Trochanteric Bursitis Following Primary Total Hip Arthroplasty: Incidence, Predictors, and Treatment

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A B S T R A C T

Background: Trochanteric bursitis (TB) remains a common complication after total hip arthroplasty (THA), with an incidence between 3% and 17%, depending on the surgical approach, with the posterior approach (PA) being relatively protective compared to the lateral approach. The purposes of this study were to determine the incidence of TB after primary THA, identify potential risk factors for TB, and examine the utility of different modes of treatment.

Methods: Retrospective cohort data of 990 primary THAs performed in a single institution, including 613 PAs and 377 direct anterior approaches (DAAs), were analyzed. Data abstracted included demographic data, operative diagnosis, comorbidities, radiographic assessment, and other specific predictors of interest that were compared between patients diagnosed with TB following THA and controls.

Results: The incidence of TB following primary THA was 5.4% (54/990) for the entire cohort. The incidence did not differ significantly between the PA and DAA (5% vs 6.1%, respectively; P = .47). Charlson comorbidity index and American Society of Anesthesiology did not differ significantly in the TB group. Lumbar spinal stenosis and history of past smoking were significantly more common in patients who developed TB (P = .03, P = .01, respectively), but did not continue to be significant risk factors on multivariate analysis. All patients were treated nonoperatively by the time of final follow-up. Seventy-four percent required a local steroid injection and 30% required treatment with more than one modality.

Conclusion: The occurrence of TB is not influenced by the surgical approach (PA or DAA), and could not be predicted by specific comorbidities or radiographic measurements. However, it can be effectively treated conservatively in most cases.

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The risk factors described in the literature for TB following primary THA included female gender [3,10], direct lateral approach [3], and trochanteric osteotomy [6]. Proposed risk factors in the native hip also include age older than 40 years, female gender, obesity, knee or hip osteoarthritis, rheumatoid arthritis (RA), and lumbosacral back pain [11].

The purpose of this study is to (1) quantify the incidence of TB after primary THA specifically comparing between the PA and DAA; (2) identify potential risk factors, both clinical and radiological, for developing TB; and (3) examine the utility of different modes of treatment.

Patients and Methods

This is a single-center case-control study. Following institutional review board approval, we retrospectively reviewed prospectively collected data on all primary THAs performed in our institution between January 2009 and December 2015, by 3 different surgeons (M.J.B., C.S.M., D.C.). The Ethics Board waived the need for written informed consent, as data were retrospective and anonymous. All data were obtained from The Mount Sinai Data Warehouse, a research infrastructure established to facilitate health services research, operated by the hospital's Research Information Technology department. The Mount Sinai Data Warehouse consists of clinical, operational, and financial data derived from patient care processes. The linking of appropriate tables and the recoding of important variables of interest was performed by an experienced programmer and overseen by one of the authors (S.S.S.).

Case Identification

Local billing records were used to identify our cohort of patients. Primary THAs were identified by ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification) code 81.51 or Current Procedural Terminology code 27130. We used ICD-9 code 726.5 for trochanteric bursitis to identify any patient given this diagnosis following the index THA. In addition, all physician progress notes found in the electronic medical records of primary THA patients were further scanned for the term “trochanteric bursitis” to identify patients with TB who were not coded. Inclusion criteria were an age of 18 years or older and final evaluation at a minimum of 1 year after surgery. Exclusion criteria were revision THA, patients who required a subsequent revision THA at any time during the interim between the primary procedure and final follow-up, patients with a documented intraoperative or postoperative complication that may result in postoperative pain (periprosthetic fracture, periprosthetic joint infection, dislocation, etc.), and patients who did not have a well-documented follow-up by the operating surgeon.

Demographic variables and previous or current medical comorbidities were ascertained, and surgical data such as operated side and surgical approach were documented. Preoperatively, patients were assessed clinically and radiographically by the operating surgeon, including a detailed history and physical examination as well as pelvis and hip radiographs (anteroposterior [AP] pelvis, AP hip, lateral hip). Postoperatively, patients were seen in office at regular intervals per the individual surgeon's protocol. TB after THA was diagnosed based on the following criteria: (1) patient complaint of lateral trochanteric hip pain; (2) palpable tenderness over the greater trochanter and/or pain on resistance to active hip abduction in a side-lying position; and (3) no other evident etiology that may account for the patients' symptoms and complaints (such as a history of postoperative infection, fracture, dislocation, or revision to the operative hip).

After case identification using ICD-9 codes, all relevant encounters in the medical records of patients with TB were reviewed and the diagnosis was verified.

