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Retrospective Review

Iliotibial-Band and Gluteus Medius Percutaneous Ultrasound Tenotomy for Refractory Trochanteric Pain Syndrome: A Longitudinal Observational Study with One-Year Durability Results

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Background: Greater trochanteric pain syndrome (GTPS) is a common cause of lateral hip pain that affects patients' quality of life and functioning. The condition is often associated with tightness of the iliotibial band (ITB) and tendinopathy of the gluteus medius (GMed) tendon, which are subjected to excessive stress and inflammation. A traditional treatment for GTPS is conservative medical management (CMM), which includes but is not limited to physiotherapy, oral anti-inflammatory medication, and/or local steroid injections. Surgery is performed when these treatments fail. The failure of these techniques indicates that some treatments classified as CMM may not be feasible for some patients.

Objectives: This study aimed to evaluate the efficacy and safety of combined GMed and ITB injections for a cohort of CMM-refractory GTPS patients.

Study Design: A retrospective chart review.

Setting: Single-center, academic hospital.

Methods: Between 01/01/2022 and 12/31/2022, a retrospective analysis of 68 hips that underwent combination GMed-ITB percutaneous ultrasound tenotomy (PUT) was performed. The primary outcome measure was a numeric rating scale (NRS) for hip pain, and the secondary outcome measures were VISA-G (Victorian Institute of Sports Assessment-Gluteal Tendinopathy) scores, sitting-to-standing and walking tolerance, and side-lying tolerance.

Results: The patients' NRS scores decreased, and the VISA-G scores and all functional measures increased one year after the procedure, indicating significant improvement in pain and functioning ($P < 0.001$). Treatment success, defined as 50% reduction in pain and side-lying tolerance, was achieved by 83% of the patients. No major complications were reported.

Limitations: The lack of a comparable cohort reduces the data's interpretative significance. Having a control arm would have enabled a statistical comparison between treated and untreated patients to provide a valid assessment of the procedure's benefit.

Conclusions: This study demonstrated the feasibility and efficacy of combined GMed-ITB PUT as a novel treatment for GTPS in patients who failed CMM. The results showed significant and durable improvement in pain, function, and quality of life at the one-year follow-up. Our study suggests that both ITB and GMed tendons are involved in the pathogenesis of GTPS. The present study compared favorably with previous studies that reported outcomes of either ITB PUT or GMed PUT alone, implying that combining the approaches may offer superior benefits. Furthermore, the study had several strengths, such as the use of a validated outcome measure (VISA-G), the elimination of bias by independent practitioners, and the inclusion of a difficult population with severe pain.

Key words: Greater trochanteric pain syndrome, tendinopathy of the iliotibial band, gluteus medius tendons, percutaneous ultrasound tenotomy, pain, hip, bursitis

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Greater trochanteric pain syndrome (GTPS) is a functionally disabling condition for patients that often leads to chronic pain. Symptoms are characterized by upper lateral hip pain that worsens when the patient transitions from sitting to standing or lies on the affected side. GTPS is likely related to tightness of the iliotibial band (ITB) and tendinopathy of the gluteus medius (GMed) tendon (1-3). These pathological processes are probably due to excessive tendon stress, thus implying a departure from traditional inflammatory paradigms, which propose bursitis as the most common cause of GTPS. The observations that contradict the traditional view of the development of GTPS underscore the importance of recognizing the multifaceted etiological factors contributing to this pathogenesis (4). Consequently, there has been a paradigm shift in the diagnosis and treatment of GTPS. Literature suggests that GTPS is a type of hip enthesopathy rather than a bursitis (3,5). For this reason, recent reports suggest ITB lengthening, trochanteric bursa debridement, and microtenotomy/microfracture of the GMed and greater trochanter as GTPS treatments when conservative medical management (CMM) such as oral medication, physiotherapy, and local steroid injections fails. Though surgery represents a good option for this cohort, some patients are not surgical candidates, which prompts the exploration of novel therapeutic approaches.

Recent literature also suggests that percutaneous ultrasound tenotomy (PUT) may be a promising intervention for GTPS. Baker et al have demonstrated that PUT of the GMed is an effective, safe, and durable procedure for GTPS, while Wahezi et al have demonstrated reduced pain and improved functional durability in patients at the one-year follow-up after ITB PUT procedures (3,6). However, no literature to date describes a PUT procedure that combines GMed and ITB injections for the treatment of GTPS. In the present study, the authors describe a novel technique for tandem GMed and ITB PUT with one-year durability data in a CMM-refractory GTPS population.

