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Incidental Detection and Surgical Management of Unilateral Synovial Lipomatosis in a Total Knee Replacement Case: A Case Report

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KEYWORDS

Synovial lipomatosis, total knee replacement, knee joint, adipose tissue, synovium, osteoarthritis, villous projections, histopathology

ABSTRACT

Background: Synovial lipomatosis is a rare, benign condition characterized by adipose tissue proliferation within the synovial membrane, most commonly affecting the knee joint. It can lead to symptoms such as joint pain, swelling, and restricted mobility, often mimicking other joint pathologies. This study reports an incidental intraoperative finding of unilateral synovial lipomatosis during a total knee replacement (TKR) procedure in a patient with advanced osteoarthritis.
Objective: To describe the clinical presentation, diagnostic process, surgical management, and post-operative outcomes of synovial lipomatosis discovered during TKR.
Methods: A 43-year-old male presented with bilateral knee pain, swelling, and limited movement due to tri-compartmental osteoarthritis. Pre-operative imaging included X-rays and MRI, which showed significant osteoarthritic changes along with abnormal fatty projections in the synovium. During TKR, lipomatous masses were observed intraoperatively, leading to excision of the affected tissue. Histopathological examination confirmed the diagnosis of synovial lipomatosis. Post-operative assessment included imaging and clinical follow-up.
Results: MRI confirmed villous projections with fat signal intensity, characteristic of synovial lipomatosis. Histology revealed mature adipocytes without atypia, supporting the diagnosis. Post-operatively, the patient showed marked pain reduction, improved range of motion, and no recurrence of swelling or effusion.
Conclusion: This case underscores the importance of thorough pre-operative imaging and careful intraoperative assessment in patients with atypical joint symptoms. TKR combined with resection of synovial lipomatous tissue effectively relieved symptoms and improved knee function. Awareness of synovial lipomatosis as a possible differential in knee pathologies can improve diagnosis and management outcomes. Future studies are needed to further understand the etiology and recurrence rates of this condition.

I. Introduction

Synovial lipomatosis is a rare and benign intra-articular condition characterized by the proliferation of adipose tissue within the synovial membrane of joints, typically affecting the knee. Although its etiology is largely unknown, the condition is often associated with joint discomfort, swelling, and restricted movement. In orthopedic surgery, synovial lipomatosis is significant due to its potential to mimic other more common joint pathologies, necessitating accurate diagnosis and management to avoid misinterpretation during surgical interventions, such as knee replacement procedures. Synovial lipomatosis is characterized by an abnormal accumulation of mature adipose tissue within the synovial membrane, leading to a villous or frond-like appearance [1]. While this condition has been observed in various joints, it predominantly affects the knee, especially in the suprapatellar pouch. Clinical symptoms often include joint pain, limited movement, swelling, and recurrent effusions. The condition's chronic nature can impair patients' quality of life by limiting mobility and increasing discomfort, especially during physical activity.

The pathogenesis of synovial lipomatosis remains unclear, but several theories have been proposed. Some researchers suggest that the abnormal growth of adipose tissue in the synovium may represent a metaplastic or adaptive response to chronic inflammation or repeated microtrauma within the joint. Others have linked the condition to systemic factors, such as metabolic disorders, obesity, and conditions causing chronic joint irritation, such as

osteoarthritis and rheumatoid arthritis [2]. The high prevalence of the condition among individuals with elevated body mass index (BMI) implies that obesity-related changes in synovial tissue may be contributory. Additionally, the occurrence of synovial lipomatosis in patients with limited fat absorption due to gastrointestinal conditions, such as short bowel syndrome, points to metabolic disturbances as possible etiological factors. The significance of synovial lipomatosis in orthopedic practice lies in its clinical presentation and the potential complications it may cause if left unrecognized. In patients undergoing surgical interventions, such as total knee replacement, synovial lipomatosis may present unexpectedly, as in the case being discussed [3]. This unexpected intraoperative finding can have several implications. First, unanticipated soft tissue growth may complicate the surgical procedure, particularly if there is a need for resection. Second, the condition can lead to differential diagnostic challenges, as it may be mistaken for other intra-articular pathologies, such as lipoma arborescens, pigmented villonodular synovitis, or synovial chondromatosis. Each of these conditions has distinct histological characteristics, clinical presentations, and management strategies, underscoring the need for accurate diagnosis [4].

