210	2320	d
2417		71	M	7	12	3	36	08	1	2110	2220	1
					00	0	73		0	1000	1000	
2427		60	F	7	11	2	31	10	0	2120	3321	1
					01	2	74		0	1010	2010	
2495		76	M	7	14	0	66	06	2	2210	2210	3 —
					14	0	62		0	2220	—	bh
2524	23	84	F	7	10	0	18	05	2+	2220	2220	1
					00	0	42		2+	1220	2220	
2535		77	F	7	—	—	—	—	0	2000	—	2
					—	—	—		0	2220	—	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
2536		73	M	7	—	—	—	—	1	2220	—	2
					—	—	—		0	2110	—	
2560		69	M	7	00	0	81	11	0	0000	0000	1
					08	3	37		2	2120	2120	
2573		79	M	7	—	—	—	—	0	2100	—	2
					—	—	—		0	1000	—	
2606		82	M	7	00	0	71	12	0	1000	1000	1
					11	3	42		0	1210	3321	
2661		79	F	7	—	—	—	—	0	1000	—	2
					—	—	—		1	2110	—	
2691		75	M	7	00	0	$79^1/_2$	09	0	1000	—	3 bh
					13	1	73		1	2221	—	
2699		72	M	7	—	—	—	—	0	2010	—	2
					—	—	—		0	2010	—	
2700		73	M	7	50	2	09	11	1	3320	3331	1
					20	0	55		2	2120	2120	
2818		79	F	7	—	—	—	—	2	2010	—	2
					—	—	—		2	2010	—	
2828		85	M	7	—	—	—	—	0	0000	—	2
					—	—	—		2	2220	—	
2840		65	F	7	34	2	32	04	2+	2110	2110	1
					00	2	83		0+	1000	0000	
2841		83	M	7	—	—	—	—	2+	2220	—	2
					—	—	—		2+	2210	—	
2882		75	M	7	—	—	—	—	0	0000	—	2
					—	—	—		0	2210	—	
3030		70	M	7	11	0	00	12	1	2220	—	3 c
					00	0	82		0	2000	2000	—
3037		77	M	7	00	0	83	03	0	1000	2000	1
					09	2	50		0	2120	2220	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
3101		59	M	7	00	0	80	15	0	0000	—	3—
					16	2	06		0	0110	—	c
3105		65	M	7	35	4	38	17	1	2221	—	3b
					35	2	44		1	2220	—	b
3114		70	F	7	13	2	29	14	1	2220	3320	1
					15	1	11		1	2220	3221	
3118		69	M	7	00	0	66	06	2	2110	2110	1
					21	2	12		1	3330	3331	
3146		77	M	7	00	0	70	10	0	1000	1000	1
					10	2	41		1	1110	2321	
3148		81	F	7	10	5	23	24	0	2220	—	3b
					10	0	04		0	2320	—	—
3155		67	F	7	00	0	71	13	0	2000	—	3e
					11	3	15		1	2120	3221	—
3191		74	F	7	—	—	—	—	1	2330	—	2
					—	—	—		0	0000	—	
3211		72	M	7	—	—	—	—	1	2321	—	5
					—	—	—		0	2110	—	
3223		74	M	7	00	0	00	15	0	1000	2000	1
					32	2	50		1	2220	3220	
3243		65	F	7	09	2	11	10	1	2320	3331	1
					00	0	82		0	0000	0000	
3255		71	F	7	10	3	13	13	2	2220	2230	1
					02	1	15		1	2010	2330	
3295		59	F	7	34	4	42	13	1	1121	2231	1
					00	0	83		0	1000	1000	
3321		72	M	7	27	5	05	20	1	2220	2321	1
					00	0	68		0	2010	2010	
3341		64	F	7	09	4	12	17	1	1110	1321	1
					00	0	74		0	0000	0000	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
3412		54	F	7	09	0	59	01	2	2010	2010	1
					00	0	72		0	1000	1000	
3435		50	M	7	00	0	82	00	0	2000	2000	1
					09	0	73		0	0010	2010	
3455		83	F	7	00	0	77	14	0	1000	1000	1
					15	4	39		1	2220	2131	
3462		79	F	7	10	1	73	26	1	1210	—	3^{fbhbhc}
					00	0	80		0	0000	0000	—
3480		70	F	7	00	0	80	01	0	1000	1000	1
					09	0	66		0	2110	2220	
3536		77	F	7	18	1	21	09	1	2220	2231	1
					00	0	75		0	2000	2000	
3571	24	73	M	7	15	4	18	14	1	3221	3221	1
					00	0	86		0	2000	2000	
3609		68	F	7	48	2	03	07	1	2221	2331	1
					00	0	82		0	1000	1000	
3625		80	F	7	00	0	86	17	0	0000	—	1
					19	1	21		1	2220	—	
3646		79	M	7	13	2	32	10	1	2220	—	3^{fb}
					00	0	66		0	2000	2000	—
3653		70	M	7	22	3	02	14	0	2220	2330	1
					14	3	14		2	2220	2220	
4070		80	F	7	—	—	—	—	0	2000	—	2
					—	—	—		1	2221	—	
4267		68	F	7	00	0	83	07	0	1000	1000	3^{-}_{g}
					08	2	50		1	1110	3221	
4276		83	M	7	—	—	—	—	0	2110	—	2
					—	—	—		1	2220	—	
4312		78	M	7	—	—	—	—	0	1010	—	2
					—	—	—		1	3221	—	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
4323		57	F	7	00	0	70	12	0	0000	1000	1
					09	3	12		1	1220	1221	
4331		74	F	7	—	—	—	—	0	0000	—	2
					—	—	—		1	2121	—	
4379		71	F	7	00	0	83	09	0	0000	0000	1
					21	2	41		0	2220	2220	
4381		64	F	7	09	2	03	15	1	2110	2331	1
					05	3	27		1	2000	2220	
4384		66	M	7	09	3	17	14	1	2221	3321	3[f]
					00	0	$69^1/_2$		0	2010	2010	—
4414		70	M	7	09	0	61	01	1	3331	3121	1
					00	0	72		0	0000	0000	
4415		80	F	7	—	—	—	—	0	2010	—	2
					—	—	—		0	2220	—	
4417		57	F	7	08	2	59	07	2	2110	2120	1
					00	0	80		0	2010	2010	
4447		92	F	7	—	—	—	—	1	2221	—	2
					—	—	—		1	2221	—	
4464		62	F	7	16	0	00	12	1	2220	—	3[e]
					00	0	79		0	2000	1000	—
4477		71	M	7	16	2	18	06	1	3221	3221	1
					00	0	68		0	2110	2110	
4478		79	M	7	00	0	69	14	0	2110	2110	3—
					14	3	53		0	2220	2220	e
4486		85	F	7	—	—	—	—	1	2220	—	2
					—	—	—		0	1000	—	
4508		80	M	7	—	—	—	—	0	2210	—	2
					—	—	—		0	2110	—	
4525		82	M	7	00	0	81	14	2	2110	2110	1
					09	2	39		0	2110	2320	