Predictors of Interest

We recorded patient-related and surgery-related factors as potential predictors of TB after primary THA: age at the time of index surgery, side of surgery, gender, diagnosis at the time of primary THA (osteoarthritis, avascular necrosis of the femoral head, femoral neck fracture, RA), history of former cigarette smoking, body mass index (BMI) at the time of THA, American Society of Anesthesiologists (ASA) score [12], history of previous TB in a native hip (ipsilateral or contralateral), Charlson comorbidity index (CCI) [13], and specific pre-existing comorbidities at the time of index THA (diabetes mellitus, RA, gout, psoriasis/psoriatic arthritis, spinal stenosis, and hypothyroidism). We tried to consider several potential risk factors including those which are not substantiated in the current literature. Postoperative data collected included occurrence of TB, follow-up duration, postoperative treatment with steroid injections, physical therapy (PT), medications, and clinical surveillance.

Radiologic Assessment

Radiographic analysis was performed on standardized preoperative and postoperative anteroposterior (AP) pelvis films. Measurements were made using the OrthoView software (OrthoView LLC, Jacksonville, FL) on the operated hip with the nonoperated hip serving as a control. Four different measurements were obtained: (1) leg-length discrepancy (LLD): we measured the perpendicular distances from the bi-ischial line to the tips of each of the lesser trochanters (the femoral reference); (2) femoral offset defined as the distance from the center of rotation of the femoral head to a line dissecting the long axis of the femur; (3) lateralization defined as the distance of the center of the femoral head from the medial teardrop [3,8]; and (4) heterotopic ossification classified using Brooker's classification [14]. LLD, femoral offset, and lateralization were all expressed as the difference in measurements between the operated and nonoperated hips. In patients who had a previous THA on the contralateral side, the center of the prosthetic femoral head served as the reference point instead of the native hip center of rotation. Radiographic evaluation was performed by an author who did not participate in the hip arthroplasties in this study (S.S.S.).

Statistical Analysis

Statistical analysis was conducted using SAS (version 9.3) with a 2-tailed alpha of 0.05. Categorical bivariate analysis was conducted using chi-squared and Fisher’s exact test where appropriate. Continuous variables were analyzed using Student’s t-test or Mann-Whitney U-test after testing for normality and equal variance. Multivariate logistic regression models only included predictors which yielded a P-value of .20 or less from bivariate analysis. All variables were assessed for confounding and interaction where appropriate. Final models were assessed for goodness of fit using the Hosmer-Lemeshow test. Analysis of occurrence of post-THA TB was performed by the Kaplan-Meier method. Exploratory analyses were performed among only post-THA TB patients to determine risk factors for greater treatment utilization within this group. For comparison of heterotopic ossification and radiographic measurements, TB patients were compared to a 1:1 propensity-matched control cohort based on age, gender, BMI, operative diagnosis, preoperative bursitis, surgical approach, bilateral THA, and ASA class.
Results

A total of 990 elective and nonelective primary THA patients performed between January 2009 and December 2015, with a minimum follow-up period of greater than 1 year, were identified. The mean follow-up interval was 2.6 ± 1.5 years (range 1-8.3). An overall number of 54 patients were diagnosed with TB following their primary THA, corresponding to an incidence of 5.4% (54/990). There were 30 cases of TB out of a total of 613 THAs performed through a PA, and 23 cases out of 377 THAs done via the DAA (incidence of 5% vs 6.1%, respectively), and no significant difference was noted with regards to the surgical approach (P = .47).

There were 52.4% (n = 519) women and 47.6% (n = 471) men. Of this cohort of patients, 97.7% (n = 967) were elective cases, and only 23 were femoral neck fractures treated with THA. Fifty-four patients who complained of atraumatic, unilateral, ipsilateral TB after THA were identified. TB was noted in 30 women (comprising 55.5% of TB cases) and 24 men (44.5%), and this difference was not statistically significant (P = .67). TB was reported for 33 right hips and 21 left hips (P = .53). The average age of patients developing TB was 66.4 ± 12.2 years, compared with 64.7 ± 12.7 in the control group (P = .37). The mean BMI was slightly higher (30.6 ± 20.7) in patients who developed TB compared with 28.3 ± 8.6 in the control group, although the difference was not significant (P = .53). The average BMI was slightly higher (30.6 ± 20.7) in patients who developed TB compared with 28.3 ± 8.6 in the control group, although the difference was not significant (P = .53). The mean duration of follow-up did not differ significantly between the TB group and the control group (2.85 ± 1.47 vs 2.6 ± 1.5 years, respectively; P = .034). In patients who developed TB, the mean duration of time from the index procedure to the diagnosis was 15.6 ± 10.8 months (range 1-42), Kaplan-Meier survival curves with diagnosis of TB as an event was conducted, and showed a mean 1-year, 2-year, and 5-year survivorship free of TB to be 97.2± 0.5, 95.7± 0.7, and 92.1± 1.2, respectively.