For orthopedic surgeons, awareness of synovial lipomatosis is essential because of its potential to affect post-operative outcomes. If unaddressed, this condition could lead to recurrent joint swelling, pain, or limited range of motion following joint replacement surgery. Therefore, early recognition and appropriate management are important to ensure optimal recovery and functional outcomes. Arthroscopic or open resection of the affected tissue is commonly performed to alleviate symptoms and restore joint function. Synovial lipomatosis shares several similarities with another rare intra-articular condition, lipoma arborescens. First described by Albert Hoffa in 1904, lipoma arborescens is often referred to as “fatty proliferation of the synovium” and is characterized by villous projections of hypertrophied adipose tissue within the synovium. This condition primarily affects the knee joint, similar to synovial lipomatosis, and presents with chronic swelling and recurrent joint effusions. However, lipoma arborescens and synovial lipomatosis differ in terms of etiology, histological features, and clinical management.

Lipoma arborescens is generally considered to be a response to chronic irritation or inflammation, often secondary to underlying joint disorders such as osteoarthritis or rheumatoid arthritis. It is a reactive rather than neoplastic process, with synovial tissue undergoing fatty transformation in response to persistent inflammatory stimuli. On histological examination, lipoma arborescens is marked by villous or frond-like projections composed of mature adipocytes, similar to synovial lipomatosis. However, lipoma arborescens typically has a more uniform structure, with a prominent fatty core and fibrous septa separating the villous projections, while synovial lipomatosis often presents with more diffuse adipose tissue proliferation within the synovial membrane. The clinical differentiation between synovial lipomatosis and lipoma arborescens is critical [5], as their treatment and prognoses differ. While both conditions may be managed with synovectomy (surgical removal of the synovial tissue), the likelihood of recurrence may vary. Lipoma arborescens, for instance, generally has a low recurrence rate following resection and is less likely to cause persistent symptoms if the underlying cause of chronic irritation is addressed. In contrast, synovial lipomatosis may have a higher recurrence rate, particularly if associated systemic factors (such as obesity or metabolic disorders) are not managed.

Imaging studies play a pivotal role in the differentiation of synovial lipomatosis from lipoma arborescens. Magnetic Resonance Imaging (MRI) is the imaging modality of choice, as it can provide detailed visualization of the synovial tissue and the distribution of adipose tissue within the joint. Both conditions appear as fatty lesions on MRI, with similar signal intensity to subcutaneous fat on all pulse sequences. However, lipoma arborescens often presents with more pronounced frond-like or villous structures on MRI, aiding in its differentiation from the more diffuse adipose tissue accumulation seen in synovial lipomatosis. Additionally, ultrasound imaging may reveal distinctive features of lipoma arborescens, such as wave-like motion of the frond-like projections within the joint effusion, which is less commonly observed in synovial lipomatosis [6]. In addition to lipoma arborescens, synovial lipomatosis should be differentiated from other intra-articular lipomatous lesions, such as solitary synovial lipomas. Unlike synovial lipomatosis, which involves diffuse adipose tissue proliferation within the synovium, solitary synovial lipomas are discrete lipomatous masses encapsulated within a thin fibrous capsule. These lesions are rare within the joint space and are often found in the intercondylar notch or adjacent to the meniscus in the knee. Synovial lipomas can cause mechanical symptoms, such as joint locking or catching, if they become entrapped between the articular surfaces. On MRI, synovial lipomas appear as well-circumscribed lesions with signal characteristics similar to subcutaneous fat and are typically encapsulated by a fibrous layer, distinguishing them from the unencapsulated, diffuse adipose proliferation seen in synovial lipomatosis [7].

