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ABSTRACT

Background: Gluteal tears are recognised as the source of pain over the greater trochanter. We investigated the outcome of primary open abductor tendon reconstruction with a 5 year follow-up.

Methods: 165 consecutive hips underwent an open abductor tendon reconstruction, with all tears confirmed pre-operatively by MRI. Oxford hip scores (OHS) were assessed at the initial visit, and at 5 to 10 years.

Results: The average pre-operative OHS was 22 (r: 7y – 34y) and average post-operative OHS was 40 a difference of 18 ($p<0.0001$).

Conclusion: Surgical reconstruction of degenerate abductor tendons should be considered in the presence of an MRI confirmed separation where clinical findings are consistent with the known tendon disruption. Open transosseous reconstruction reliably results in good pain relief at 5 to 10 years.

Key words: Abductor, reconstruction, gluteal tendinopathy, hip, pain, chronic.

INTRODUCTION

Trochanteric pain is a chronic and disabling symptom that affects 1.8 per 1000 patients.^[1] Recalcitrant trochanteric pain has more recently been ascribed to partial or full thickness tears of the abductor tendons when patients experience persistent lateral peri-trochanteric pain that may or may not be associated with a positive Trendelenburg test.^[2]

Historically, pain over the greater trochanter was presumed to be solely from bursitis, but studies have challenged this idea with gluteal tears increasingly recognised as the source of this pain.^[2] The first reported similarity between calcific bursitis of the shoulder and hip was likely Stegemann in 1923.^[3] Schein and Lehmann thought that injury or degeneration in the gluteus medius tendon was responsible for the calcifications.^[3] Two decades later in 1961, Gordon^[4] stated that trochanteric bursitis started in the gluteal tendons at their attachment to the greater trochanter. It was proposed that the adjacent bursae were involved secondarily, analogous to bursitis and tendinitis of the shoulder. Supporting this, Karpinski and Piggot^[5] doubted trochanteric pain syndrome represented bursitis and suggested the entity may be akin to supraspinatus tendinitis.

Treatment of this syndrome just as a bursitis often results only in short term improvement in the symptoms. Because of the focus on the bursa, gluteal tendinopathy remains underdiagnosed despite 10% of the elderly population suffering from gluteal tears.^[6] Bunker et al reported gluteal tears in 22% of patients presenting with a neck of femur fracture.^[6] Similarly, degenerative tears of the abductor tendons have been reported in 20-25% of the patients during arthroplasty^[7], with the greatest prevalence being in elderly women.^[8]

Gluteal tendon tears associated with chronic trochanteric pain are due to a degenerative process^[5, 9] rather than an inflammatory process.^[10] The geometry of these tears of the gluteus medius can be either intra-substance, partial, or complete and can occur spontaneously or even occasionally traumatically.^[6, 11, 12]

Several small series case reports on patients treated with open surgical repair of hip abductor tears have been reported.^[6, 12-16] Most authors report good pain relief and some improvement in function after surgical repair, but clinical follow-up was limited. Endoscopic repair studies in small cohorts reported good pain relief after two years for low-grade tears, however Voos et al. suggested open repair was required for larger tears.^[16] Davies et al., repaired 23 abductor tendons with an open, transosseous approach and found the mean patient-reported percentage improvement in pain relief at five years was 90%, although there was slightly less improvement in function (79.6%).^[17]

Our previous study on open abductor reconstruction demonstrated significant improvement in Merle d'Aubergine and Postel hip scores. The most significant change was due to pain relief, with 95% of cases being relieved of their lateral hip pain.^[10] Additionally, 5% of patients in this cohort presented pre-operatively with a normal gait and this improved to 78% 6-months after surgery.

In this study, we investigated the outcome of primary open abductor tendon reconstruction with a minimum of 5 years follow-up in the largest consecutive case series reported to date.

MATERIALS AND METHODS

185 consecutive hips underwent an open abductor tendon reconstruction by a single surgeon (MJW), with all tears (partial or complete, gluteus medius, gluteus minimus, or both) confirmed pre-operatively by MRI.

Findings of an abductor tendinopathy on MRI included an area of hyperintensity on the T2-weighted image superior to the greater trochanter, T1-weighted images with fat saturation of the tendons, and / or tendons revealing thickening, hyperintensity with delamination, separation and retraction. All abductor reconstructions were included, with exclusions only of patients who had further interventions on their hips (arthroplasty, platelet-rich plasma (PRP) injections, dextrose injection, steroid injections). Only patients without associated spine symptoms at the time of presentation, or patients who had been previously assessed by a spine surgeon and cleared of significant spinal comorbidity were included in this study. All surgeries were for abductor tendinopathy only with no further surgery performed on the patient at the time. Oxford Hip Scores (OHS) were assessed at the time of the initial visit, with post-operative OHS at 5 to 10 years obtained with a follow up phone call.

