

Failure of Reinserted Short External Rotator Muscles After Total Hip Arthroplasty

Thomas Stähelin, MD,*† P. Vienne, MD,† and O. Hersche, MD*†

Abstract: The frequency and point in time of failure of repaired short external rotator muscles were determined in 27 total hip arthroplasties. The piriformis, triceps coxae, and obturator externus muscles were released close to the trochanter and reattached only if tension was low and if the tendon tissue allowed a good hold for anchoring the stitch. A radiopaque marker was attached to each side of the suture with maximum 1-cm distance between opposite markers. The distance between markers was determined on radiographs obtained 1 day and 3 months postoperatively; ≥ 2.5 cm indicated failure. Of 50 repaired short external rotator muscles, 35 (70%) failed—26 within the first day and 9 within 3 months postoperatively. In 2 hips, no failure of the repaired short external rotator muscles was observed. Repair of the short external rotator muscles after total hip arthroplasty contributes little to prevention of hip dislocation. **Key words:** tendon repair, repair failure, external rotator muscles, total hip arthroplasty (THA), posterior approach. Copyright 2002, Elsevier Science (USA). All rights reserved.

Piriformis, triceps coxae (consisting of obturator internus and both gemelli), and obturator externus are short external rotator muscles of the hip joint. These muscle units are released when using the posterior approach to the hip for total hip arthroplasty (THA). The benefit of repairing these units is controversial. Repair is required to restore muscle function. Significant reduction of hip dislocation after THA from 7.5% to $<1\%$ has been reported with repair [1]. Kao and Woolson [2] found early failure of the repaired piriformis muscle unit in 80%, however. The aim of our study was to determine the frequency and point in time of failure of

all the repaired muscle units using a posterior approach in THA.

Materials and Methods

A total of 29 primary THAs were done in 28 patients. Two patients were lost to follow-up, leaving 27 hips of 26 patients (10 women and 16 men) available for this study. The mean age at the time of surgery was 64 years (range, 33–81 years). No patient had a neuromuscular disorder or a dysplastic proximal femur.

THA usually was done with epidural anesthesia. The posterior approach to the hip joint was used [3]. The short external rotator muscles were released from the femur close to the bone. The quadratus femoris muscle was only partially released. The capsule was excised. The prosthetic components (Fitek and Zweymüller; Sulzer Medica, Winterthur, Switzerland) were implanted. Joint stability was confirmed. Piriformis, triceps coxae, and obturator externus muscles were reattached to the posterior aspect of the greater trochanter only if

*From the *Schulthess Clinic, and †Department of Orthopaedics, University of Zürich, Balgrist, Zürich, Switzerland.*

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Reprint requests: Thomas Stähelin, MD, Schulthess Clinic, Lengghalde 2, 8008 Zürich, Switzerland. E-mail: thomas@stahelin.ch

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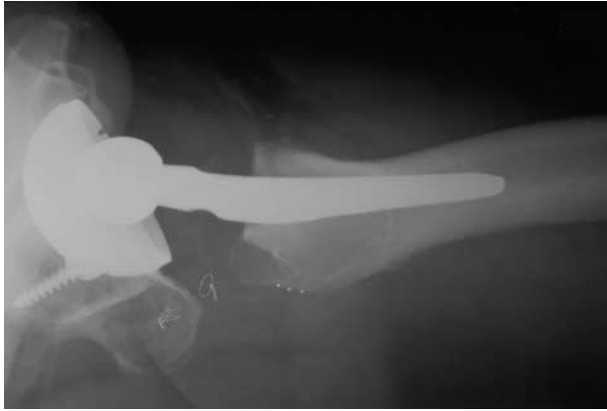


Fig. 1. Early failure of each repair (piriformis, triceps coxae, and obturator externus muscle) on the axial radiograph of the first postoperative day. The distance between wire knot and tantalum ball is >2.5 cm.

the senior surgeon (O.H.) considered the tension low enough for reinsertion and if the tendon tissue allowed a good hold for anchoring the stitch. Under these circumstances, all 3 ($n = 9$), 1 or 2 ($n = 13$), or none of the 3 ($n = 5$) short external rotator muscles were repaired. For transosseous suture fixation, 2-mm holes were drilled to the posterior aspect of the greater trochanter. A modified Mason-Allen stitch [4] was applied to each repaired tendon. The suture material was nonresorbable polybutylate-coated braided polyester USP No. 2 (Ethibond Excel; Ethicon, Norderstedt, Germany). Radiopaque chrome-nickel wire (surgical stainless steel wire 2-0 USP; Ethicon, Norderstedt, Germany) was stitched to the tendon before the tendon was sutured to the trochanter. The wire was located close to but not in the modified Mason-Allen stitch. On the femoral side, a tantalum ball was applied to the surface of the trochanter at the reinsertion point with the aid of a pistol (Sulzer Medica, Winterthur, Switzerland). The distance between the 2 reference points was measured intraoperatively. The maximum distance allowed was 1 cm.

