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Decreased abduction strength after Charnley hip replacement without trochanteric osteotomy

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In 27 patients operated on for unilateral coxarthrosis with the Charnley hip, the muscular strength and mobility were measured. Half the cases had a trochanteric osteotomy and half an anterolateral transgluteal approach. The abduction strength was normal after trochanteric osteotomy and weaker than normal in the nonosteotomized hips.

Many surgeons perform hip replacements by an anterolateral incision without osteotomy of the greater trochanter (Müller 1970, Ahnfelt 1986); access to the joint is achieved by the partial division of the gluteus medius muscle. We have compared the postoperative isometric strength of the hip muscles and the range of joint motion after total hip arthroplasty using an anterolateral technique with either a transtrochanteric or a transgluteal approach.

Patients and methods

During 18 months in 1984 and 1985, 190 patients were operated on in our department with a Charnley total hip prosthesis, because of arthrosis, with either a transtrochanteric or a transgluteal approach. Seventy-two patients were above aged 75 years or had died; 1 had been reoperated on, and 40 were excluded due to bilateral hip disease. Of the remaining 77 patients, 30 could be matched into an osteotomy or a nonosteotomy group with regard to age, sex, and time of follow-up. Three patients declined to participate in the study. Thus, 13 patients remained in the osteotomy group and 14 in the group that had been operated on with the anterolateral incision technique with the division and resuturing of the gluteus medius muscle.

At the 1–2 year follow-up ,the mean age of the patients in the two groups was 69 and 68 years. Sixteen surgeons had performed the operations; and for each group, 9 surgeons had been involved. The radiographs taken 1 year after surgery were examined as regards the position of the prosthetic components and the position of the greater trochanter. The extent of ectopic calcifications was determined according to Brooker (1973).

The patients were examined by one of us, who did not know which operative technique the patients had had. The active range of motion was determined for both hips with a goniometer. The isometric strength in flexion, extension, and abduction was determined for both hips with a Cybex 2® dynamometer. All the measurements were made with the patient lying on a couch. To measure the strength in flexion and extension, the patients were lying supine with the pelvis locked with a girdle and the hip positioned in 45° of flexion. The strength in abduction was measured with the patient lying on the side with the upper hip in 15° flexion and 0° abduction. The test arm was positioned above the patella, and the weight of the leg was compensated for.

The measured values were used to express the muscle strength of the operated on hip as the ratio of that of the nonoperated on hip.

The range of motion and muscle strength ratios were compared using the two-tailed *t*-test.

Results

Total patient material (Table 1)

The isometric hip strength in abduction was stronger in the osteotomized group as compared with the nonosteotomized group, with average strength ratios of 1.03 and 0.77, respectively. With regard to the flexion and extension strength ratios, there were no differences between the two groups (Table 2).

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Table 1. Data on 27 patients with unilateral arthrosis operated on with a Charnley total hip

A	B	C	D	E	F	G	H	I	J	K	L	M
1	73	F	21	0	110	0	20	1.03	0.91	1.20	0	N1
2	63	F	22	0	105	0	10	0.49	0.94	0.57	0	N2
3	59	M	22	0	105	0	10	1.06	0.83	0.73	0	U
4	69	M	22	0	110	5	15	0.94	1.14	1.07	2	U
5	75	M	22	0	110	0	15	0.84	1.30	1.03	1	U
6	66	M	22	0	120	0	10	0.79	0.72	1.04	0	U
7	69	M	20	0	110	0	15	0.76	0.57	1.03	3	U
8	72	M	23	0	100	0	10	0.83	0.97	1.14	2	U
9	73	F	21	0	105	0	10	0.89	0.81	1.25	1	U
10	62	F	20	0	115	5	15	0.62	1.40	1.05	2	P 0.5
11	75	M	24	0	105	0	15	0.91	0.66	0.97	2	U
12	70	F	21	0	120	0	20	0.82	0.88	1.08	0	P 1.5
13	72	M	16	0	115	0	20	1.01	0.81	1.22	0	P 1.5
14	61	M	20	DL	120	0	25	0.82	0.89	0.46	1	–
15	59	F	21	M	90	0	20	1.13	1.00	0.94	1	–
16	62	F	19	M	105	5	20	0.61	0.77	0.89	0	–
17	75	F	23	M	90	–5	10	0.98	0.88	1.05	0	–
18	75	F	14	M	90	0	5	1.02	1.11	0.61	1	–
19	74	M	29	M	95	0	10	0.76	1.18	0.70	0	–
20	70	F	20	M	115	0	15	0.96	0.83	0.89	0	–
21	66	F	19	DL	100	0	15	0.68	0.71	0.47	0	–
22	60	M	23	DL	110	0	10	0.86	0.93	0.81	3	–
23	73	M	20	M	105	0	15	0.88	1.43	0.73	0	–
24	72	M	19	M	85	–5	10	0.64	1.02	0.70	2	–
25	72	F	19	M	115	0	15	0.88	1.00	1.00	0	–
26	66	M	25	DL	90	0	15	1.03	1.53	0.72	1	–
27	67	M	19	M	105	0	5	1.08	0.73	0.83	3	–