OPERATIVE TECHNIQUE

The patient is placed in the lateral decubitus position as for a total hip arthroplasty. A direct approach to the trochanter is made through the fascia lata to expose and examine the trochanteric bursa and the gluteus medius tendon. Grasping the tendon with Kocher forceps reveals mobility of the tendon with respect to the underlying trochanter. Where the detached tendon is abraded by the roughened new bone (enthesophytes), palpable and even audible crepitus can be felt and often, a full thickness defect in the overlying tendon with fluid discharging is observed.

The gluteus medius tendon is then split in the line of the fibres at the junction of the separated, mobile tendon anteriorly and the usually intact attached tendon on the posterior aspect of the trochanter. The gluteus minimus is then exposed and any pathological changes are noted. The gluteus minimus tendon is then dissected down to the level of the junction of the trochanter and the femoral neck. Both tendons individually are thoroughly débrided and all delaminations, stringy, stretched and scarred tendon fragments are removed. The trochanter is prepared by removal of enthesophytes and careful decortication of the entire exposed trochanteric surface. 5-Ethibond sutures (Ethicon Inc., Sommerville, NJ) are woven into the tendons in a vertical mattress configuration. Gluteus minimus has two sutures woven through the tendon in the line of the fibres, one medially and another laterally. The gluteus medius tendon has three or four sutures woven into place in line with the muscle fibres, followed by three or four superficial tendons sutures placed at the peripheral margin in between the 'in-line' sutures described previously (Image 1). Tunnels for each suture arm are drilled into the trochanter. Those for the gluteus minimus are from front to back at the corners of the minimus footprint. The tunnels for the medius are placed obliquely based at the back of the trochanter (to overly the lateral facet). These are placed in such a way that a hip prosthesis can easily be accommodated. Each tunnel is marked with 19-g drawing-up needle until all tunnels are drilled (Image 2). The tunnel configuration is disposed in this way so as to pull the minimus tendon posteriorly onto its footprint on the anterior trochanter and to pull the medius medially onto its triangular footprint on the lateral aspect of the trochanter (Image 3).

The sutures of the minimus are passed through their respective tunnels with a Hewson Suture Passer® (Smith and Nephew) and clipped. This is then repeated for the gluteus medius sutures commencing proximally and working distally. For the posterior suture arms, the Hewson suture passer® is then fed posteriorly through the second transosseous tunnel, where a separate 5-ethibond loop is threaded through the tunnel to draw one arm of the ethibond and a nylon loop which will later carry an arm of the superficial suture through this tunnel (Image 1, nylon represented in purple suture). As there can be up to 20 suture arms, disciplined handling of sutures is of paramount importance to ensure each arm is placed in its correct tunnel. This extra step expedites this process. The lateral arm of the superficial suture is then fed through the nylon loop and passed through the tunnel. Once all sutures are in their tunnels, sequential ligation of the sutures can be started. The order is medial minimus followed by lateral medius to fix the minimus in place. Position and stability of the repair can be checked at this point. Next the superficial sutures in the medius are ligated and the order is determined in each case as to which will bring the tendon closest to its anatomical position. More superficial sutures are placed at this time in the proximal extension of the medius tendon above the trochanter and also in the split of the vastus lateralis at the level of the vastus ridge. Finally the deep in-line sutures are ligated to draw the entire gluteus medius tendon firmly onto its footprint. This step ensures the gluteal tendons are compressed firmly onto the bone, maximizing the area of contact of the freshened tendon with freshened bone (Image 4). Closure of the remaining layers is performed as per total hip arthroplasty.

POSTOPERATIVE MANAGEMENT

Patients are advised to remain non-weight bearing for 6 weeks to protect the abductor repair. The abductors are powerful muscles and the power of the gluteus medius and minimus applied to the repair in single leg stance exceeds the pull out strength of the repair by a substantial amount^[18]. This is probably the most difficult instruction in this patient population but the very nature of the poor quality of the degenerate tendon makes the initial repair intolerant of physiological loads until it has healed firmly onto the bone. Active hip abduction was discouraged specifically when getting into the bed, with the patient instructed to approach the bed from the contralateral side of the operative hip. No bracing was used. All patients were recommenced on pre-existing anticoagulation, or treated with low molecular weight heparin and compression stockings for 6 weeks. After the six week period, weight-bearing commences at their own pace graduating from one crutch held on the non-operative side to a stick and then to no aids as tolerated. We regard walking on flat ground as the most important method of recovering power and stamina in the often very weak muscles from chronic disuse.