The postoperative regimen included walking with partial weight bearing on crutches started on the 1st postoperative day, maximal hip flexion of 70° , and no internal rotation for 2 months. Analgesics, omeprazole (20 mg/d) for 2 weeks, and warfarin for 2 months were administered.

Axial radiographs [5] and anteroposterior radiographs of the hip were obtained on the 1st postoperative day and 3 months after the operation. On the radiograph, the distance between the wire knot and the tantalum ball was measured. As proposed by Kao and Woolson [2], a distance between refer-

ence points of ≥ 2.5 cm in any radiograph indicated tendon repair failure.

Results

Of 50 repaired short external rotator muscles, 35 (70%) failed; 26 of the 35 failures occurred within the 1st postoperative day (Fig. 1), and 9 occurred within 3 months after the operation (Fig. 2). In 12 hips, all repairs failed; in 8 hips, a part of the repairs failed. In 2 hips, no failure of the repaired short external rotator muscles of the hip was observed (Fig. 3). Results are summarized in Table 1.

Discussion

Our study showed that despite restricted indications for repair, most repaired short external rotator muscles failed, and most failed early. High early failure of 80% of repaired piriformis muscles was

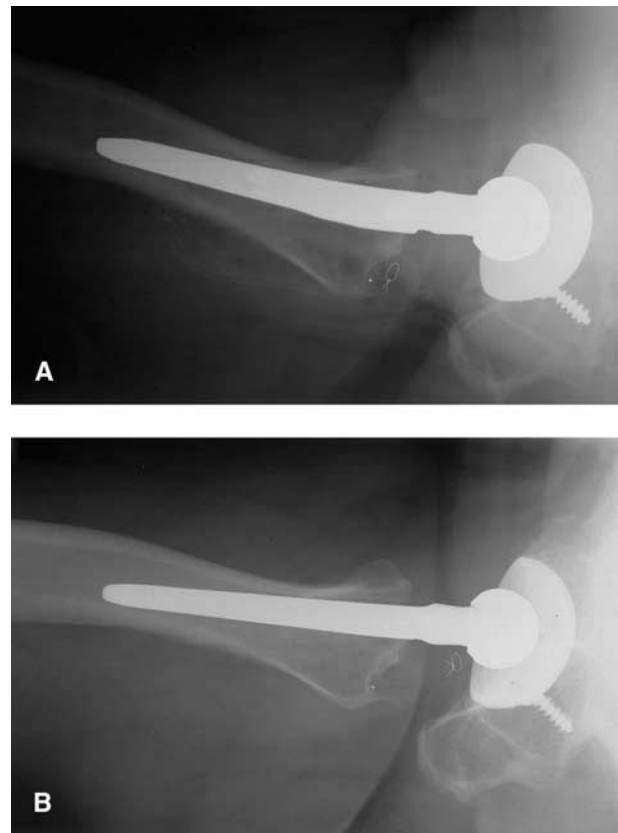


Fig. 2. Late failure of piriformis muscle repair. Reference points are close to each other in the radiograph obtained on the first postoperative day (A) but >2.5 cm apart in the radiograph obtained 3 months postoperatively (B).

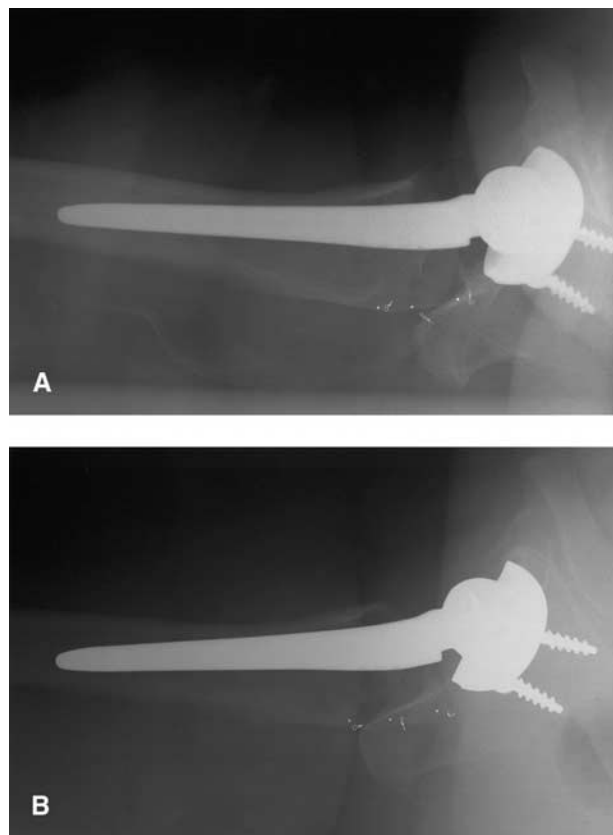


Fig. 3. No failure of the repaired short external rotator muscles. Reference points are $< 2.5\text{ cm}$ to each other in the radiographs obtained on the first postoperative day (A) and 3 months postoperatively (B).

found by Kao and Woolson [2]. In their study, a transosseous repair technique and suture material of equal strength as in our study were used.