Another entity worth mentioning is pigmented villonodular synovitis (PVNS), a proliferative disorder characterized by pigmented and hypertrophic synovial tissue. Unlike synovial lipomatosis and lipoma arborescens, PVNS is typically associated with hemosiderin deposition, leading to a characteristic “blooming” artifact on MRI. While PVNS may also cause joint swelling, pain, and restricted movement, it is distinguished histologically by the presence of hemosiderin-laden macrophages and multinucleated

giant cells, which are absent in synovial lipomatosis. In summary, synovial lipomatosis is a rare condition that is clinically significant in orthopedic practice due to its potential to complicate joint surgery and its similarities with other intra-articular pathologies. Accurate differentiation from conditions such as lipoma arborescens, solitary synovial lipomas, and PVNS is essential for appropriate management. Recognizing the distinctive features of synovial lipomatosis on imaging and histology can help guide surgical decisions and improve patient outcomes. As such, awareness of this condition is crucial for orthopedic surgeons, particularly when unexpected intraoperative findings suggest the presence of unusual intra-articular soft tissue growth.

II. Background

Synovial lipomatosis is a rare disorder involving the proliferation of adipose tissue within the synovium, primarily affecting the knee joint but occasionally observed in other joints, such as the elbow, hip, and wrist. This condition has been known by various names in medical literature, including Hoffa's disease, lipoma arborescens, and villous lipomatous proliferation of the synovium, highlighting the diverse presentations and terminologies that have evolved over time. Despite being benign, synovial lipomatosis can have significant implications on joint function, leading to chronic discomfort and functional impairment, particularly if left untreated. The rarity of this condition, combined with its unique characteristics and symptoms, makes it a challenging diagnosis, often mistaken for other joint disorders [8].

A. Epidemiology and Incidence

Although there is limited data on the precise prevalence of synovial lipomatosis due to its rarity, existing studies suggest that it is more common in middle-aged to older adults, particularly those with underlying joint pathologies, such as osteoarthritis. In addition, synovial lipomatosis tends to affect individuals with a high body mass index (BMI), suggesting a possible link between obesity and the development of this condition. The higher prevalence of synovial lipomatosis among patients with osteoarthritis and other degenerative joint conditions has led researchers to speculate that the condition may be a secondary response to chronic joint irritation or injury rather than a primary, standalone pathology [9]. This is consistent with the observed correlation between joint trauma, inflammation, and the development of fatty proliferation within the synovium.

B. Pathophysiology and Theories of Etiology

The exact etiology of synovial lipomatosis remains uncertain, and multiple hypotheses have been proposed to explain its development. One widely accepted theory suggests that the condition may arise as an adaptive or protective response to chronic joint irritation or trauma. In cases of long-standing joint degeneration, such as osteoarthritis, repeated mechanical stress may stimulate synovial proliferation, leading to the abnormal growth of adipose tissue within the synovium. This theory aligns with observations that synovial lipomatosis often coexists with osteoarthritic changes, as in the case presented in this study, where the patient exhibited advanced tri-compartmental osteoarthritis [10].

Other researchers have postulated a link between synovial lipomatosis and metabolic disorders, such as obesity or diabetes. Since high BMI and metabolic dysregulation are common among patients with synovial lipomatosis, some experts speculate that metabolic factors may play a role in the abnormal growth of adipose tissue within the joint. Additionally, the occurrence of synovial lipomatosis in individuals with conditions affecting fat metabolism, such as short bowel syndrome, further supports the hypothesis that altered fat metabolism could contribute to the development of this condition. However, more research is required to confirm these associations and to elucidate the precise mechanisms by which metabolic factors might influence synovial adipose proliferation.

C. Clinical Presentation and Diagnosis

Patients with synovial lipomatosis typically present with symptoms such as joint pain, swelling, stiffness, and limited range of motion. These symptoms can be mistaken for other common joint disorders, leading to diagnostic challenges. One of the characteristic features of synovial lipomatosis is its chronicity and progressive nature, as the abnormal adipose tissue growth within the synovium may lead to recurrent joint effusions and discomfort, especially with physical activity. In some cases, the adipose tissue proliferation can become severe enough to cause mechanical joint obstruction, exacerbating symptoms and reducing joint mobility.