The indications for surgery did not differ significantly between the TB group and the controls (P = .89), with osteoarthritis counting for most of the cases (88.8% vs 90%, respectively), followed by avascular necrosis, fractures, and RA (Table 1).

A previous history of TB affecting the native hip was not found to be a risk factor for post THA TB (P = .41). Similarly, the general condition of the patient as reflected by the ASA score and CCI was not found to be statistically different between the 2 groups even though both were slightly increased in the TB group (Table 1). The 2 groups were further analyzed for predisposing risk factors. Specific systemic diseases were compared including diabetes mellitus, hypothyroidism, and peripheral vascular disease which did not differ considerably between the 2 groups. Likewise, the prevalence of inflammatory and rheumatic conditions such as RA, gout, inflammatory bowel disease, psoriasis, and psoriatic arthritis was not found to be increased in patients with TB.

Of the 990 patients included in the analysis, there were 195 patients who had a history of former cigarette smoking. A third (n = 18) of the patients who developed TB were past smokers, compared with 19% (n = 177) of the controls, a difference found to be statistically significant (P = .013). The relative risk of smokers compared to nonsmokers to develop TB was 1.76 (95% confidence interval [CI] 1.18-2.62). Of the 990 patients, there were 124 patients with a history of lumbar spinal stenosis (LSS). LSS was more prevalent in the TB group compared to the control group, and the difference was found to be statistically significant (P = .034). The relative risk of patients with LSS compared to patients with no such history to develop TB was 1.85 (95% CI 1.094-3.15). Risk factors with P < .2 after initial bivariate analysis were carried forward into multivariate logistic regression analysis to independently assess for the effect of given risk factors on the occurrence of TB. On multivariate analysis, no factors were found to be significant independent risk factors for post-THA TB.

Radiographic Assessment

There were 53 patients with a diagnosis of TB after THA with preoperative and 3-month postoperative radiographs available for review. These were compared with radiographs obtained from a 1:1 propensity-matched control cohort. The mean change in the horizontal position of the femoral head (lateralization) in the operated hips was a decrease of 2.8 ± 2.9 mm in the TB group compared to 2.7 ± 2.4 mm in the propensity-matched controls. The mean change in femoral offset was an increase of 4.5 ± 3.6 mm in the TB group compared to 4.0 ± 2.9 mm in the controls. The postoperative LLD was 3.7 ± 3.3 mm in the TB group vs 3.3 ± 3.2 mm in the controls. There were no statistically significant differences among patients with TB and controls in regard to postoperative changes in femoral offset (P = .42), lateralization (P = .92), and LLD (P = .56). Similarly, the presence and the grade of heterotopic ossification did not differ considerably between the 2 groups (Table 2).

Treatment History

Patients diagnosed with post-THA TB were followed for a mean period of 1.6 ± 1.2 years (2 months to 5.9 years), from the time of TB diagnosis to their latest follow-up encounter. All 54 patients were treated with nonoperative treatment measures. Fifty of 54 patients (92.6%) required treatment other than surveillance alone (Table 3). Forty (74%) patients required local steroid injection. There were 5 (9.2%) patients in whom treatment included 2 injections and 2 (3.7%) patients requiring 3 injections. No complications were reported after local injections. Oral nonsteroidal anti-inflammatory drugs were prescribed to 18 (33.3%) patients and topical nonsteroidal anti-inflammatory drugs to 5 (9.2%). Overall, 34 (63%) patients required only a single modality, whereas 16 (29.6%) needed treatment with more than one modality. At the time of latest follow-up, TB symptoms resolved sufficiently with these

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Bivariate Analysis of Risk Factors for Post-THA Trochanteric Bursitis.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Controls</td>
</tr>
<tr>
<td>Age (mean)</td>
<td>64.7 (SD 12.7)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>447 (47.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>489 (52.3%)</td>
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<tr>
<td>BMI (mean)</td>
<td>28.3 (SD 8.6)</td>
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<tr>
<td>Former smoker</td>
<td>177 (19%)</td>
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<tr>
<td>Diabetes</td>
<td>117 (12.5%)</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>65 (7%)</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>92 (9.8%)</td>
</tr>
<tr>
<td>Gout</td>
<td>32 (3.4%)</td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
<td>8 (0.8%)</td>
</tr>
</tbody>
</table>

Bold values indicate a statistically significant P-value. SD, standard deviation.
Iorio et al indicated a 4.9% incidence with the lateral approach and direct-lateral approach and less for the other approaches. This may explain the higher occurrence found in previous studies with the lateral approach.

