Interact Surg (2006) 1: 1–4

DOI 10.1007/s11610-006-0005-3

ORIGINAL ARTICLE

Capsular closure and piriformis preservation to prevent dislocation after total hip arthroplasty through the minimal posterior approach. Comparative series of 196 patients

F. Prigent

Clinique Saint-Louis, 1, rue Basset, 78300 Poissy, France

Abstract: *Purpose of the study:* This study analyzes the incidence on hip dislocation of a posterior minimally invasive approach that combines the suture of the capsular joint and the preservation of the piriformis muscle.

Material and methods: A first prospective series of 98 patients having undergone hip prosthesis by a posterior minimally invasive approach that combines piriformis preservation and capsular closure is analyzed regarding 7 criteria: age, weight, duration of the intervention, piriformis integrity and quality of the capsular closure at the end of the intervention, radiological position of the implants, and rate of dislocation at M12.

This series is compared to another consecutive series of 98 hip prostheses performed by the same operator, by posterior access, consisting in capsular resection and cutting of the piriformis reinserted on the trochanter.

Results: The two series were identical regarding patients' age and weight. The minimally invasive surgery lasted 20 minutes more than the other intervention. In both interventions, no effect was observed on the radiological position of the implants. The rate of hip dislocation after twelve months was significantly improved by the capsular closure combined with piriformis preservation (2.9% *vs* 0%).

Discussion: The restoration of the capsular plane has been the subject of numerous works. The techniques described had some variants, with a related rate of dislocation less than 1%.

Piriformis preservation participates in the joint coaptation. This muscle is stretched out during the first step of the dislocating movement.

The presented series highlights the benefit of combining a capsular flap truly suturable and the preservation of the piriformis muscle aimed at creating a "hammock", passive and active at the same time, at the upper posterior part of the joint, a strategic area with a high related risk of dislocation.

Keywords: Piriformis – Capsule – Capsular repair – Dislocation – Hip prosthesis

Summary

Posterior minimally invasive access allows the preservation of the piriformis muscle and the closure of the capsular joint. The employed technique is described. Each time of the intervention corresponds to a position of the limb that alternatively stretches out and releases the tendinous and capsular structures to be preserved.

This study compares two series of 98 patients having undergone posterior access with or without pririformis sectioning and capsular closure. This analysis is based on seven criteria: age, weight, duration of the intervention, prospective control of the piriformis and the capsular closure, radiological position of the implants, dislocation rate at M12.

The dislocation rate was significantly lower with the minimally invasive technique.

Several publications recommend the restoration of the capsular plane. The techniques described have some variants, with a rate of dislocation less than 1%.

The author underlines the benefit of combining this restoration with piriformis preservation. This muscle is stretched out during the first step of the dislocating movement and participates in joint coaptation.

The minimally invasive posterior access with piriformis preservation and capsular joint closure allows creating a "hammock", passive and active at the same time, at the upper posterior part of the joint, a strategic area with a high related risk of dislocation.

Introduction

At present, the postero-lateral access is the most frequently utilized in France in total arthroplasty of the hip. It is easily feasible, allowing efficient exposure of both acetabulum and femur, and useful in complex interventions such as femoral or acetabular reconstructions. Despite these advantages, it has a bad reputation regarding primary dislocation.

This article compares the results of two techniques: a less invasive access that preserves the piriformis and

repairs the capsular joint, and a standard posterior access by which both capsule and piriformis are "sacrificed".

Operative technique

The patient is in the strict unilateral position. A support is placed under the lower quarter of the leg.

Four peroperative positions are useful in releasing alternatively capsular and muscular structures: straightness, internal rotation, abduction and internal rotation, bent knee with the foot sole in the zenithal position (Fig. 1).

The posterior incision measures 9 cm (Fig. 2). After discision, the gluteus maximus is placed on a Charnley device. The piriformis tendon is individualized and placed on a retractor. The gemellus muscles and the obturator internus are cut. The capsule is opened following a T design (Fig. 3).

The acetabulum exposure is obtained using three retractors. At each operative time, a different position of the limb facilitates their installation. The anterior retractor is placed in front of the anterior horn of the acetabulum after capsule perforation. The foot positioned following a zenith angle. Then, the pyramidal tendon is turned upright. Its fixation is achieved using a Steinmann's pin tilted forward. The abduction of the limb relaxes the piriformis. After capsule perforation below the posterior horn, the lower retractor is positioned, with the limb in internal rotation (Fig. 4).

The acetabular procedure and implant fitting are realized using standard tools with the limb maintained in internal rotation.

The femoral preparation is simple, the foot in the zenithal position; the femoral elevator is placed beneath the femoral neck and the femur is prepared using a right rasp.

Once the prosthesis is reduced, the capsule is sutured by four stitches on the ascending branch of the T. The capsule covers the prosthesis head. The piriformis regains its place.