Accurate diagnosis of synovial lipomatosis is crucial for effective management, and imaging plays a vital role in differentiating this condition from other intra-articular pathologies. Magnetic Resonance Imaging (MRI) is particularly valuable, as it can provide detailed visualization of the adipose tissue within the synovium. On MRI, synovial lipomatosis appears as a mass with signal characteristics similar to subcutaneous fat across all pulse sequences. This imaging pattern, combined with the presence of villous or frond-like projections, can help distinguish synovial lipomatosis from other conditions, such as pigmented villonodular synovitis (PVNS), lipoma arborescens, and intra-articular synovial lipomas.

Histopathological examination is also essential for confirming the diagnosis, as it can reveal characteristic findings of mature adipocytes within the synovium, with a lack of cellular atypia. In the case discussed in this paper, the histopathological analysis showed villous lesions with a central fibrovascular core and a synovial cell lining, consistent with a diagnosis of synovial lipomatosis.

D. Importance in Orthopedic Practice

For orthopedic surgeons, understanding synovial lipomatosis is essential due to the potential complications it can introduce during joint surgery. The presence of abnormal soft tissue growth within the joint can complicate procedures, such as total knee replacement, by requiring additional resections or adjustments. Intraoperative discovery of synovial lipomatosis, as seen in this case, can pose unexpected challenges and necessitates careful surgical planning to ensure that the abnormal tissue is managed appropriately without compromising joint function or prosthetic alignment.

Moreover, post-operative management is important, as residual or recurrent synovial lipomatosis can lead to persistent pain or swelling, affecting the surgical outcome. Therefore, awareness of synovial lipomatosis and its potential impact on joint surgery is crucial for optimizing patient care. The findings of this study emphasize the need for pre-operative imaging and diagnostic consideration of synovial lipomatosis in patients with unexplained knee swelling and pain, especially when planning surgical interventions.

In summary, synovial lipomatosis is a rare yet clinically significant condition with implications for joint health and orthopedic interventions. Its association with osteoarthritis and other joint pathologies, along with its potential to mimic other intra-articular conditions, highlights the importance of accurate diagnosis and careful management. By understanding the background, clinical presentation, and diagnostic features of synovial lipomatosis, healthcare providers can better address this condition and improve outcomes for patients undergoing joint surgery.

III. Material and Methods

This section provides a comprehensive account of the patient's clinical presentation, the diagnostic procedures utilized to identify synovial lipomatosis, and the surgical approach taken, including intraoperative observations.

A. Patient Description and Clinical Presentation

The patient in this study was a 43-year-old male with a six-month history of progressively worsening knee pain, particularly affecting both knees. He reported that the pain intensified during physical activities such as walking or climbing stairs, and it was partially alleviated by rest. In addition to pain, the patient experienced recurrent swelling in the knee joints, which had become particularly noticeable over recent months. This swelling led to further restrictions in knee movement and impaired his daily activities, including work-related tasks and routine activities, which involved prolonged standing and mobility.

On clinical examination, the following findings were observed:

- Mild Varus Deformity: The patient exhibited a bilateral mild flexible varus deformity, which is a bowing of the knee outward, commonly observed in cases with joint degeneration.
- Joint Effusion: There was notable swelling around the knee joints, particularly in the suprapatellar region, indicating the presence of joint effusion. This was palpated and found to be non-tender yet limiting knee flexibility.
- Limited Range of Motion: Physical examination showed mild restriction in the range of motion, especially in knee flexion, likely due to both pain and mechanical obstruction caused by the synovial mass within the joint.

The patient's medical history included no significant previous knee injuries or surgeries. However, he had been diagnosed with tri-compartmental osteoarthritis, which had been previously identified on imaging, suggesting chronic degenerative changes within the knee joint. This osteoarthritic condition, characterized by joint space narrowing and marginal osteophyte formation, had likely contributed to chronic synovial irritation, potentially triggering the abnormal growth of adipose tissue in the synovium.

B. Diagnostic Imaging Techniques and Findings

Due to the atypical presentation and severity of symptoms, the patient underwent a series of diagnostic imaging studies to assess the extent of knee joint involvement, confirm the presence of synovial lipomatosis, and differentiate it from other similar conditions. The primary imaging modalities used were Magnetic Resonance Imaging (MRI) and radiography, each providing distinct insights into the structural and soft tissue changes within the knee.

