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A RADIOGRAPHIC AND CLINICAL SURVEY OF THE HIP JOINT IN SERO-POSITIVE RHEUMATOID ARTHRITIS

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The hip joint in patients with rheumatoid arthritis presents serious difficulties in early diagnosis, in determining the disease pattern of progression and/or remission and in the response to treatment. There are several reasons for this; firstly because of its anatomical situation several of the earlier diagnostic criteria resulting from soft tissue changes, *e.g.* synovitis, effusion and increase in local temperature are impossible to determine. Therefore emphasis has to be given to other criteria such as limitation of movement and radiographic changes. Secondly it is a weight-bearing joint affected by biomechanical factors associated with movement and stability, and therefore secondary or coincidental changes of osteoarthritis may arise early and affect the diagnosis, especially in the age group of fifty years which is most commonly seen. And finally to make a diagnosis of a definite or classical rheumatoid arthritis seven of the American Rheumatism Association criteria (*Ropes et al.* 1949) must be present, but radiographic changes make up only one of these criteria.

Although the incidence, and diagnostic criteria of rheumatoid hip joint disease have been described (*Glick et al.* 1963), very few attempts (*Sharp et al.* 1964) have been made to evaluate the hip joint in patients who have definite or classical rheumatoid arthritis as well as a positive serology as shown by the Latex Fixation Test. This reaction is one of the few modalities of rheumatoid arthritis which can be quantitated and most probably delineates a particular type of rheumatoid mani-

festation. For example, *Kellgren* (1964) suggested that hip joint changes in adults with sero-positive rheumatoid disease were more likely to be destructive in nature, whereas in patients with sero-negative disease or with spondylitis, the hip changes were those of ankylosis.

Therefore, the incidence, radiographic changes, and the functional impairment of the hip joint will be presented in patients not only with definite rheumatoid arthritis, but who also exhibited a positive rheumatoid serology. Treatment for this particular group of rheumatoid patients will also be mentioned briefly.

METHOD

To avoid some of the inevitable selection biases, all patients with definite rheumatoid arthritis and positive serology who were seen either as in- or out-patients in the Arthritis Study Unit of the University of Rochester Medical Center between 1963 and 1964 were studied. Eighty-four patients, including 30 males, with "definite" or "classical" rheumatoid arthritis and a positive Latex Fixation Test were included in this study. In their selection, no consideration was given specifically to complaints regarding hip disease, previous therapy or other medical problems, but it is of note that none had had their disease during childhood, and all had Latex Fixation titers of 1-40 dilution or greater. The Latex Fixation Test was carried out using the method of *Singer & Plotz* (1956) with the following modifications: the serum to be tested was serially diluted and then heated for 30 minutes at 56° C (*Schubart et al.* 1959).

A detailed history of steroid therapy was obtained, as well as the presence of hip, foot or knee complaints, and the greatest disability due to the rheumatoid disease which was present at the time of the examination. Passive ranges of abduction, adduction, flexion, extension, internal and external rotation were measured. It was important to measure adduction and rotation together in both flexed hips in order not to mask limited motion by pelvic rotation.

The functional range of motion was obtained by utilizing Gade's Indices. This system was introduced by *Gade* (1947) to assess the active functional range of motion following hip surgery. Certain ranges of motion are more important functionally in walking or in climbing stairs, etc. Therefore these are given more importance and significance by multiplying the ranges of motion by a varying decimal factor. A flexion contracture will subtract greatly from the cumulative total when it occurs in the first 90° of flexion, but a contracture in other ranges, i.e., of internal rotation, would subtract only slightly. Gade's Indices have significance also in giving values not only to the present state of an individual's range of motion, but also show more clearly any subsequent change which may occur with progression of the disease or after treatment, etc. This is particularly important in rheumatoid disease where marked changes in ranges of motion result but the residual ranges are still functional.

Radiographic examination consisted of an antero-posterior view of the pelvis taken supine to include both hip joints and lower lumbar spine. Lateral radiographs were also taken but did not add significantly to the characteristic diagnostic

changes of rheumatoid disease or its severity. Unidentified X-rays were examined and charted by one of us without benefit of prior knowledge of history or physical examination. The X-rays were examined for density of both acetabulum and femoral bones with special regard to osteoporosis and to subchondral sclerosis; to joint space as regards narrowing; to resorption and/or necrosis resulting in changes of the asymmetry in outlines of both the femur and acetabulum; and to any protrusion of acetabuli or osteophytic formation. Attempts were made to observe deformities of adduction around the hip joint as well as the position of the lesser trochanter. Previous radiographic films were examined for progression of disease. Examinations of peripheral joints were made both clinically and by X-ray examination.

