



## Patients with operative gluteus medius tears often present with a concomitant history of lumbar pathology

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### ABSTRACT

**Background:** Studies have indicated a correlation between patients presenting with decreased gluteus medius function and a history of lumbar pathology (LP). However, literature investigating the relationship between the prevalence of lumbar pathology in patients with gluteus medius tears is lacking. The purpose of this study is to determine if patients undergoing repair for gluteus medius tears have concomitant lumbar pathology.

**Materials and methods:** Patients aged 18–80 who underwent endoscopic gluteus medius repair by one fellowship-trained surgeon between May 2016 and May 2020 for peritrochanteric pain/tenderness, abductor weakness, and MRI findings consistent with a gluteus medius tear were identified. Pre-operative and post-operative data were gathered using the Visual Acuity Scale (VAS), and post-operative data was gathered using the Abbreviated International Hip Outcome Tool (iHOT-12) and Hip Outcome Score – Activities of Daily Living (HOS-ADL). Outcomes were compared between patients with and without a history of lumbar pathology.

**Results:** Of 23 hips, 19 (82.6%) presented with a prior history of lumbar pathology. Twenty (87.0%) patients identified were female. A total of 19 hips were included with completed PROM scores. Patients with lumbar pathology had similar pre and post-operative patient reported outcomes.

**Conclusions:** This study demonstrates a high incidence of lumbar pathology in patients presenting for operative gluteus medius tears, which may suggest an association between lumbar disease and the development of gluteus medius weakness and tears.

### 1. Introduction

Greater trochanteric pain syndrome (GTPS) is a common clinical diagnosis affecting approximately 10–25% of people.<sup>1</sup> While GTPS has historically been associated with trochanteric bursitis, current literature suggests tendinosis and gluteus medius tendon tears as additional possible etiologies.<sup>2</sup> Surgical intervention is often pursued after failure of nonoperative management.<sup>3</sup> Studies have demonstrated that endoscopic repair is an efficacious treatment, with significant improvements in pain and hip outcome scores up to five years post-operatively.<sup>2,4–7</sup>

It is known that actions of the gluteus medius are closely linked with spinal musculature function, and injury to these muscles can lead to the development of lateral hip pain and Trendelenburg gait, which can promote additional spinal stress.<sup>2,8</sup> Biomechanical studies have demonstrated decreased hip range of motion in patients with lumbar

back pain.<sup>9–12</sup> It has also been demonstrated that patients with scoliosis or positive sagittal plane deformities display less symptomatic improvement and have lower hip-related outcome scores following gluteus medius repair.<sup>13,14</sup> Although current evidence suggests an association between lumbar pathology and gluteus medius weakness, the mechanism behind this is unknown.

Literature investigating the prevalence of lumbar pathology in individuals with gluteus medius tears is lacking. The purpose of this study was to evaluate the incidence of lumbar pathology in patients undergoing gluteus medius repair. The secondary purpose was to assess the effect of lumbar pathology on patient reported outcomes after gluteus medius repair. The authors hypothesize that the majority of patients undergoing gluteus medius repair would have a history of lumbar pathology and those with a history of lumbar pathology would exhibit poorer outcomes.

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## 2. Methods

### 2.1. Patient selection

Institutional review board approval was obtained prior to study initiation (IRB number 300006773). Patients aged 18–80 years who underwent endoscopic gluteus medius repair by a single fellowship-trained surgeon between May 2016 and May 2020 for MRI findings consistent with a gluteus medius tear, peritrochanteric pain/tenderness, or abductor weakness were retrospectively identified. It was confirmed that patients had either current ongoing lumbar pathology symptoms greater than 6 months or they had spine surgery to address lumbar pathology. Lumbar pathology diagnosis was made based on history of symptoms, imaging, and surgical history. Chronic gluteus medius tears were defined as tears causing symptoms lasting for at least six weeks prior to intervention. In all cases, conservative therapy, including rest, physical therapy, corticosteroid injections, and nonsteroidal anti-inflammatory medications failed to provide improvement after three months. Other information collected from patients included sex, age at time of surgery, tear severity, chronicity, duration of symptoms prior to repair, BMI at the time of surgery, laterality, prior radiological diagnosis of lumbar pathology, and history of lumbar surgery.