Code No.	Fig.	Age (years)	Sex	Etiology	Pain		Range of motion	Restriction of function	Localisation	Radiographic severity		Surgery and vital statistics
					Duration (years)	Severity				1950—54	1962	
4556		82	M	7	10	2	27	18	1	3321	3331	1
					00	0	35		1	2221	2221	
4575		71	F	7	08	1	25	12	2	2110	2110	1
					08	1	29		2	2110	2110	
4610		48	F	7	10	4	03	09	1	2220	3330	1
					05	0	32		1	2000	2220	
4638		96	F	7	—	—	—	—	0	2000	—	2
					—	—	—		1	2230	—	

Symbols

H+ = Hip with the highest counting rate.
H — = Hip with the lowest counting rate.
Kh+ = Knee on the same side as the hip with the highest counting rate.
Kh— = Knee on the same side as the hip with the lowest counting rate.
K — = Knee with the lowest counting rate.

Table 35. *Coxarthrotic patients studied with external counting of* Sr^{85}

Code No.	Case	Activity ratios		
		H+/H—	Kh/Kh—	H/K—
1380	F 11	1.04	1.14	2.53 2.65
0278	F 8	1.59	1.08	1.20 0.76
1036	F 2	1.30	0.99	1.55 1.19
1043	F 20	1.21	0.96	2.38 1.97
1311	F 18	1.87	0.78	1.87 1.00
1335	F 44	1.50	1.31	2.56 1.70
1407	F 12	1.31	0.97	2.81 3.68
1411	F 19	1.28	1.01	2.71 2.12
1436	F 16	3.30	0.83	3.83 1.16
1607	F 32	2.67	0.60	3.72 1.39
1868	F 25	5.60	0.28	1.04 5.80
2560	D 100	2.52	0.98	0.62 1.49
3341	F 42	2.83	0.62	2.42 0.89
4323	E 75	2.71	0.83	1.44 3.90

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