For purposes of this study, radiographic diagnosis of rheumatoid involvement of the hip was made only if there was:

(1) Subchondral sclerosis with osteoporosis of the femoral head and the presence of joint space narrowing, but minimal new bone formation and/or:

(2) Progression of sclerosis or joint space narrowing, bone resorption or collapse without osteophyte formation.

The X-ray diagnosis of rheumatoid hip disease was not made if the following changes were present singly; osteoporosis, sclerosis, joint narrowing or osteophytic changes. However, when any of these changes are seen alone in the presence of the rheumatoid factor, this is most suggestive of disease and requires treatment. These criteria were similar to the standards described by *Isdale* (1962), *Glick* (1963) and *Forestier* (1964).

Data retrieval and analysis was obtained from coded McBee Sort Cards to lessen any bias. As in all retrospective studies, criticism can be made of the very selection of patients, of the choice of the variables to be studied, and of the attempt to observe the progress of disease from its first diagnosis. The majority of patients began the study with the diagnosis of rheumatoid arthritis, and therefore certain bias was early established. However, such studies do provide worthwhile information about early diagnosis, progression and change with the identification of certain disease patterns.

RESULTS

It was noted in Table 1 that in the 34 patients having rheumatoid hip disease, osteoporosis was present in 27 patients, joint space narrowing in 33 and resorption with collapse in 13. Twenty out of the 34 patients with rheumatoid hip disease had bilateral involvement. In this group there were 10 males, seven of which had ilateral involvement, and 24 females having 13 bilateral hips affected. The less frequent appearance of osteophyte formation in the "rheumatoid hip" in contrast to that of the "non rheumatoid hip" (30 such patients) may have resulted from what *Ball* (1964) has described as a local inhibitory effect by the rheumatoid inflammatory process on reactive new bone formation. He has demonstrated in unstable rheumatoid knees gross cartilagenous degeneration without any accompanying marginal lipping or osteophyte formation. In the remaining 50 patients which were not considered to

Table 1. Various radiographic features in both patient groups with rheumatoid hips and without involvement of the hips.

Changes		Patients with	
		Rheumatoid hip disease	"Non-rheumatoid" hips
Bone density:	Diffuse osteoporosis	27	18
	Subchondral sclerosis	25	6
	Resorption with collapse	13	0
Joint space:	Narrowing	33	14
Changes in bony outline:	Acetabulum	30	30
	Femur	28	19
Osteophyte formation:		16	30
Acetabular deformity:	Protrusio	14	0
	Protrusio with femoral head changes	11	0
Static deformity of hips:	Adduction	28	19
	Abduction	0	0

Table 2. Distribution of the patient population as regards duration of radiographic follow-up.

Duration of radiographic evaluation	No. of patients	Rheumatoid hip disease	Progression	Resorption and collapse	Protrusio acetabuli
18 months to 4 years	26	10	8	5	3
One X-ray	29	6	—	2	2
18 months or less	16	7	7	3	4
4 years to 8 years	10	9	8	2	4
8 years or more	3	2	2	1	1
Totals	84	34	25	13	14

have rheumatoid hip disease there was a great deal of osteophyte formation.

In terms of duration of X-ray follow-up (Table 2) 29 of the patients had only one radiographic examination. An additional 16 patients were observed radiographically for 18 months or less. It is of interest that in this latter group of 16 patients, 7 showed progression of disease indicating the rapidity with which these changes can occur. Another feature is that out of the 34 patients who had hip disease, 25 showed



Figure 1.

Figures 1, 2 and 3. A series of radiographs showing the progressive and characteristic appearance of rheumatoid hip joint disease. The first radiograph (Figure 1) was taken in 1952 when the patient was symptomatic with hip pain; Figure 2 was taken in 1954, when she had become confined to a wheel chair. Figure 3 was taken ten years later.

progression (Figures 1, 2 and 3). Only one patient in the whole series had radiographic and symptomatic improvement but still limitation of movement following immobilization in a Plaster of Paris hip spica for a fracture of the ipsilateral femur (Figures 4 and 5).