Methods

The present investigation was a retrospective study approved by the Montefiore Health System institutional review board (IRB 2019-10877). Consent was waived by the IRB, since the study was retrospective, and data were collected by chart review of the patients' electronic medical records. All patients who underwent the GMed-ITB tenotomy between the dates of 01/01/2022 and 12/31/2022 at Montefiore Health System Pain Center were identified and made part of the study population.

A total of 132 hips were identified as belonging to patients who underwent GMed-ITB tenotomy. All patients were given Victorian Institute of Sports Assessment-Gluteal Tendinopathy (VISA-G) scores before the procedure at the clinic. The VISA-G score was used because it was a validated reliable tool for the evaluation of GTPS and lateral hip pain (4). To be included in the study, all patients needed to satisfy the following inclusion criteria.

1) > 18 years of age.
2) Identification of tendon hypo-echogenicity on ultrasonogram or edema on magnetic resonance imaging (MRI).
3) Side-lying tolerance of fewer than 5 minutes.
4) Lateral hip pain for more than 6 months and reproducible by palpation in clinic.
5) Nonresponsive to conservative management, including rest, physical therapy, and oral medications.

In the present investigation, 17 hips were excluded from the study because of missing data. VISA-G scores were also administered to patients at one month, 6 months and 12 months after the GMed-ITB tenotomy. A thorough chart review of a total of 115 hips was conducted. Sixty-eight hips in total were included in the study because the patients had completed the one-year time point. All data points relevant to the study were extracted, including pain scores and VISA-G scores.

The primary outcome measure of the study was the Numeric Rating Scale (NRS) for hip pain. Secondary outcome measures included VISA-G scores, sitting-to-standing tolerance, walking tolerance, and side-lying tolerance. Patients who did not respond to the procedure were defined as those with side-lying intolerance and/or reductions of less than 50% in their NRS scores. Patients were considered responsive only if they had achieved both a 50% reduction in pain and side-lying tolerance through the night. We defined responsive and nonresponsive patients in these ways because, in our clinical experience, the most common complaints of GTPS patients were pain and the inability to sleep on the side. Bias was eliminated by the usage of independent practitioners for follow-up data. In addition, one of the secondary aims of the study was to compare the results of GMed-ITB PUT with those of an ITB PUT study (3).

Procedure

Patients were placed in the lateral decubitus position with the affected side up. Manual palpation identified the trochanter, and ultrasound (ULSD) examination was performed to identify important landmarks for the procedure—the greater trochanter, GMed tendons, and ITB—as well as visualize the anterior-posterior and cephalo-caudal dimensions of the greater trochanter. After the area was marked appropriately, it was sterilized using a 2% CHG/70% IPA (ChloraPrep™) solution and covered with a sterile drape. A 500 mL 0.9% NaCl bag was attached to the tenotomy device to lavage the tissue and to improve the ULSD dynamics during the procedure. A 10 MHz linear ULSD probe, also covered with a sterile drape, was then primed and positioned to identify the midline of the trochanter and tensor fascia lata tendons in a long-axis view. With the ULSD in place and muscular landmarks in view, a 1.5-inch, 25-gauge needle was used to anesthetize a tract, using an in-plane trajectory along the diseased tendon and the subcutaneous tissue with 6-10 mL of 2% lidocaine. Next, one-2 cm distal to the US probe, a #11 scalpel was used to create a 2-4 mm skin puncture, large enough to accommodate the tenotomy needle (Tenex Health®). Following the initial tract created with local anesthetic, the tenotomy device was introduced through the puncture site and advanced to contact the GMed tendon through the ITB. The Tenex® needle was positioned on the tendon, and the ULSD energy from the device was deployed for approximately 2 minutes and 30 seconds. Afterward, the tip of the instrument was pulled back onto the ITB, and PUT was performed along the ITB's length and width across the trochanter (Fig. 1A). First, the midline portion of the tendon was addressed, using an oscillatory motion, from the distal to the proximal points. Next, the ULSD was angled slightly to visualize and address the anterior and posterior portions of the tendon in a similar fashion. The needle tip was kept within 1-2 mm of the ITB and in view throughout the entirety of the procedure to ensure that the ITB received treatment (Fig. 1B). The number of passes and the cutting time were recorded during each procedure. After appropriate debridement of the tissue (approximately 4 minutes and 30 seconds of working time), the surgical tip was used to suction the remaining fluid from the tissues. The tenotomy device was then withdrawn from the patient. Excess subcutaneous fluid was expressed from the entry site by manual massage, and hemostasis was obtained. Steri-Strips™ (3M™) were used to approximate the skin at the incision site and covered with a clear pressure dressing. Patients were asked to keep the pressure dressing dry for 2 days to prevent superficial infection of the percutaneous entry site. No activity restrictions were placed on the patient after the procedure.