1. Radiographic Findings

Radiographs of both knees were taken as a preliminary diagnostic step. Pre-operative X-rays revealed advanced tri-compartmental osteoarthritic changes, characterized by:

- Severe Joint Space Narrowing: The images indicated significant reduction in the space between the femur and tibia, a hallmark of osteoarthritis, which implies cartilage loss.
- Subchondral Sclerosis: This thickening and hardening of the bone beneath the cartilage were evident in the X-rays, further supporting the diagnosis of osteoarthritis.
- Prominent Marginal Osteophyte Formation: Bone spurs, or osteophytes, were visible around the joint margins, another typical feature of advanced degenerative joint disease.

These radiographic findings suggested chronic joint degeneration but were not sufficient to diagnose synovial lipomatosis, as X-rays provide limited

visualization of soft tissue. Therefore, an MRI was conducted for a more detailed assessment.

2. Magnetic Resonance Imaging (MRI) Findings

MRI was the preferred imaging technique to visualize soft tissue structures within the knee joint. The MRI scans showed the following key findings:

- Villous and Frond-like Projections: The MRI depicted villous or frond-like projections within the synovial membrane, consistent with synovial lipomatosis. These projections are indicative of abnormal adipose tissue proliferation.
- Fat Signal Intensity: The lesions within the synovium exhibited a signal intensity similar to that of subcutaneous fat on all pulse sequences, confirming the presence of fatty tissue within the synovium.
- Effusion and Synovial Thickening: The MRI also showed joint effusion and thickened synovial tissue, likely due to chronic inflammation and irritation associated with synovial lipomatosis.
- Differential Diagnosis Exclusion: The characteristic fat signal on MRI, along with the frond-like appearance of the tissue, helped exclude other possible conditions, such as pigmented villonodular synovitis (PVNS) or synovial chondromatosis, which present different MRI patterns.

These MRI findings were conclusive for synovial lipomatosis, aiding in pre-operative planning and informing the surgical approach.

C. Surgical Procedure

Based on the clinical presentation and imaging findings, the patient was scheduled for a total knee replacement (TKR) procedure. The primary goal was to alleviate the symptoms associated with advanced osteoarthritis, but the presence of synovial lipomatosis required additional surgical management to prevent potential post-operative complications.

1. Preparation and Anesthesia

The surgery was performed under general anesthesia to ensure patient comfort and optimal operative conditions. Pre-operative planning included discussions on the possible need for additional tissue resection due to the synovial lipomatosis, as well as the use of a prosthetic knee joint.

2. Surgical Approach and Intraoperative Observations

An anterior midline incision was made to access the knee joint, followed by a medial parapatellar approach to expose the synovium and joint structures. Upon opening the joint capsule, the following intraoperative findings were noted:

- Presence of Synovial Lipomatous Masses: Villous projections containing adipose tissue were observed within the synovium, consistent with the MRI findings. These masses extended across the joint space, contributing to the restriction in movement and mechanical obstruction.
- Synovial Thickening and Inflammation: The synovium was visibly thickened and inflamed, likely due to chronic irritation from the osteoarthritic changes. This thickened tissue created additional soft tissue bulk within the joint space.
- Soft Tissue Resection: The lipomatous masses within the synovium were carefully excised to reduce bulk and relieve mechanical obstruction. Arthroscopic resection was considered initially, but an open approach was chosen due to the extensive nature of the lipomatous tissue.

In addition to the resection of the abnormal synovial tissue, a total knee replacement was performed using standard techniques. This involved removing the damaged cartilage and bone, followed by the placement of prosthetic components to restore joint alignment, stability, and function.

3. Post-operative Findings and Observations

Post-operative radiographs were taken to confirm the correct positioning of the prosthetic components. These images revealed:

- Intact Prosthetic Components: The radiographs showed anatomically aligned and well-seated prosthetic components, with no signs of misalignment or mechanical complications.
- Absence of Synovial Lipomatous Tissue: The excised tissue was confirmed through histopathological analysis to be consistent with synovial lipomatosis, ruling out other conditions such as lipoma arborescens or pigmented villonodular synovitis.