Another important radiographic change was the relative frequency of significant osseous resorption of the femoral head (Figure 6) with collapse and compaction in 14 out of the 34 hips involved. Resorption on the acetabular side was seen in 11 patients with a protrusio-acetabular defect. (Figure 7). (This was almost the same number as those hips which showed resorption of the femoral head, although not necessarily in the same patient). This suggests that resorption occurs on both sides of the joint, and this pathological change was not limited



Figure 2.

only to the femoral head. *Johnson* (1964) has described the bony changes in avascular necrosis. Firstly, there is an apparent increase in bone density because of surrounding osteoporosis; secondly, a true loss of bone density as seen in bone destruction or subchondral cyst formation; and finally a true increase in bone density due to fracture and/or collapse leading to "compaction" of bone, or from new bone formation around trabeculae giving rise to subchondral sclerosis. Several of these pathological changes were seen in the rheumatoid hip group of patients, but the incidence of frank avascular necrosis as specifically resulting from rheumatoid rather than from degenerative changes was difficult to record when based solely upon radiographic interpretation. Also there is no evidence that there is reduced blood supply to the femoral head in rheumatoid arthritis, indeed the bone resorption may be due to hyperemia with increased osteoclasia.

*Figure 3.*

Table 3. Age distribution in the patient population with 27 out of 34 rheumatoid hip patients being over 50 years of age.

Age group	Rheumatoid hip disease	"Non-rheumatoid" hips
39 or under	3	6
40-49	4	13
50-59	13	16
60-69	10	12
70-79	4	3
Total	34	50

Age Groups

Over the age of 50 years (Table 3) radiographic evidence of hip joint disease appeared more frequently, *i.e.*, 27 out of 34 patients were over 50 years of age. This has also been described by *Glick*.



Figure 4.

Figures 4 and 5. Radiographs demonstrating improvement. The first radiograph (Figure 4) was taken in 1960 at the time of an ipsilateral femoral shaft fracture. Before this, motion was severely limited and the patient was incapacitated by pain. The second radiograph (Figure 5) was taken in 1962.

Table 4. Distribution of the patient population in terms of duration of symptomatic disease.

Duration of symptomatic disease	Rheumatoid hip disease	"Non-Rheumatoid" hips
1-4 years	4	21
5-8	13	8
9-12	4	3
13-16	7	4
17-20	1	5
21 years	5	9
Total	34	50



Figure 5.

Duration of Symptomatic Disease Correlated with X-ray Changes of Hip Arthropathy

It can be seen (Table 4) that the longer the duration of symptoms the more likely there is to be hip joint disease, *i.e.*, 4 patients had hip disease with a history of rheumatoid disease of under 4 years duration, but 17 out of 34 patients had hip joint involvement with less than 8 years of disease.

Fifty patients had no demonstrable rheumatoid radiographic changes in the hip. However, 21 of these patients (Table 5) had symptoms of hip pain or stiffness, a limp, a snapping or a feeling of shortening or of restricted movement with inability to pull on stockings, etc. In the 34 patients who exhibited rheumatoid hip disease, only 4 were without symptoms of joint disturbance. Three of these were observed by radiographs between 1-6 years and during this time showed progressive



Figure 6. A radiograph of a right hip joint demonstrating marked osseous resorption with minimal new bone formation.

Table 5. Showing the radiographic features in 21 patients who did not meet the criteria of rheumatoid hip disease but who were symptomatic in one or both hips.

Radiographic features	No. of patients
No radiographic changes	3
Osteophytic formation on Acetabulum	4
Osteophytic formation with other changes such as narrowing, etc.	8
Sclerosis or narrowing but not together with flexion-adduction position	6

narrowing of the joint space suggestive of active disease. The fourth had a protrusio lesion with osteophyte formation and narrowing of the joint space.



Figure 7. An X-ray of the pelvis demonstrating advanced protrusio-acetabuli on the right.

Gade's Cumulative Index of Movements of the Hip Joint

On comparing this index with X-ray evidence of rheumatoid hip disease (Figure 8) whenever radiographic changes were present there was marked restriction in all movements with significant lowering of the index score in the majority of involved patients (*i.e.*, 27 out of 34 with less than 85 points. A normal hip would be in the 100–110 points range). The strongest correlation occurred between the loss of internal rotation and the presence of radiographic changes (Figure 9). Loss of internal rotation which occurred early was seen to be more affected than any other clinical modality in this series. Unlike the movement of internal rotation loss of abduction was less related to severity or to the diagnosis of rheumatoid disease (Figure 10).