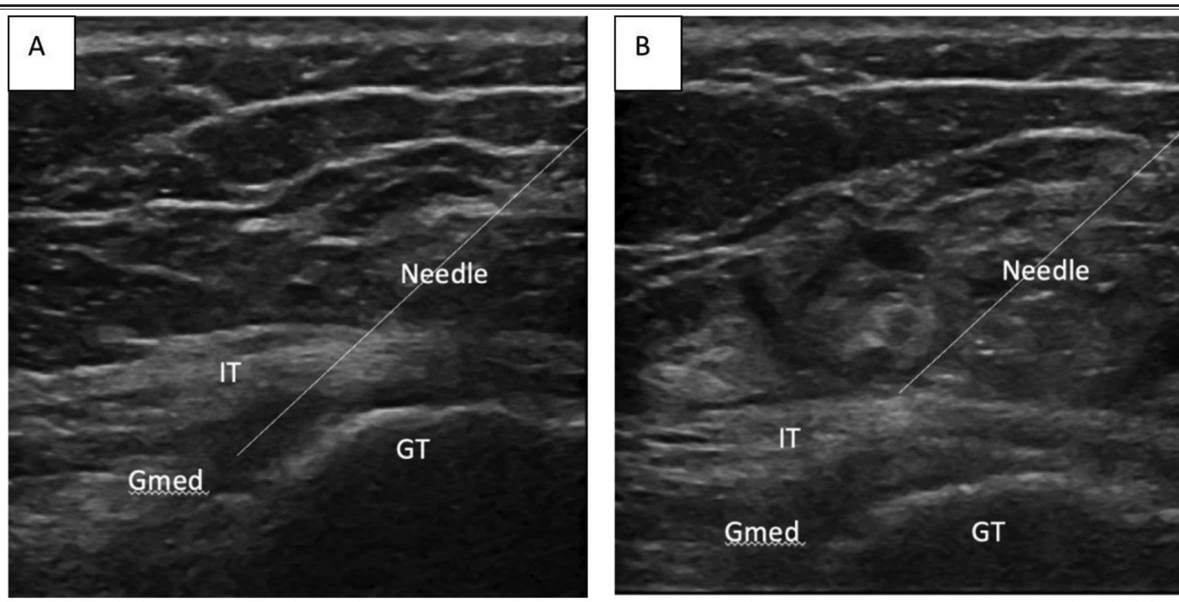

Fig. 1. *Positioning of the Tenex™ needle. A) Tip of the needle in the GMed tendon. B) Tip of the needle in the ITB tendon.*
*GMed: gluteus medius, GT: greater trochanter, IT: iliotibial.

Results

The median NRS score before the procedure was 10 (IQRs: 9, 10), and the median NRS score at one year after the procedure was 2 (1, 4) and statistically significant (*P*-value < 0.001). Eighty-one percent of the patients were considered responsive to the treatment, defined as achieving a 50% reduction in pain scores as well as side-sleeping tolerance through the night. The median VISA-G score pre-GMed-ITB tenotomy was 3 (2, 8), and the median VISA-G score post-tenotomy was 82 (59.5, 99) indicating substantial improvement in quality of life (QoL) and activities of daily living (ADL) (*P*-value < 0.001). Demographic data and other variables are defined in Table 1, as are the primary and secondary outcome measures (Table 1).

The present investigation was completed to further refine the technique achieved with our previous ITB PUT study. Thus, a comparison was made between this study (GMed-ITB PUT) and a previously published study concerning ITB PUT. Our data demonstrated that patients who received GMed-ITB PUT experienced a reduction of pain scores by 3 more points than did those who received ITB PUT (Table 2, Figs. 1 and 2). All secondary outcomes were better in the present study's GMed-ITB PUT group than in the earlier study's ITB PUT group (Table 2, Figs. 1 and 2). No VISA-G scores were available for comparison because VISA-G scores were not recorded for the ITB PUT study. The graphical representation of the differences in primary and secondary outcomes between the GMed-ITB PUT patients and the ITB PUT patients is represented in Figs. 2 and 3.