Material and method

Between November 2003 and July 2004, 98 patients were consecutively operated on by the same surgeon using the described procedure. The main criteria of this technique are: short cutaneous incision, limited muscular handling preserving the piriformis, capsular joint repair.

In this prospective series, the following parameters were taken into account: patient's age and weight, duration of the intervention, control of piriformis integrity and quality of the capsular closure at the end of the intervention, radiological control of implants' position, and rate of prosthetic dislocation at M12.

This series was compared to another series of 98 patients operated on by the same surgeon between January and December 2002, using a standard procedure of

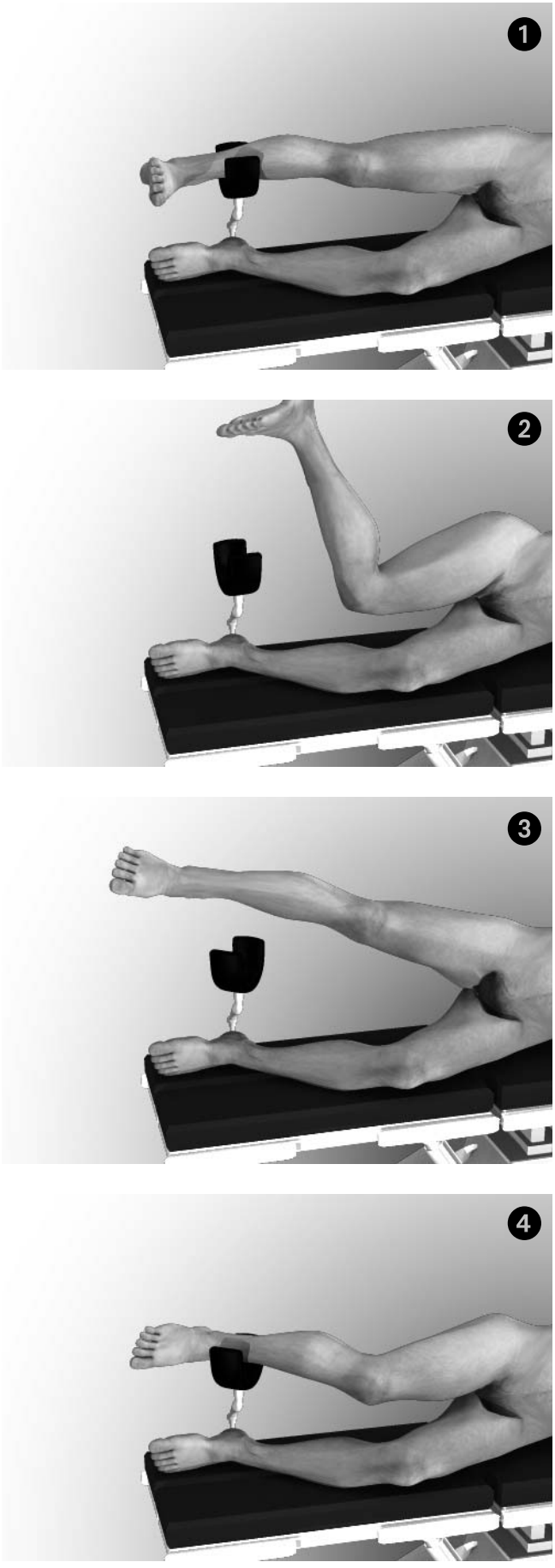


Fig. 1. Four peroperative positions are useful

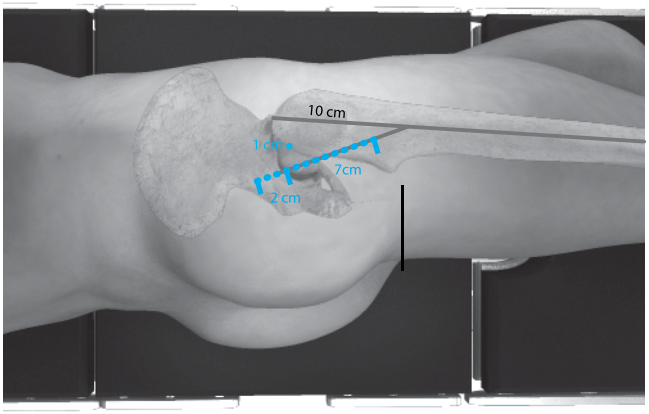
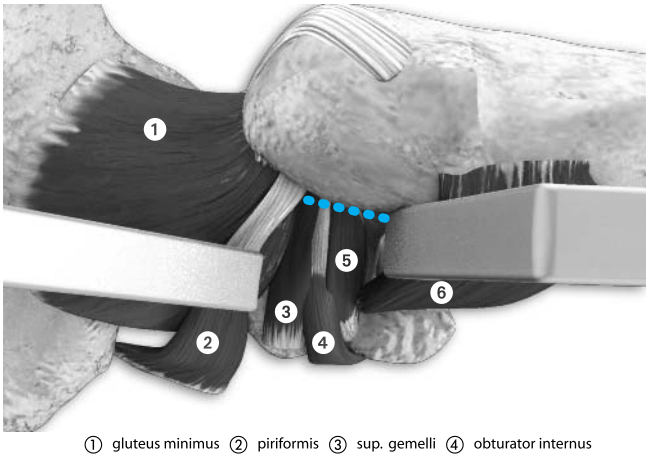