We do not know whether the suture material failed or the anchoring technique was insufficient. Besides insufficient stitch anchoring in the tendon tissue, increased tension of elastic elements of the repaired muscle may play an important role. Increased tension may be generated by a loss of muscle length and an increase in distance between muscle origin and insertion. Loss of muscle length occurs through dividing and gathering a muscle unit. Loss also occurs through incapacity to release the tendon directly from the bone, as is true for the piriformis tendon, which passes below the gluteus medius tendon to insert at the anterior half of the greater trochanter. An increase in distance between muscle origin and insertion may be caused by lateralization of the proximal femur after THA.

Failure was defined as the distance on the radiograph being at least twice the distance measured intraoperatively. We believe this criterion ensured exclusion of false-positive results. In contrast, some of the repaired tendons presumed to be intact may be failures because a radiograph perpendicular to the plane of the reference points would show the actual distance, whereas a radiograph oblique to this plane would decrease the radiographic distance and give the impression that a failed repair was intact. This impression might be especially true for the assessment of failure of the obturator externus muscle in the axial radiograph.

Repair failure of short external rotator muscles may decrease the hip external rotation force. This decrease seems not to be a problem, however. Repair of short external rotator muscles of the hip after the posterior approach for THA failed in most patients, and failure occurred early in most patients. This repair technique contributes little to the prevention of hip dislocation and was abandoned.

Table 1. Number and Time of (Noticed) Failure of Repaired Short External Rotator Muscles (X) in 27 THAs

Piriformis	Triceps Coxae	Obturator Externus	No. Failed Repairs (No. Repaired Muscles)	
			1st p.o. day	3 mo. p.o.
	x	x	2 (2)	2 (2)
x	x	x	3 (3)	3 (3)
x	x	x	1 (3)	1 (3)
			0 (0)	0 (0)
x	x	x	0 (3)	0 (3)
x	x	x	1 (3)	1 (3)
x			1 (1)	1 (1)
x	x		2 (2)	2 (2)
			0 (0)	0 (0)
			0 (0)	0 (0)
x	x	x	1 (3)	1 (3)
x	x	x	3 (3)	3 (3)
x	x		1 (2)	1 (2)
x	x		1 (2)	1 (2)
	x		0 (1)	0 (1)
			0 (0)	0 (0)
x	x		0 (2)	1 (2)
		x	0 (1)	1 (1)
	x	x	1 (2)	1 (2)
			0 (0)	0 (0)
x		x	1 (2)	1 (2)
x	x		0 (2)	2 (2)
	x	x	0 (2)	2 (2)
x	x		2 (2)	2 (2)
x	x	x	3 (3)	3 (3)
x	x	x	3 (3)	3 (3)
x	x	x	0 (3)	3 (3)

Abbreviation: p.o., postoperative.

Bone-to-bone reattachment may be more secure than reattachment of soft tissues. Iyer [6] cut the greater trochanter so that the detached part included the insertions of all short external rotator muscles and the posterior third of the gluteus medius muscle and used wires for fixation. No loss of reduction was found in the follow-up radiographs of all 15 patients studied. Iyer [6] also tested the ultimate tensile strengths of his repair technique and compared it with a soft tissue suture repair technique in the opposite hip in 3 cadaver specimens. Bone-to-bone repair was superior to soft tissue suture repair in all 3 comparisons. Johnsson et al [7] released the short external rotator muscles with a shell from the greater trochanter to allow bone-to-bone suture. They found little loss of shell reduction in 9 of 78 hips studied. Daum [8] combined bone-to-bone reattachment of inferior short external rotators with tendon-to-tendon reattachment of the piriformis muscle in >30 patients. He used a nonresorbable 5-mm tape (Mersilene; Ethicon, Norderstedt, Germany) to fix the bone block. Loss of reduction was found in only 1 patient who had rheumatoid arthritis and osteopenic bone. Shaw [9] cut the posterior one third of the greater trochanter and used screws and washers for fixation. Loss of reduction was absent in all 13 patients studied. Other authors preferred to leave the greater trochanter intact and used a Krackow locking loop stitch [10] or the posterior capsule in conjunction with the tendon [11,12] to achieve good stitch anchorage. Failure rates of such repair techniques were not determined, however.

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