Latex Fixation Test

Although 34 patients out of the total patient series of 84 had a significant serological titer, there did not appear to be any correlation between the amount of serological titer of the rheumatoid factor to the

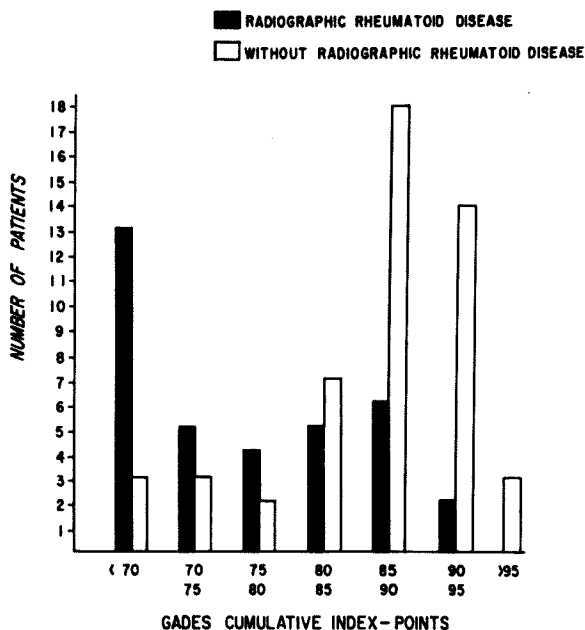


Figure 8. Showing the distribution of the points by Gade's Cumulative Index in the patient population.

presence of hip joint disease (In Figure 11). The degree of positivity was not related significantly to the number of patients who had hip involvement, but 21 out of the 34 patients who had X-ray evidence of rheumatoid hip disease had a positive Latex Test in the medium titer range of 620 or above. Glick reported only 29 per cent involvement of one or more hips in 279 consecutive patients with rheumatoid disease, but without designating their serological status. Positivity, in the Latex Fixation Test indicating the presence of a rheumatoid factor, is greatest in patients who have had the disease five to ten years (*Alexander 1964*). Its presence may be associated with an increased incidence of hip disease because of the duration of the disease rather than anything more specific.

Positional Deformities

The presence of positional abnormality involving the hip articulation was related to losses in certain ranges of movement. 28 cases out of 34 rheumatoid hips exhibited an adduction position of the femoral head and neck (Figure 12) and 15 out of these 28 hips showed decreased

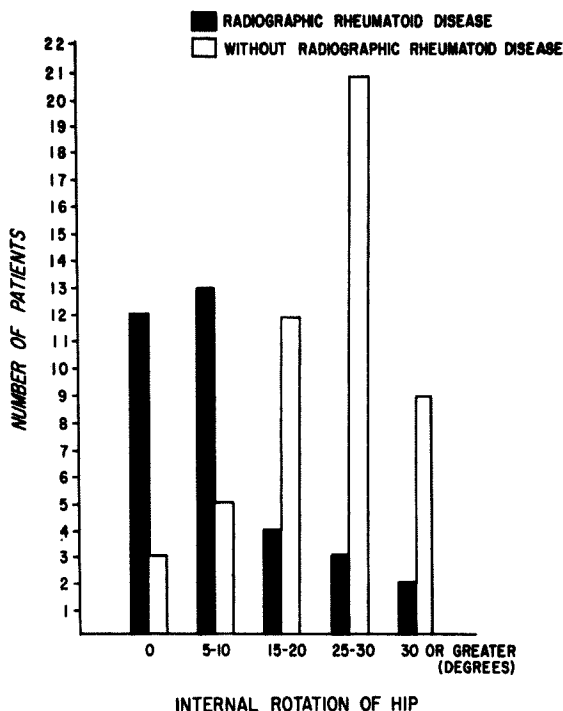


Figure 9. Distribution in terms of degrees of internal rotation of the hip in the two patient groups. The figure given is the maximum degree of rotation in the most severely involved hip.