### 2.2. Patient-reported outcome measures

Visual analogue scale (VAS) scores were collected from patients at their last pre-operative clinic visit before endoscopic repair of their gluteus medius tear.<sup>15</sup> Patients were contacted between six months and five years (average of 2.3 years) after initial surgery to collect post-operative VAS scores and hip patient reported outcomes. The Hip Outcome Score – Activities of Daily Living (HOS-ADL) survey and Abbreviated International Hip Outcome Tool (iHOT-12) were both used to evaluate post-operative hip functionality in daily activity. The HOS-ADL is a validated tool to assess sport and activities of daily living.<sup>16,17</sup> The iHOT-12 is a validated measure for the assessment of quality of life.<sup>18</sup>

#### 2.2.1. Statistical analysis

Statistical analysis was performed using SPSS statistical software (version 28.0; SPSS, IBM, Chicago, IL, USA). Demographic data was evaluated with descriptive statistics, and differences between groups were evaluated with Fisher’s exact test. Pearson Chi-Square tests were used to compare the degree of tears with the presence of different lumbar pathologies. The normality of pre-operative and post-operative VAS pain scores were determined through a Shapiro-Wilk test. The Mann Whitney *U* test was used to evaluate variations in patient reported outcome scores with the presence or absence of lumbar pathology.

## 3. Results

### 3.1. Demographics

Twenty three cases met inclusion criteria, with one patient included twice after undergoing right endoscopic gluteus medius repair and left gluteus medius repair three years later. The majority of patients were female (87.0%). Patient body mass index, age, and gluteus medius pathology laterality did not differ between patients with and without a history of lumbar pathology (Table 1). Mean follow-up time from surgery was 2.3 years ± 1 year (range 0.5–5 years).

A history of lumbar pathology was present in 19/23 (82.6%) cases, of which 17/19 (73.9%) had a concomitant history of degenerative disc disease (DDD) and 12/19 (52.2%) spinal stenosis (Table 2). All gluteus medius tears were managed operatively. Six patients (26.1%) did not undergo any lumbar procedures, and 16 patients (73.0%) patients had some form of previous lumbar spine intervention performed, five patients (21.7%) underwent epidurals, eight patients (34.8%) underwent a

**Table 1**  
Patient demographics.

Preoperative Variable	All Hips	Lumbar Pathology	No Lumbar Pathology	P-Value
	(n = 23)	(n = 19)	(n = 4)	
<b>Total Patients - n (%)</b>	23 (100.0)	19 (82.6)	4 (17.4)	
<b>Sex</b>				0.435
Female - n (%)	20 (87.0)	17 (89)	3 (75)	
Male - n (%)	3 (13.0)	2 (11)	1 (25)	
<b>Mean Age at Surgery ± SD</b>	63.6 ± 9.1	65.2 ± 7.7	61.0 ± 9.1	0.590
<b>Mean BMI at Surgery ± SD</b>	30.6 ± 5.4	30.7 ± 6.1	28.6 ± 2.9	0.344
<b>Laterality</b>				0.200
Right Hip	13	12	1	
Left Hip	10	7	3	
<b>Degree of Tear</b>				0.103
Full Tear	15	14	1	
Partial Tear	8	5	3	
<b>Mean Pre-Operative VAS Score ± SD</b>	8.5 ± 1.9	8.8 ± 1.9	7.5 ± 1.9	0.138

BMI, body mass index; VAS, visual analogue score.

**Table 2**  
Lumbar pathology and previous lumbar procedures.

Lumbar Disease Category	Tear Severity	
	Partial Tear	Full Tear
<b>Overall Lumbar Pathology – n (%)</b>	5 (26.3)	14 (73.7)
Degenerative Disc Disease (DDD) – n (%)	4 (23.5)	13 (76.5)
Spinal Stenosis – n (%)	2 (16.7)	10 (83.3)
Bulging Disc – n (%)	1 (50.0)	1 (50.0)
Spondylolisthesis – n (%)	1 (50.0)	1 (50.0)
Spondylosis – n (%)	1 (25.0)	3 (75.0)
Radiculopathy – n (%)	2 (22.2)	7 (77.8)
<b>Lumbar Procedures – n (%)</b>		
None – n (%)	3 (50.0)	3 (50.0)
Epidural – n (%)	2 (40.0)	3 (60.0)
Laminectomy – n (%)	7 (87.5)	1 (12.5)
Fusion – n (%)	3 (42.9)	4 (57.1)

laminectomy, and seven patients (30.4%) underwent a fusion, with some patients having multiple procedures performed (Table 2).

Tear severity was reported as either full or partial, with 15 hips (65.2%) having full gluteus medius tears and eight hips having partial gluteus medius tears (34.8%). In all cases, patients had failed conservative treatment for a minimum of six weeks. Of the 19 patients with lumbar pathology, 14 (73.7%) had full tears, and 5 patients (26.3%) had partial tears (Table 2).

