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FEMORAL NECK ANGLES IN OSTEOARTHRITIS OF THE HIP

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Femoral neck angles were determined in 44 patients with unilateral or bilateral idiopathic osteoarthritis of the hip. The mean anteversion angle was 20° ± 9° and the neck-shaft angle 131° ± 7°. In comparison with a normal material the anteversion was significantly larger in the patients ($P < 0.001$), but no difference was found in the neck-shaft angle. A positive correlation between the size of the anteversion and the severity of the disease was observed.
It is concluded that increased anteversion of the femoral neck may contribute to the development of osteoarthritis of the hip.

Key words: angle; anteversion; femoral neck; osteoarthritis

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The mechanics of the hip joint are dependent on the relationship between the femoral head and the acetabulum. It is well known that incompatibility of the head and the acetabulum leads to secondary osteoarthritis, for example in Legg-Calvé-Perthes' disease and in congenital dislocation of the hip.

The adjustment of the head to the acetabulum is influenced by the femoral neck angles. Various authors have suggested that increased anteversion might lead to osteoarthritis of the hip (Alvik 1950, Morscher 1967), but there is no concrete evidence to support this theory.

The purpose of the present study was to determine the femoral neck angles in patients with idiopathic osteoarthritis of the hip and to compare the values found with those of a normal material.

PATIENTS AND METHODS

The patients were examined by the method described by Dunlap et al. (1953) and modified by Rippstein (1955). This method requires a certain range of flexion and abduction of the hip joints. In addition, the contours of the femoral head and neck must be visible on the radiograms. Many patients were therefore not suitable for this study and were excluded.

The study includes 44 patients, 27 females and 17 males with a mean age of 65.5 years, ranging from 55 to 79 years. All had sufficient hip joint mobility to allow the use of the radiological method (Figure 1).

The patients had idiopathic unilateral or bilateral osteoarthritis of a severity which indicated intertrochanteric osteotomy or total hip replacement. The severity of the disease was assessed from pelvic radiograms (Figure 2) and classified according to Kellgren & Lawrence (1957), with a range from minor formation of osteophytes on the joint margins (grade 1) to distintegration of the hip joint (grade 5).

A normal control material was obtained from 33 cadavers, 17 females and 16 males, with a mean age of 67.8 years, ranging from 46 to 85 years. None of the specimens had radiological signs of osteoarthritis of the hip. The femoral neck angles were determined by the same method as that used on the patients.

The data analysis was made on a Digital Equipment Corporation "DEC 10" using standard statistical procedures. Significance testing was carried out using the Mann-Whitney U-test or the Wilcoxon test for pair differences. Differences were regarded as significant when $P \leqq 0.05$. The two-tailed test was used in all cases.

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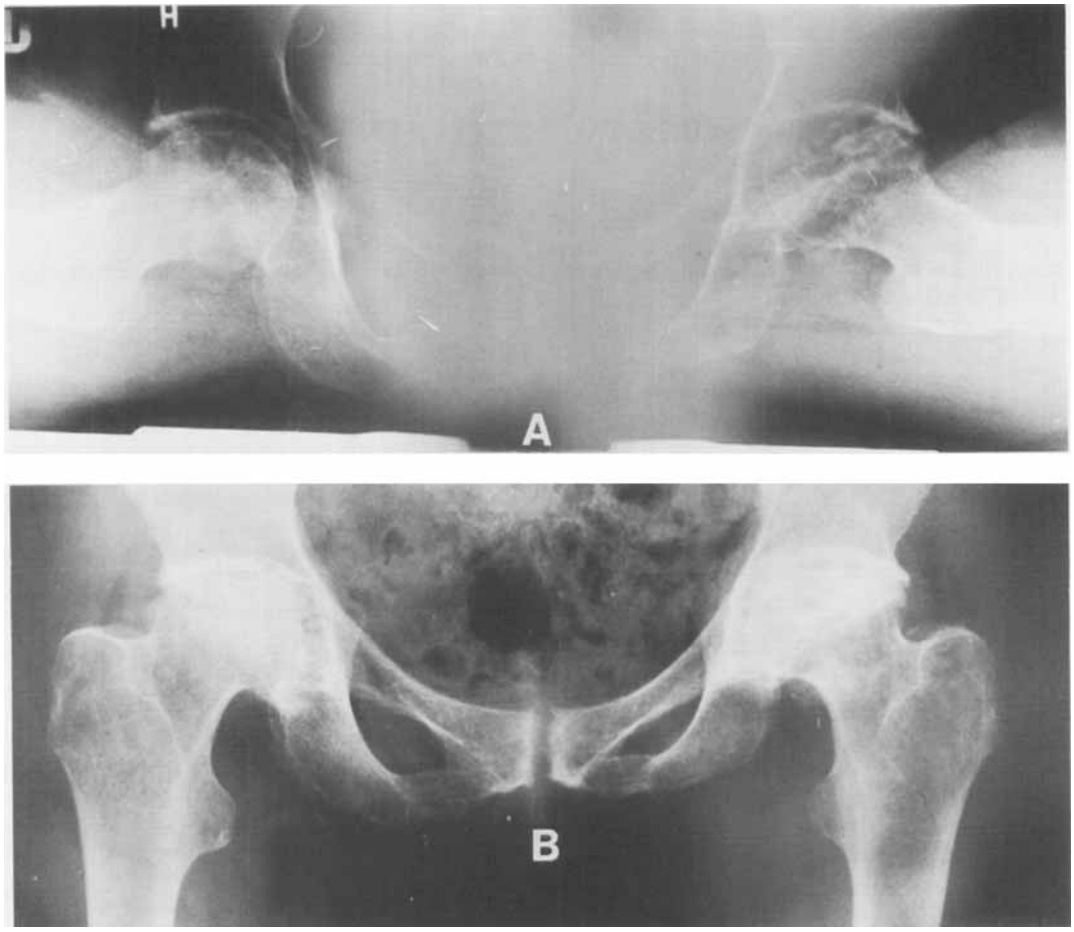