abduction of less than 30° on clinical examination. Only one had a decreased abduction without any adduction deformity, and 5 had normal adduction without this deformity. In the remaining 50 patients who were without radiographic rheumatoid hip disease, 19 showed a similar adduction deformity. In these 19 hips, 14 showed osteoporosis, 2 sclerosis and 11 joint space narrowing but only as a single feature and without progression. However, these latter nineteen cases are being followed to see whether they will eventually present joint changes compatible with the diagnosis of rheumatoid arthritis. It is difficult to assess the accuracy of static deformities radiographically, especially if mild or if there is any variation in the supine position which the patient takes up for the X-ray examination, or if there is a flexion contracture of the ipsilateral knee present, etc. *Strange* (1965) has pointed out that in the flexed osteoarthritic hip which is subluxing slightly upwards and outwards, there is lateral rotation of the head with the

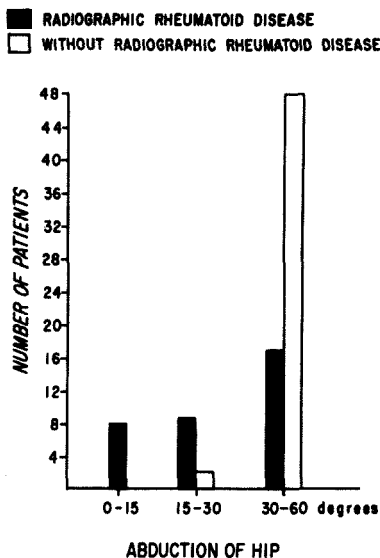


Figure 10. Similar to Figure 9 but showing the degree of abduction and its limitation.

lesser trochanter becoming more prominent due to ilio-psoas muscle action. However, in the rheumatoid type of deformity in which the head sinks more deeply into the acetabulum, as seen in 14 patients of this survey, there was medial rotation with the lesser trochanter becoming less prominent. Such changes suggest that the soft tissue pathology may well be contributing to the appearance of this lesion as well as the intra-articular changes.

Positional deformities have also certain significance particularly in describing the amount of resorption or of alteration of joint space, etc. However, the total mass or surface of the femoral head present on X-rays does not appear to be significantly altered by changes in the positions of abduction, adduction or rotation (*Isdale*).

Other X-ray changes of rheumatoid disease were seen in other joints such as knees and/or feet. In all 84 patients there were X-ray changes and/or clinical manifestations involving both knees, feet or ankles, which appeared in the more peripheral form of rheumatoid arthritis.

In no case in this series was there bony ankylosis of hip or sacro-iliac disease, although this occurred in 2 per cent of the series (*Glick et al.*) in which no study of serological status had been carried out.

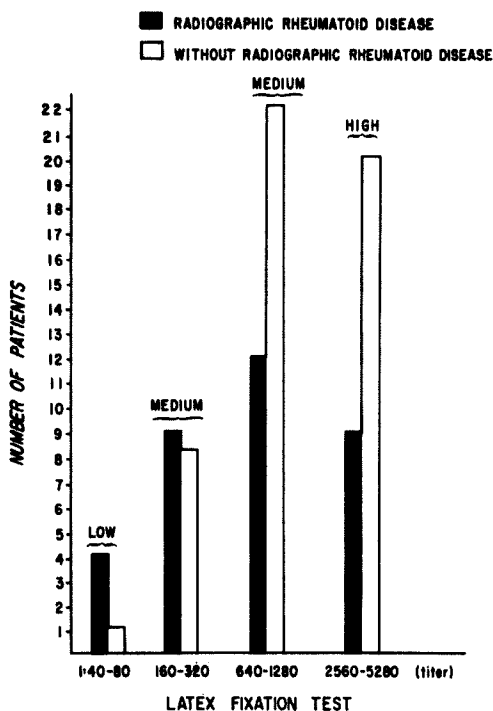


Figure 11. Distribution of the two patient groups in terms of Latex Fixation Test titres.

History of Steroid Therapy

In the 34 patients with radiographic rheumatoid hip disease, 24 patients had had steroids systemically for varying periods from one year to four years, whereas in the 50 patients without radiographic hip disease only 25 patients had had steroids (Figure 13).

In the rheumatoid hip patients who had had steroids, 13 showed significant resorption collapse or avascular necrosis. It was impossible to correlate the taking of steroids with these changes because much of the data was historical with marked variation in dosage, in duration and in type or types of steroid drug given.