Fig. 2. Incision planning



① gluteus minimus ② piriformis ③ sup. gemelli ④ obturator internus
⑤ inf. gemelli ⑥ quadratus femoris

Fig. 3. The pyramidal tendon is individualized. The gemellus and the obturator internus are cut

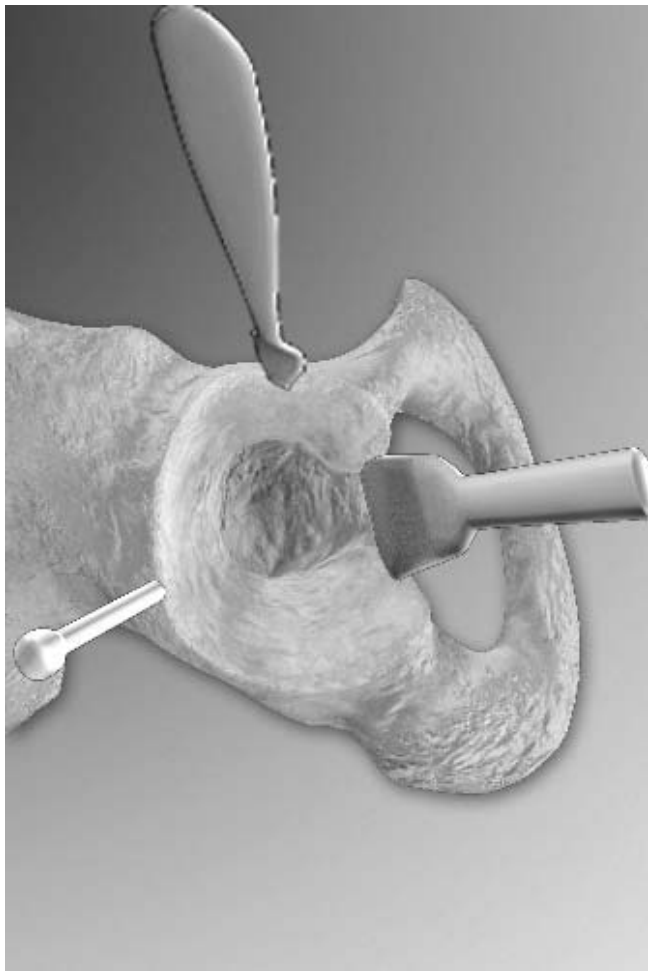


Fig. 4. Acetabular exposition: for each retractor one leg position

posterior access, and having undergone posterior capsular resection and section of the piriformis re-inserted into the trochanter.

Patients with a significant overweight, BMI >40 and dysplastic hips with a VCE covering angle <15° were excluded.

The prosthetic head diameter was 28 mm.

Results

No difference was found between the two groups regarding mean age and weight: 67.1 years versus 68.2; 69.1 Kg *versus* 72.1 Kg. The minimally invasive surgery lasted 20 minutes more than the other intervention: 84 minutes versus 62 minutes.

At the end of the intervention, the piriformis was intact in 94% of the cases; the capsule was completely closed and adequately covering the prosthetic head in 86% of the patients. 2 patients had a deficit on these two criteria. The posterior double contention was correctly placed in 82% of the cases.

The radiographic control of the acetabulum showed a vertical displacement >50° of 2 cupulae in the two groups and 30° in 1 cupula in the first group. One femoral stem showed a varus >5° in the second group.

A crural palsy that regressed after 2 months was observed in the group having undergone the conservative procedure. No infection and no migration of the implants occurred in this series.The standard procedure was associated with a 2.9% rate of dislocation at 1 year: 3 dislocations, all occurring during the first three months. The conservative procedure was not associated with any dislocation.

Discussion

In this series, the posterior contention was implemented by a double "hammock": one "postero-passive", the capsular joint, and the other, the piriformis, "postero-active". Capsular plane repair was studied in numerous works.