Figure 1. Radiograms of hip joints for measuring femoral neck angles by the method described by Dunlap et al. and modified by Rippstein. The patient examined has bilateral osteoarthritis of the hips. A *shows the projected anteversion angle,* B *shows the projected neck-shaft angle.*

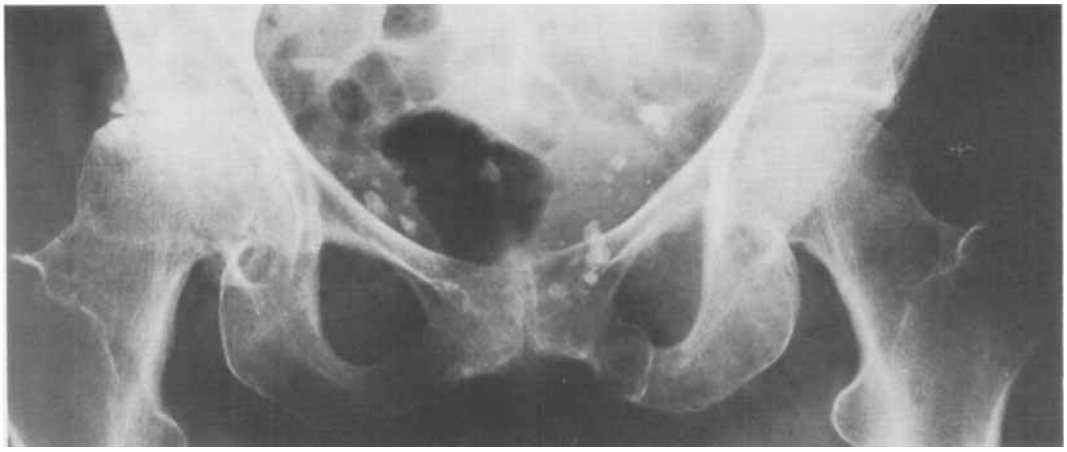

Figure 2. Pelvic radiogram for grading of osteoarthritis of the hip joints. Right hip has grade 4 (cystic degenerations), left hip grade 1 (no osteoarthritis).

RESULTS

No sex difference was found in the femoral neck angles, either in the patient group or in the normal material. Table 1 shows the difference in femoral neck angles between the patients and the normal material. The difference in anteversion is significant ($P < 0.001$). The neck-shaft angle shows no difference in the two groups.

Table 2 shows that there is no difference in the femoral neck angles in patients younger and older than the mean age.

Table 3 shows a significantly larger anteversion in those patients with bilateral disease compared to those with unilateral disease ($P < 0.001$). The patients with unilateral disease had a mean anteversion of 4° (standard deviation 6°) larger on the affected side than on the normal side. The P-value for this difference is <0.05.