A Patient number.
B Age.
C Sex.
D Follow-up, months.
E Approach:
O osteotomy.
M Müller incision.
DL direct lateral approach.
Mobility in degrees:
F Flexion.
G Extension.
H Abduction.

Muscle strength ratio operated/nonoperated side:
I Flexion.
J Extension.
K Abduction.
L Ossification Grades 0–4.
M Trochanter osteotomy healing:
N nonunion with diastasis in cm.
P proximal migration in cm but healed.
U uneventful.

Table 2. Isometric muscle strength and range of motion after total hip replacement with a Charnley prosthesis 1–2.5 years after surgery in 27 patients with unilateral arthrosis. The force ratio was calculated by dividing the force values of the operated on/nonoperated on hip. Mean *SD*

	Flexion	Extension	Abduction	Abduction force ratio	Flexion force ratio	Extension force ratio
Lateral incision with trochanteric osteotomy (n 13)	110 *6°*	1 *2°*	14 *4°*	1.03 *0.19*	0.85 *0.16*	0.92 *0.24*
	P=0.018			P=0.0013		
Anterolateral incision without trochanteric osteotomy	101 *11°*	0 *2°*	14 *6°*	0.77 *0.18*	0.87 *0.15*	1.00 *0.25*

The trochanteric osteotomy cases had a larger range of flexion compared with the group that had been operated on without osteotomy, averaging 110° and 101°, respectively. There was no difference between the two groups in ability to extend or abduct the leg (Table 2).

Fourteen of the 27 cases had signs of ectopic bone formation 1 year after surgery, but there was no difference between the groups. None had massive calcification; 1 osteotomized and 2 nonosteotomized patients had Class 3 calcifications according to Brooker

(1973). In 2 of the trochanteric osteotomy cases, a proximal migration of the greater trochanter with 1.0- and 2.0-cm diastasis was found at the follow-up. Three trochanters had healed in a position 0.5 – 1.5 cm proximal to the original position. One of these 5 patients had weak abduction strength on the operated on side.

Discussion

Charnley (1970) emphasized the advantage of extensive exposure with trochanteric osteotomy for a mechanically sound component positioning. In Sweden, his prosthesis has been inserted through an anterolateral approach without trochanter osteotomy in 44 percent of about 2,700 cases during 1985 (Ahnfelt 1986). Consensus has been lacking as to which one of the two lateral approaches is to be preferred (Murray et al. 1981, Vicar and Coleman 1984).

Even though two of our trochanteric osteotomies did not heal, the osteotomized patients were stronger in their abduction. This result differs from that obtained by Murray et al. (1981), who found no difference with or without osteotomy. Their measurements were, however, made in nonmatched groups of patients with several diagnoses and bilateral hip involvement.

Most of the muscle-splitting incisions in our material were performed according to Müller (1970); the anterior portion of the gluteus medius and most of the gluteus minimus were reflected proximally and laterally. A longitudinal incision in the muscles and preserved continuity of the anterior part of the gluteus medius muscle with the vastus lateralis (Hardinge 1982) may result in a better abduction strength postoperatively. However, we used this approach in two few cases to permit an evaluation.

Although Johnsson et al. (1987) have shown that standard physiotherapy has no effect on mobility and Trendelenburg limp after posterolateral hip surgery, this might be the case after anterolateral surgery if the abductor muscles are specifically trained. In most cases a loss of one quarter of abduction strength after the muscle-splitting incision causes no trouble. However, if a general or localized muscle weakness for other reasons is added, a limp and inferior function may develop.

We did not find any difference in ectopic calcification between the two incision techniques. Our results agree in this respect with those obtained by Morrey et al. (1984).

We conclude from this study that hip flexion and the strength of abduction after Charnley hip arthroplasty were better after the trochanteric osteotomy than after the anterolateral incision technique; and, although the first procedure can be somewhat more time-consuming, we now recommend it instead of the anterolateral approach. If an anterolateral incision is used, the Müller (1970) technique seems unsuitable.

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