RESULTS

185 patients were followed up with a phone call to complete the 5 to 10 year OHS. Twelve of these patients were lost to follow up (one death (0.5%), nine had change of contact details (5%), two were unable to participate due to dementia (1%)), a further eight patients were excluded as they had further interventions performed (two THR (1%), two PRP injections (1%), one PRP and dextrose injection (0.5%), one stem cells (0.5%), two revisions (1%) leaving a total of 165 patients to be included in the study. 152 patients (92%) were female. The average age at follow up was 69 years (r: 34y – 91y). Side to side difference was minimal (58% right sided). On initial examination 70% of patients were found to have a Trendelenburg gait. The average follow up time was 6.5 years (r: 5 y – 10 y). The average pre-operative OHS was 22 (r: 7 – 34) and average post-operative OHS was 40 (r: 14 – 48) a difference of 18 ($p<0.0001$). Nine patients had a worse OHS at the 5 year follow up. Bursitis was not histologically reported in any case. All tendons were sent for histological examination and in all cases degenerative tendinosis was reported.

Deep vein thrombosis occurred in 4% of the patients. There were no infections or delayed wound healing. There were no trochanteric fractures.

DISCUSSION

Our study confirms the trivial nature of any associated bursopathy related to chronic trochanteric pain and that tendinopathy is really the aetiology of the pain. In those patients with lateral hip pain that is attributable to the MRI findings of abductor tendinopathy, surgical reconstruction of the tendons reliably relieves this pain at five years and beyond. These findings are consistent with our previous study involving 72 patients,^[10] where 95% of patients had minimal or absent pain by 6 months postoperatively. We also confirmed that no bursa had changes that could explain the pain and chronic abductor weakness. Treating this condition as bursitis is inappropriate and simply delays treatment of the primary problem.

Nine of our patients reported a worse OHS at the 5 to 10 year follow up. Interestingly, 2 of these patients felt they were improved despite the decline in their scores. An important limitation of our study methods there was no clinical assessment of these patients. Symptoms from unrelated co-morbidities may be attributed to their previous tendinopathy. Other causes unrelated to gluteal tendinopathy causing buttock pain could not be excluded such as lumbar spine pain, SI joint pain, sciatic nerve entrapments through the external rotators or irritation from the presence of suture material. Biological factors contributing to a worsening OHS include very poor tendon quality reducing the capacity for them to heal securely onto the bone or from fatty infiltration of muscle from long term disuse. Other issues such as obesity, diabetes, smoking, older age, social isolation, poor cognition and chronic steroid use may also contribute to worse OHS's however this information wasn't collected, so predictors for outcome can only be speculated. The largest contributor to a worse OHS in the short term that we know of is the poor compliance with the 6 week non-weight bearing period resulting in early failure of the tendon repair. The long period of protected weight bearing is certainly a major concern for more elderly patients especially.

We also understand that there was no control group in our study. However we feel that most if not all our patients had already failed to improve with multiple non-operative treatments including cortisone injections, PRP, physiotherapy, chiropractic and strengthening exercises prior to their initial presentation to the senior author. We feel that 'doing nothing' for a further period of time would not improve patients' lateral hip pain especially in the presence of MRI confirmation of a gluteal tendon tear.

We found a relatively high rate of DVT in our cohort despite LMW heparin and compression stockings. This has since been changed in the past 3 years to aspirin and sequential calf compression and the rate has fallen to 2.9%.

Postoperative MRI's were not routinely performed or assessed in this paper. It would provide a more objective assessment of the surgical repair, with the potential to determine less or resolved gluteal tendinopathy. This however was not our primary endpoint, rather a patient who had less pain and more function as per the OHS. Future studies could review postoperative imaging on this patient cohort with a potential to demonstrate causation for those patients that had a worse OHS.

The diagnosis of a gluteal tendon tear with MRI was confirmed preoperatively in every case and has been described in multiple studies^[13, 19, 20] having 91% accuracy.^[19] Identification of

an area of hyperintensity on the T2-weighted image superior to the greater trochanter has the highest sensitivity and specificity (73% and 95%, respectively).^[19] Additionally, tears can be accurately diagnosed with an MRI specifically with use of T1-weighted images with fat saturation and axial T2-weighted images^[13, 14, 19-23]. Plain radiographs are usually unremarkable however they may reveal sclerosis, an irregular border or enthesophytes at the margin of the greater trochanter on the lateral view or superiorly and inferiorly on the A-P view.^[6]

Surgical reconstruction of degenerate abductor tendon separations should be considered in the presence of an MRI confirmed separation where clinical findings of trochanteric pain and abductor weakness are consistent with the known tendon disruption. Open transosseous reconstruction reliably results in good pain relief at 5 to 10 years.