In 1996, Scott in the « Current concept » [1] and Pellisi, Poss *et al.* [2,13] recommend a capsular suture with a dislocation rate of 4%-0% and 6.2%-0.8%, respectively. The randomized study of Chiu [3], and the series of Goldstein

[4] and Dixon [6] confirm these results with dislocations rates of 2.3%-0%, 2.8%-0.6%, and 0.4% (for 255 hips), respectively. These publications/works show a steady objective which is the restoration of the capsular plane. Some variants appear in the described techniques: in some of them, the inferior capsular flap is sutured at the upper part of the capsule [4,7] or on the gluteus medius [1,6], in others the suture is more complete, reinserted together with the external rotators on the greater trochanter [2,3,8]. All these studies report a dislocation rate <1%.

The biomechanical study of Mihalko underlines the greater passive resistance of a complete suture of the capsule and external rotators on the trochanter as compared with non restoration or simple reinsertion of the piriformis [9].

In such case, the quality of the reinsertion is conditioned by the bone quality [10]. White reports a rate of 0.9% of trochanteric fracture-avulsion with a satisfactory rate of dislocation (0.7%) [8]. In the study of Stahelin *et al.*, controlled by radiopaque markers this trochanteric reinsertion fails after 3 months in 75% of the cases [11].

Classically, cutting the piriformis tendon remains a widely generalized surgical act in the posterior access.

The piriformis is a coaptator muscle of the hip. It is a postural muscle, fatigue-resistant and containing a great quantity of slow muscular fibres (56%) [10].

During the first step of the dislocating movement, the hip bent at 90° and in abduction, the piriformis is stretched out on about a quarter of its total length [11].

In cases of sectioning-reinsertion, controls by radiopaque markers show suture failures in 75% to 90% of the cases [9,12].

In the present series, the piriformis tendon is kept intact at 94%. It works like a hammock, postero-active regarding dislocation.

During walking, one foot on the ground, the piriformis curbs the pelvic internal rotation around the hip, which corresponds to the initiation of the opposite step.

Conclusion

In this series of total arthroplasty of the hip by posterior access, the rate of dislocation is significantly reduced when the piriformis is preserved and the capsular joint is restored. This underlines the benefit of combining a capsular flap truly suturable and the preservation of the piriformis muscle aimed at creating a "hammock", passive and active at the same time, at the upper posterior part of the joint, a strategic area with a high related risk of dislocation.

References

1. Scott RD (1996) Posterior capsulorrhaphy for hip stabilisation. 12th Annual Current Concepts in Joint Replacement Proceedings. December 12–14, 1996, Orlando, Florida, 87
2. Pellici PM, Bostom M, Poss R (1998) Posterior approach to total hip replacement using enhanced posterior soft tissue repair. Clin Orthop 355: 224–8
3. Chiu FY, Chen CM (2000) The effect of posterior capsulorraphy in primary total hip arthroplasty. A prospective randomised study. J Arthroplasty, 15(2): 194–9
4. Goldstein WM, Gleason TF, Kopplin M , Branson JJ (2001) Prevalence of dislocation after total hip arthroplasty through a posterolateral approach with partial capsulotomy and capsulorrhaphy. J Bone Joint Surg Am 83-A Suppl: 2–7
5. Swanson TV (2005) Early results of 1000 consecutive, posterior, single-incision minimally invasive surgery total hip arthroplasty. J Arthroplasty 20(7 suppl 3): 26–32
6. Dixon MC, Scott RD, Schai PA, Stamos V (2004) A simple capsulorrhaphy in posterior approach for total hip arthroplasty. J Arthroplasty 19(3): 373–6
7. Mahoney CR, Pellici PM (2003) Complications in primary total hip arthroplasty: avoidance and management of dislocations. Intr Course Lect 52: 247–55
8. White RE, Forness TJ, Allman JK, Junick DW (2001) Effect of posterior capsular repair on early dislocation in primary total hip replacement. Clin Orthop Relat Res 393: 163–7
9. Mihalko WM, Whiteside LA (2004) Hip mechanics after posterior structure repair in total hip arthrosplasty. Clin Orthop Relat Res 420: 194–8
10. Robinson PS, Placid R, Soslowsky LJ, Born CT (2004) Mechanical strength of repairs of the hip piriformis tendon. J Arthroplasty 19(2): 204–10
11. Stahelin T, Drittenbass L, Hershe O, et al. (2004) Failure of capsular enhanced short external rotator repair after total hip remplacement. Clin Orthop Relat Res 420: 199–204
12. Hitomi Y, Kizati T, Watanabe S, et al. (2005) Seven skeletal muscles rich in slow muscle fibers may function to sustain neutral position in the rodent hindlimb. Comp Biochem Physiol B Biochem Mol Biol 140: 45–50
13. Snijders CJ, Hermans PF, Kleinrensink GJ (2005) Functional aspects of cross-legged sitting with special attention to piriformis muscles and sacroiliac joints. Clin Biomech (Bristol, Avon). 2005 Oct 28
14. Stahelin T, Vienne P, Hershe O (2002) Failure of reinserted short external rotator muscles after total hip arthroplasty. J Arthroplasty 17(5): 604–7