Table 1. *Demographics, primary outcomes, and secondary outcomes of GMed-ITB tenotomy.*

Variable	Outcomes	*P*-value
Total hips treated	68	-
Average BMI (SD)	32.28 (6.7)	-
Men	5	-
Women	63	-
Median pre-procedure NRS (IQRs)	10 (9, 10)	**
Post-procedure NRS at one month	1 (1, 3)	< 0.001
Post-procedure NRS at 6 months	2 (1, 4)	< 0.001
Post-procedure NRS at 12 months	2 (1, 4)	< 0.001
% of patients reporting improved side lying at one month	89	< 0.001
% of patients reporting improved side lying at 6 months	87	< 0.001
% of patients reporting improved side lying at 12 months	81	< 0.001
% of patients who reported improved sitting-to-standing tolerance at one month	89	< 0.001
% of patients who reported improved sitting-to-standing tolerance at 6 months	86	< 0.001
% of patients who reported improved sitting-to-standing tolerance at 12 months	82	< 0.001
Pre-procedure VISA-G score	3 (2, 8)	**
Post-procedure VISA-G score	82 (59.5, 99)	< 0.001
Treatment failure or lack of relief	13	-
Treatment success	81%	-

Abbreviations: GMed: gluteus medius. ITB: iliotibial band. SD: standard deviation. IQR: interquartile range. NRS: numeric rating scale (for hip pain). Side-lying tolerance: ability to sleep through the night on the side. Treatment success: defined as reducing pain by over 50% and improving side-lying tolerance. VISA-G: Victorian Institute of Sports Assessment-Gluteal Tendinopathy score.
**Baseline value.

Discussion

The underlying pathology for GTPS is commonly tendinosis in the ITB and gluteus medius. Treating this condition can be challenging (3,6). Orthotics, physical therapy, local steroid injection, and radiofrequency ablation of associated trochanteric nerves have variable success, and the data on the long-term durability of these treatments are limited (7-9). Microfracture of the greater trochanter and tendon release can be performed when these conservative measures fail, but not all patients are candidates for these surgeries (10). Therefore, our authors submit that percutaneous tenotomy may be an appropriate option when conservative treatments have failed and surgery is impossible. PUT is generally considered a safe treatment with a side effect profile similar to that of local steroid injections (11). Wahezi and Baker's studies support this finding for the ITB and GMed, respectively. Furthermore, the diagnostic utility of imaging in GTPS is debatable, making precise localization of the affected tendon unreliable (12). The authors evaluated combined IT and GMed PUT because of this documented safety profile and the juxtaposition of the tendons to one another, which did not create technical barriers or extend procedure time significantly. For these reasons, we submit that the outcomes are more important than defining a cause and hypothesize that performing PUT on 2 tendons would yield better outcomes than would performing PUT on either tendon alone.

Cases of GTPS have been shown to be managed effectively with ITB PUT or GMed PUT (3,6). Previously, Wahezi et al reported approximately 50% pain relief in 70% of patients (56 hips) as well as improved function at one year after ITB PUT. Baker et al described approximately 50% pain and functional improvement in 29 patients 22 months after they received GMed PUT. However, no studies to date detail patient outcomes after ITB and GMed PUT are performed together. Our investigation is the first to describe concomitant GMed and ITB PUT. The authors hypothesized that a PUT of both tendons might improve pain and functional outcomes differently than might PUT of either tendon alone. In our study of 68 hips, approximately 80% of patients reported 80% improvement in pain, side lying, and sitting-to-standing tolerance. No adverse events were reported in any of these studies, suggesting the safety of PUT.

In evaluating the therapeutic efficacy of our integrated intervention, the data analysis encompassed both short-term (1- and 6-month) and long-term (one-year) assessments. The statistically significant improvements observed across multiple outcome measures, including pain scores, side-lying and standing tolerance, and the VISA-G scores, signify the robustness and enduring impact of the implemented treatment protocol. These results underscore the effectiveness of the integrated method in alleviating symptoms and enhancing functional capabilities over an extended duration.

Though our results demonstrate compelling long-term data, we assume but cannot validate that concomitant GMed and ITB PUT is superior to either procedure alone. The methodological differences between each study limit comparatives to conjecture.

Table 2. *Comparison of ITB tenotomy with GMed-ITB tenotomy.*

Variable	ITB Tenotomy	GMed-ITB Tenotomy
Reduction in hip pain NRS score	4	7
% of patients reporting improved side-lying tolerance at 12 months	57	81
% of patients reporting improved sitting-to-standing tolerance at 12 months	78	82
% of patients reporting improved walking tolerance at 12 months	66	82
Treatment success	63	81

Abbreviations: NRS: numeric rating scale (for hip pain). Side-lying tolerance: ability to sleep through the night on the side. Treatment success: defined as reducing pain by over 50% and improving side-lying tolerance.