TREATMENT

The difficulties and poor results of treating rheumatoid hips are obvious but briefly result from: firstly, the inability to make an early clinical diagnosis or to appreciate the degree and velocity of expected change; secondly, poor timing of conservative or operative treatment,



Figure 12. A radiograph illustrating joint narrowing, sclerosis of the femoral heads, an early subluxing femoral head on left in abduction.

and finally, the complexity of other lower extremity joints being involved simultaneously.

As regards deciding upon operative treatment there are two main groups of patients. *Firstly, those patients with structural and permanent change, e.g. resorption with collapse and/or protrusio acetabuli.* These require reconstructive/replacement surgery such as a cup arthroplasty or preferably a pseudarthrosis as described by *Girdlestone* (1945), reinforced by an angular trochanteric osteotomy of *Milch* (1950) or of *Batchelor* (1948). Although they relieve pain, maintain some stability and improve mobility, their results are most variable, depending greatly upon the motivation and rehabilitative capacity of each individual patient and whether there is the more than likely progression of the disease in other weight-bearing joints.

Secondly, those patients with pain, limitation of motion and radiographic changes of early subchondral sclerosis, minimal osteoporosis and joint narrowing. These can often be helped temporarily by a soft tissue release of the adductors, iliopsoas and occasionally the rectus femoris muscles, as well as a partial synovectomy and capsulotomy.

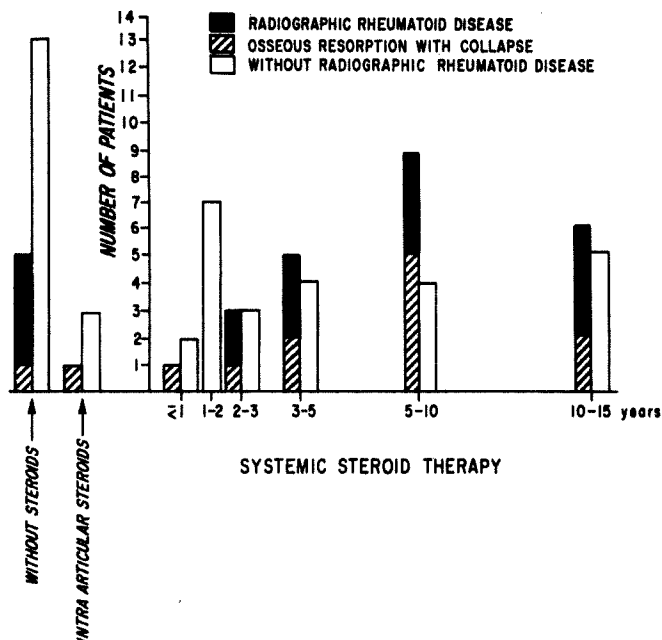


Figure 13. Demonstrating distribution of the two patient groups as well as those with resorption or collapse, and their history of the use of systemic or intra-articular steroids.

This procedure will provide diagnosis and pathogenesis of this disease. It is followed by traction for 10–14 days, intensive physiotherapy with protected weight-bearing for several months within a brace or caliper. This procedure has been carried out in a very small series of ten patients with promising results over short periods of time.

CONCLUSIONS

1. In 84 patients with classical or definite rheumatoid arthritis as well as positive serology, rheumatoid hip disease was diagnosed by radiography in 34 patients (*i.e.* 40 per cent) Osseous resorption with collapse of the femoral head was seen in 14 patients with a similar number showing a protrusio-acetabular deformity.

2. Twenty-five of these patients showed progression of the rheumatoid disease with clinical features of pain, limitation of internal rotation and an adductor contracture appearing early.

3. In 27 out of the 34 patients with rheumatoid hip disease, there was

a significant lowering of the Gades' Cumulative Index particularly in internal rotation and in abduction.

4. There was no correlation between the amount of rheumatoid factor by serological titre and the severity of hip joint disease.

5. Treatment—on identifying the early “sub-clinical” case—prophylactic soft tissue release and synovectomy operation should be carried out to maintain joint integrity.

When structural deformation has occurred, reconstructive and ablative procedures are necessary.

6. 24 out of the 34 patients had taken steroids for between 1 and 4 years and of these 13 showed excessive resorption and collapse. 25 out of the 50 non-rheumatoid hip group had had steroid without resorption or collapse.

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