TB in a native hip is an umbrella term encompassing a host of different pathologies known to cause lateral sided hip pain [16]. Likewise, the etiology and pathogenesis of post-THA TB remains complex and not entirely understood. A recent study based on trochanteric bursal samples harvested intraoperatively during THA could not substantiate histologic acute or chronic inflammatory changes. The authors concluded that there is no inflammatory component to TB [16]. Our analysis did not reveal any statistically significant differences in patient comorbidities (in general and also for specific systemic and inflammatory conditions) between patients who experienced TB and those who have not. The CCI has been studied as a predictive tool for various events following primary THA, including postoperative readmissions [17,18], complications [19,20], discharge disposition [21], and functional outcomes [21,22]. However, we did not find a remarkable difference in CCI between the 2 groups.

We also could not demonstrate a predilection to develop TB in patients who have previously been diagnosed with TB of their native hip. This, perhaps, indicates that the 2 should be considered 2 separate entities, with different etiologies.

An interesting finding in our study was the higher incidence of spinal stenosis among patients experiencing TB. This is not surprising, because spinal stenosis is considered an important extra-articular source for hip pain, and should be evaluated in every case of persistent pain following a THA [23–25].

Another notable finding was the higher incidence of past smoking in the TB group, which was statistically significant. Smoking has been shown to have adverse clinical musculoskeletal effect including an increased risk of sustaining a fracture, nonunion and delayed union of fractures, and decreased bone mineral density [26,27]. Smokers are known to be at increased risk for wound and soft tissue complications as compared with nonsmokers. Recent studies have also suggested that smoking is a risk factor for tendon injuries including rotator cuff tears [28]. Although we cannot draw conclusions with regards to an association between former smoking and TB after THA, this may be an important hypothesis to be addressed in future basic science studies.

It seems plausible that TB may also be correlated with excessive offset of the femoral stem. However, our study is in line with previous ones, as we were unable to verify this hypothesis. The other radiographic measurements were also not associated with the occurrence of TB.

Our study shows that TB following THA is a manageable condition, which can be resolved with nonsurgical treatment modalities, in most cases. This is in line with previous studies that showed excellent results with similar treatment modalities [3,8]. Of the patients who received injections, 59% required a single injection, a proportion comparable to the one described in Farmer et al [8] who had 56% symptom resolution with a single injection.

It is important to keep in mind, however, that a large proportion of patients will require a combination of several modalities. Although we have not found higher incidence of TB among female patients as shown in a previous study [3], we did demonstrate that men have a higher chance of being effectively treated with fewer treatment modalities.

We acknowledge several limitations of this study. First, due to the retrospective design, our results are likely to have been affected by confounding variables that could not be controlled. These include variability in data collection, potential bias, and missing data for some patients. Case identification using ICD-9 codes may be limited by several forms of bias such as inaccurate coding and under-reporting [29]. Second, the diagnosis of TB is subjective and relies on physical examination alone, with no standardized criteria.
or diagnostic test to prove it. Third, we relied on the electronic medical records and were not able to completely control for other patient characteristics that may affect the risk for TB. Some patients might have been treated for TB elsewhere. As PT was delivered at different locations outside our network, data regarding the utility of specific PT modalities were not available for analysis. Furthermore, as with all retrospective studies, the quality and availability of the data depended on the quality of the medical records, which could have contained errors or omissions. Fourth, our analysis did not include functional scores to reflect patient-reported outcome measures. Finally, our group of symptomatic patients with diagnosed TB was relatively small. A larger or multicenter series might provide more insight on this matter in the future.

Nonetheless, the study is based on a relatively large cohort of patients who underwent THA in a single institution, with 3 surgeons, over a relatively short period of time and who were subjected to very similar care protocols.

Conclusion

TB continues to be a fairly common condition, with comparable incidence after both PA and DAA. Although it can be effectively treated conservatively in most cases, efforts should emphasize on understanding the pathogenesis and exploring more effective treatment options. Larger prospective studies will be mandatory to overcome the limitations of this study.

References