IMAGES

Image 1: Tunnel placement for the gluteus medius sutures and suture placement in gluteus medius tendon. Note that the gluteus minimus is not illustrated for simplicity.

Image 2: Showing the intraosseous tunnels facilitating the pull of the gluteus minimus posteriorly and gluteus medius medially on their anatomic footprints of the greater trochanter.

247 **Image 3:** Intraoperative image demonstrating suture placement in tendons of G. medius and
248 G. minimus.

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251 **Image 4:** Firm fixation of the gluteal tendons onto their footprint.
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REFERENCES

1. Lieveense, A, Bierma-Zainstra, S., Schouten B, et al., Prognosis of trochanteric pain in primary care. Br J Gen Pract 2005; 55
2. Domb B, Nasser R, Boster I, Partial-thickness tears of the gluteus medius: rationale and technique for trans-tendinous endoscopic repair. Arthroscopy 2010; 26
3. Schein A, Lehmann O, Acute trochanteric bursitis with calcification. Surgery 1941; 9
4. Gordon E, Trochanteric bursitis and tendinitis. Clin Orthop 1961; 20:
5. Karpinski M, Piggott H, Greater trochanteric pain syndrome: A report of 15 cases. J Bone Joint Surg 1985; 67B:
6. Bunker T, Esler C, Leach W, Rotator-cuff tear of the hip. J Bone Joint Surgery 1997; 79-B:
7. Howell G, Biggs R, Bourne R, Prevalence of abductor mechanism tears of the hips in patients with osteoarthritis. J Arthroplasty 2001; 16:1
8. Hendry J, Biant L, Breusch S, Abductor mechanism tears in primary total hip arthroplasty. Arch Orthop Trauma Surg 2012; 132:11
9. Dwek J, Pfirrmann C, Stanley A, Parthria M, Chung C, MR Imaging of the hip abductors: Normal anatomy and commonly encountered pathology at the greater trochanter. Magn Reson Imaging Clin N Am 2005; 13:vii
10. Walsh M, Walton J, Walsh N, Surgical repair of the Gluteal Tendons. Arthroplasty 2011; 26:8

- 277 11. Connell D, Bass C, Sykes C, Young D, Edwards E, Sonographic evaluation of gluteus
278 medius and minimus tendinopathy. Eur Radiol 2003;1339-1347
- 279 12. Davies H, Zhaeentan S, Tavakkolizadeh A, Janes G, Surgical repair of chronic tears of the
280 hip abductor mechanism. Hip Int 2009; 19
- 281 13. Chung C, Robertson J, Cho G, Vaughan L, Copp S, Resnick D, Gluteus medius tendon tears
282 and avulsive injuries in elderly women: Imaging findings in six patients. AJR Am J Roentgenol
283 1999; 173:2
- 284 14. Fisher D, Almand J, Watts M, Operative repair of bilateral spontaneous gluteus medius
285 and minimus tendon ruptures. A case report. J Bone Joint Surg Am 2007; 89:5
- 286 15. Kagan A, Rotator-cuff tear of the hip. J Bone Joint Surgery 1998; 80-B
- 287 16. Voos J, Shindle M, Pruett A, Asnis P, Kelly B, Endoscopic repair of gluteus medius tendon
288 tears of the hip. Am J Sports Med 2009; 37:4
- 289 17. Davies J, Stiehl J, Davies J, Geiger P, Surgical Treatment of Abductor Tendon Tears. J
290 Bone Joint Surg 2013; 95:15
- 291 18. Bombelli R: Biomechanics in Osteoarthritis of the Hip. p. 15. *Osteoarthritis of the Hip*.
292 Springer-Verlag, 1976
- 293 19. Cvitanic O, Henzie G, Skezas N, Lyons J, Minter J, MRI diagnosis of tears of the hip
294 abductor tendons (gluteus medius and gluteus minimus). AJR Am J Roentgenol 2004; 182:1

295 20. Kingzett-Taylor A, Tirman P, Feller J, et al., Tendinosis and tears of gluteus medius and
296 minimus muscles as a cause of hip pain: MR imaging findings. AJR Am J Roentgenol 1999;
297 173:4

298 21. Bird P, Oakley S, Shnier R, Kirkham B, Prospective evaluation of magnetic resonance
299 imaging and physical examination findings in patients with greater trochanteric pain
300 syndrome. Arthritis Rheum 2001; 44:9

301 22. Blackenbaker D, Ullrick S, Davies K, De Smet A, Haaland B, Fine J, Correlation of MRI
302 findings with clinical findings of trochanteric pain syndrome. Skeletal Radiol 2008; 37:10

303 23. Looner J, Van Kleunen J, Spontaneous rupture of the gluteus medius and minimus
304 tendons. Am J Orthop (Belle Mead NJ) 2002; 31:10

305