### 3.2. Patient-reported outcomes

Three individuals did not complete the patient reported outcome measure (PROM) surveys. PROM scores of 20 hips were included in statistical analysis. Patients with a history of lumbar pathology reported similar mean post-operative iHOT-12 scores compared to those without a history of lumbar pathology (LP absent: 72.9 ± 21.1, LP present: 61.7 ± 33.5, *p* = 0.62) (Table 3). Patients with a history of lumbar disease tended to report lower post-operative HOS-ADL scores compared to those without lumbar pathology (LP absent: 80.5 ± 14.9, LP present: 60.7 ± 20.2, *p* = 0.08), but this did not reach statistical significance (Table 3). Pre-operatively, patients with lumbar pathology reported similar VAS scores (to those without lumbar pathology (LPD absent: 7.5 ± 1.9, LPD present: 8.8 ± 1.9, *p* = 0.14) (Table 3).

**Table 3**  
Post-operative patient reported outcome measure scores examined in relation to lumbar pathology.

	No Lumbar Pathology (n = 4)	+ Lumbar Pathology (n = 16)	P-Value
iHOT-12 ± SD	72.9 ± 21.1	61.7 ± 33.5	0.617
HOS-ADL ± SD	80.5 ± 14.9	60.7 ± 20.2	0.080
Pre-Operative VAS Score ± SD	7.5 ± 1.9	8.8 ± 1.9	0.138
Post-Operative VAS Score ± SD	2.8 ± 2.5	2.8 ± 3.3	0.750
Δ VAS ± SD	-4.8 ± 3.1	-5.9 ± 3.5	0.437

#### 4. Discussion

In this study, we found that the majority of patients undergoing endoscopic gluteus medius tear repair have a history of lumbar pathology. However, there was no difference in post-operative outcome scores between those with or without a history of lumbar spine disease. To our knowledge, this is the first study to examine the incidence of lumbar pathology in patients with gluteus medius tears requiring endoscopic repair. Notably, our findings highlight the important relationship between lumbar spine health and gluteus medius function.

The relationship between gluteus medius function and spinal biomechanics is well established. Injury to or dysfunction of the lumbar spine can lead to decreased hip function including decreased range of motion, increased fatigability and instability, and increased limb asymmetry.<sup>9,11,12,19–24</sup> Our study found that the majority of patients (87%) undergoing endoscopic gluteus medius repair had a previous history of lumbar pathology. The most common lumbar pathologies were degenerative disc disease (74%), spinal stenosis (52%), and radiculopathy (39%).

The high prevalence of lumbar disease in patients with gluteus medius tears suggests that dysfunction of the lumbar spine may promote gluteus medius tendon weakness, predisposing these patients to tears. Biomechanical studies have evaluated this relationship, demonstrating that those with low back pain have decreased hip range of motion and gluteus medius strength than asymptomatic patients.<sup>9,11,12,20,21,24</sup> Aboufazel et al. observed that those with low back pain had a smaller gluteus medius thickness during muscle contraction, which suggests weakness of the gluteus medius.<sup>19</sup> Additionally, individuals with low back pain have been shown to have increased gluteus medius fatigability.<sup>25</sup> The high prevalence of hip pathology in individuals with lumbar disease has also been observed in the literature. In a study examining degenerative lumbar pathologies, it was noted that 51% of patients with lumbar disc degeneration (LDD) also presented with GTPS.<sup>26</sup> The high incidence of lumbar disease (87%) demonstrated in our study further supports these findings, thus strengthening the potential contribution of lumbar pathology to the development of gluteus medius weakness and ultimately increased tear risk.

The results of this study suggest that pre-existing lumbar pathology is not associated with significantly worsened outcomes following gluteus medius tear repair. Our results differ from the findings of Beck et al. that patients undergoing hip arthroscopy for femoroacetabular impingement syndrome with concomitant lumbosacral pathology had significantly lower hip outcome scores.<sup>27</sup> Additionally, Saltzman et al. found less improvement in postoperative outcomes in patients with a history of scoliosis and sagittal plane deformities following gluteus medius repairs.<sup>14</sup> Neither of the aforementioned studies provide data on a history of lumbar procedures.<sup>14,27</sup> It is plausible that the PROM differences in these studies are the result of unaddressed lumbar pathology. Okoroha et al. defines the Patient Acceptable Symptomatic State (PASS) for HOS-ADL to be 77.9 in patients undergoing endoscopic repair of the gluteus medius.<sup>28,29</sup> Only 5/20 (25%) of the patients in our series achieved PASS. This is lower than in Okoroha et al. (56.4%).<sup>28</sup> The differing PASS rates may be specific to the patient population since 29.3% of

patients in Okoroha et al. had history of spinal disease as opposed to 82.6% in our study.<sup>28</sup>