The findings of our study revealed a notable predilection for GTPS among the female demographic, aligning with existing literature that posits gender-based disparities in the prevalence of this disorder (1). In addition, the relative improvement associated with GMed-ITB PUT over that associated with ITB PUT validates the importance of GMed and ITB as important cofactors in GTPS's development. The improvements in pain scores indicate a substantial decrease of the primary symptomatology associated with GTPS. Though pain reports are subjective, as were our patients' reported outcomes of side-

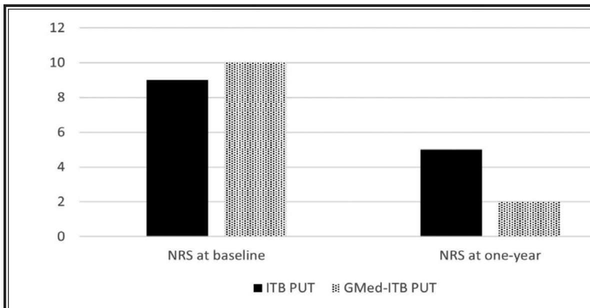

Fig. 2. *Comparison of NRS scores, showing a greater improvement by 3 points in patients in the GMed-ITB PUT study (NRS at one year = 2) over patients in the ITB PUT study (NRS at one year = 5).*
*GMed: gluteus medius, NRS: numerical rating scale (for hip pain), PUT: percutaneous ultrasound tenotomy, ITB: Iliotibial band.

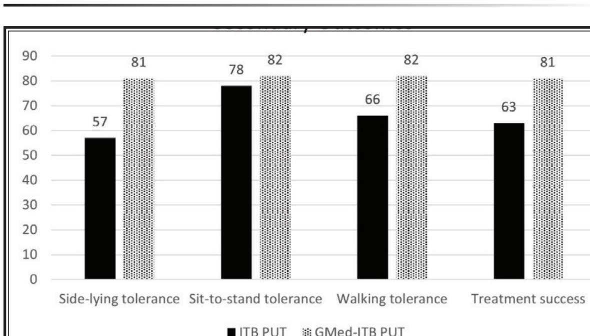

Fig. 3. *More patients in the GMed-ITB study experienced improvement in all secondary outcomes than did patients in the ITB PUT study. For reference, both studies use the inclusion criteria of side-lying intolerance, reduced walking tolerance, and sitting-to-standing intolerance.*
*Side-lying tolerance: ability to sleep through the night on the side. Treatment success: defined by achieving greater than 50% reduction in pain as well as side-lying tolerance. GMed: gluteus medius. NRS: numerical rating scale (for hip pain). PUT: percutaneous ultrasound tenotomy. ITB: iliotibial band.

lying and sitting-to-standing tolerance, a comprehensive improvement of all of these metrics suggests cross-validation. Furthermore, the aforementioned outcomes are all common limitations in GTPS, thereby underpinning the importance of concomitant ITB and GMed PUT for refractory cases of this condition. It is important to mention that the patients selected for this study had not responded to several other treatments, such as oral medications, physical therapy, and at least one local steroid injection, and that their symptoms persisted for more than 6 months. Therefore, the patients represented a difficult population with severe pain (median NRS 10). A strength of the study is the impressive improvement in these severely compromised patients. The long-term durability of the procedure's effects remains to be seen, and the authors submit that an important design for future research should be to create a prospective randomized control crossover study evaluating ITB, GMed, and GMed-ITB PUT with steroid injections or surgical release.

Sustained efficacy is crucial in the context of managing chronic musculoskeletal conditions, emphasizing the potential of our integrated method as a viable long-term therapeutic strategy for individuals afflicted with GTPS. The authors submit that current treatment strategies for GTPS can be optimized by including PUT in the treatment algorithm because this procedure can minimize repeat local injections, physiotherapy, and oral medication therapies, which have demonstrated modest improvement at best (13). We argue that using PUT for GTPS can decrease the health care cost burden, since no responder in our study required any additional treatment for GTPS during the follow-up period. However, larger multicentered and longer-term studies are required for validation.

Limitations

Though the patients improved with concomitant GMed and ITB PUT despite not responding to multiple conservative therapies, the lack of a comparative cohort limits the interpretative value of the results. A control arm would have allowed for the statistical comparison of treated and untreated patients and thus the development of a justifiable measure of the procedure's benefits. We believe that our results require confirmation by a randomized control trial in the future.

Conclusion

In the present investigation, combination GMed-ITB PUT was demonstrated to be a durable option for patients with GTPS. Concomitant GMed-ITB PUT should be considered in the treatment algorithm for this painful condition.

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