Table 4 shows that there was a significantly larger anteversion ($P < 0.05$) in severely deteriorated hips (grade 4–5) compared to those with moderate osteoarthritis (grade 3). The hips classified as radiological grade 1–2 had a significantly smaller anteversion than those with grade 3 ($P < 0.001$).

Table 1. Femoral neck angles in 44 patients (88 hips) with unilateral or bilateral osteoarthritis of the hip and in 33 controls (66 hips) with no hip joint disease. Mean (± standard deviation)

	Anteversion angle	Neck-shaft angle
Patients	20 (±9)	131 (±7)
Controls	10 (±6)**	130 (±6)

** $P < 0.001$

Table 2. Femoral neck angles related to age in 44 patients (88 hips) with unilateral or bilateral osteoarthritis of the hip. Mean (± standard deviation)

Age	*n*	Degrees	
		Anteversion angle	Neck-shaft angle
<65 years	42	21 (± 9)	131 (±7)
≧65 years	46	20 (±10)	132 (±8)
Total	88	20 (± 9)	131 (±7)

Table 3. Femoral neck angles in 44 patients (88 hips) with unilateral or bilateral osteoarthritis of the hip. Mean (± standard deviation)

Osteoarthritis	*n*	Anteversion angle	Neck-shaft angle
Unilateral	52	17 (±8)	130 (±8)
Bilateral	36	25 (±9)**	133 (±6)
Total	88	20 (±9)	131 (±7)

** $P < 0.001$

Table 4. Femoral neck angles related to the severity of disease in 44 patients (88 hips) with unilateral or bilateral osteoarthritis of the hip. Grade 1–2 = no osteoarthritis; grade 3 = moderate osteoarthritis; grade 4–5 = severe osteoarthritis. Mean (± standard deviation)

Grade	*n*	Anteversion angle	Neck-shaft angle
1–2	26	15 (±9)	130 (±7)
3	20	19 (±8)**	130 (±9)
4–5	42	24 (±9)*	133 (±6)
Total	88	20 (±9)	131 (±7)

* $P < 0.05$ ** $P < 0.001$

Corresponding differences were not found for the neck-shaft angle (Tables 3 and 4).

DISCUSSION

Idiopathic osteoarthritis of the hip is a chronic disease lasting for decades, and its frequency of occurrence increases with age. Since the studies of Pommer (1927) and Collins (1947), it has been confirmed repeatedly that the process is initiated by a degeneration of the cartilage. Nutrition of the cartilage is stimulated by intermittent compression in a joint with normal function (Bauer et al. 1940, Ingelmark 1950, Ekholm & Norbäck 1951). Harrison et al. (1953) reported that in 91 hips studied postmortem, the earliest cartilage lesion was found in that part which had not been submitted to intermittent pressure. In a comparative study, Trueta (1963) reached the

conclusion that the major factor responsible for joint cartilage disintegration is uneven distribution of pressure, causing overloading in some parts and insufficient pressure in other parts of the joint. He concluded that the main cause of osteoarthritis of the hip is the unsatisfactory adaptation of the femoral head to the socket.

In cases of increased anteversion of the femoral neck, parts of the femoral head may be uncovered anteriorly and are thus not subjected to sufficient pressure, while other parts are exposed to excessive load. It is therefore reasonable to suppose that increased anteversion of the hip may predispose to osteoarthritis.

Prospective studies on increased anteversion of the femoral neck are difficult to design. Investigations on patients with idiopathic osteoarthritis are restricted further owing to difficulties in obtaining the radiological neck angle measurements. In the present study the femoral neck angles were determined by the method described by Dunlap et al. (1953) and modified by Rippstein (1955). In a previous study the precision of this method was estimated to be of the order of 5° (Reikerås et al. 1982).

Increased femoral anteversion may be secondary to the degenerative process of osteoarthritis. However, in all the patients included in this study the original contours of the femoral head and neck were distinguishable from the bony spurs.

The results of the present investigation indicate that the neck-shaft angle is of no importance in the pathogenesis of idiopathic osteoarthritis of the hip. The values for the anteversion angle were, however, significantly greater in the patients than in the normal material. A positive correlation was revealed between the degree of anteversion and the severity of the disease. This indicates that increased anteversion enhances the progression of the arthritic process. Furthermore, the oldest patients with a presumably longer duration of the disease did not have a greater anteversion than the younger patients. This indicates that the increased anteversion has not developed secondary to the osteoarthritis.

CONCLUSION

This study indicates that increased anteversion of the femoral neck is a predisposing factor for osteoarthritis of the hip.

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