In our study, patients presenting for endoscopic gluteus medius repair were elderly (63.7 years) and female (87%) (Table 1). These findings are consistent with current literature that gluteus medius tears are commonly reported in females over the age of 50.<sup>7,26,30–32</sup> Suggested mechanical rationale for this predisposition is that the wider pelvic girdle in women alters the force angle of the iliotalibial band across the greater trochanter, leading to increased forces acting on underlying structures, and ultimately resulting in the potential for degeneration of the gluteus medius tendon.<sup>26</sup> Woyski et al. indicates that in males and females of equal size, females have a smaller insertion area of the gluteus medius, shorter gluteal moment arms, and comparable pelvic moment arms.<sup>33</sup> In addition to these biomechanical differences, women tend to experience additional biologic factors such as joint laxity and hormone levels that increase risk of gluteus medius tears.<sup>10,34–37</sup>

The majority of existing literature corroborates a female predisposition for both gluteal tears and lumbar pathology, since 87% of all patients in our study were female with prior lumbar pathology in 82.6% undergoing gluteus medius repair.<sup>7,30–32</sup> In contrast to existing literature, a larger (n = 52) sample composed of 25% male patients identified that men are more likely to have concomitant lumbar pathology with gluteus medius tears.<sup>38</sup> The three male patients in our study constitute an insufficient sample size to statistically corroborate or refute these findings. With an increased incidence of both lumbar pathology and gluteus medius tears compared to men, women are more likely to experience low back pain, lumbar disc herniation, and spondylolisthesis.<sup>39–41</sup>

Our study also noted an average age at surgery of 63.6 ± 9.1 years. Degenerative spinal conditions are increasingly common with age. Women are particularly susceptible to such pathology secondary to postmenopausal bone loss. Additionally, lumbar disc herniation is more common in women and incidence increases further with age.<sup>39</sup> Degenerative spinal pathologies also increase the likelihood a patient will experience low back pain and pursue pain-relieving treatment, including laminectomy, spinal fusion, or epidural.<sup>42,43</sup> Because of the high incidence rate of lumbar pathologies, the population of patients over 60 years old is of particular concern for gluteus medius tear, especially following an intervention for a degenerative spine condition. Additionally, the need for post-operative therapies focused on regaining strength and stability of the musculature of the lumbar spine and hip is highlighted in this population.

##### 4.1. Limitations

This study is not without limitations. Foremost, the study population was small, which limited its statistical power. We may have been underpowered to detect differences in pre-operative scores between those with and without a history of lumbar pathology. Due to the retrospective nature of the study, we were unable to obtain pre-operative iHOT-12 and HOS-ADL scores, and we were subject to selection and recall bias.<sup>44</sup> Furthermore, there was great variability in the timeline for follow up, ranging from six months to five years. Finally, the use of patient-reported data introduces another source of variability due to the qualitative, subjective nature of the surveys. However, the VAS, iHOT-12, and HOS-ADL tools used have been proven to be reliable resources in other peer-reviewed studies.<sup>4,13,21,32</sup> Finally, it is difficult to determine if lumbar pathology may lead to gluteal tendon pathology or if patients with gluteal tendon pathology may be more likely to experience lumbar pathology. Further studies are needed to elucidate the causal direction of this association.

#### 5. Conclusions

This study shows a high incidence of lumbar pathologies in patients presenting for operative gluteus medius tears. Most of the patients

presenting with gluteus medius tears in this study population were female, and this is consistent with current literature. More work is needed to understand the connection between pre-existing lumbar pathology and the development of gluteus medius tears.

### IRB approval

This study was approved by the University of Alabama at Birmingham Institutional Review Board: IRB-300000780.

### Ethical statement

This study was approved by the University of Alabama at Birmingham Institutional Review Board: IRB-300000780. The authors agree that this study represents honest and original research.

### Funding statement

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### Guardian and patient consent

This study was deemed minimal risk by the University of Alabama at Birmingham Institutional Review Board which allowed for verbal consent to be used over the phone rather than written consent. All patients included in this study were 18 and older so parental consent was not applicable to this study.

### CRediT authorship contribution statement

**Kyle D. Paul:** Conceptualization, Investigation, Writing – original draft, Visualization, Data curation, Formal analysis. **Mathew Hargreaves:** Writing – review & editing, Visualization. **John N. Manfredi:** Conceptualization, Methodology, Writing – original draft, Investigation, Data curation, Formal analysis. **Brett Cooke:** Conceptualization, Methodology, Writing – original draft. **Anna Crawford:** Conceptualization, Methodology, Writing – original draft. **Thomas Evely:** Writing – review & editing, Supervision. **Eugene Brabston:** Writing – review & editing, Supervision. **Aaron Casp:** Writing – review & editing, Supervision, Project administration. **Amit Momaya:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration. **Tyler Marshall:** Conceptualization, Writing – review & editing, Project administration.

### Declaration of competing interest

The authors have no relevant conflicts of interests to report.

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