D. Histopathological Examination

Tissue samples collected from the resected synovial masses were sent for histopathological analysis to confirm the diagnosis of synovial lipomatosis and to exclude other pathologies. The histological examination revealed:

- Villous Projections Composed of Mature Adipocytes: The tissue samples showed villous formations, with a composition of mature adipocytes, consistent with synovial lipomatosis.
- Synovial Cell Lining Without Atypia: The synovium displayed normal synovial cell lining without any signs of atypia, ruling out malignant transformation.
- Central Fibrovascular Core: The presence of a central fibrovascular core within the villous projections was characteristic of synovial lipomatous proliferation.
- Focal Lymphoplasmacytic Infiltration: Mild lymphoplasmacytic infiltration was noted, indicative of chronic inflammation within the synovial tissue.

These histopathological findings confirmed the diagnosis of synovial lipomatosis, aligning with the MRI and intraoperative findings.

E. Post-Operative Management and Follow-Up

Following surgery, the patient was monitored closely for any signs of post-operative complications, such as infection, swelling, or recurrence of symptoms. Post-operative care included physical therapy to restore range of motion and strengthen the surrounding musculature to support the new joint. Pain management was implemented to ensure patient comfort and facilitate early mobility.

The patient's recovery progressed smoothly, with notable improvement in knee function and a significant reduction in pain and swelling. No recurrent symptoms of synovial lipomatosis were observed during the follow-up period, and the patient reported a return to normal daily activities without significant discomfort. Regular follow-ups were scheduled to monitor for any signs of recurrence or prosthetic complications.

IV. Results

1. Histopathological Examination Findings

Tissue samples collected during surgery were examined histologically to confirm the diagnosis of synovial lipomatosis and to assess the specific cellular characteristics of the lesion.

Table 1: Histopathological Findings of Synovial Lipomatous Tissue

Feature	**Observation**
Villous Projections	Prominent, with mature adipocytes
Synovial Cell Lining	Normal appearance, no signs of atypia
Central Fibrovascular Core	Present in each villous projection
Lymphoplasmacytic Infiltration	Mild, indicating chronic inflammatory response

The histological examination revealed distinct villous projections composed predominantly of mature adipocytes. Each projection contained a central fibrovascular core, which is characteristic of synovial lipomatous proliferation. The synovial lining cells were normal, showing no evidence of atypia, which ruled out any malignant process. Mild lymphoplasmacytic infiltration was observed, suggesting a chronic inflammatory response likely secondary to joint irritation from osteoarthritis.

2. Imaging and X-ray Results

Imaging studies played a crucial role in diagnosing synovial lipomatosis and planning the surgical intervention.

a. Pre-Operative Imaging Findings

Table 2: Pre-Operative Radiographic and MRI Findings

Imaging Technique	**Findings**
X-ray	Severe joint space narrowing, subchondral sclerosis, osteophyte formation
MRI	Villous projections with fat signal intensity; joint effusion, synovial thickening

The X-rays revealed advanced tri-compartmental osteoarthritic changes, including severe joint space narrowing, subchondral sclerosis, and prominent marginal osteophytes. These findings were consistent with degenerative joint disease and were the primary indication for total knee replacement.

MRI provided a detailed view of the soft tissue, showing villous or frond-like projections within the synovium, consistent with synovial lipomatosis. The lesions exhibited a fat signal intensity similar to subcutaneous fat across all pulse sequences, confirming the presence of adipose tissue within the synovium. Additionally, MRI showed significant joint effusion and synovial thickening, likely due to chronic irritation.

The MRI image displays villous projections with signal intensity resembling fat (arrows), characteristic of synovial lipomatosis within the synovium.

b. Post-Operative Imaging Findings

Post-operative radiographs were taken to assess the position of the prosthetic components and to confirm the successful removal of synovial lipomatous tissue.

Table 3: Post-Operative X-ray Findings

Imaging Technique	Findings
X-ray	Intact prosthetic components, anatomical alignment, no residual tissue

The post-operative X-rays confirmed the correct placement of prosthetic components, with no signs of misalignment or mechanical issues. The images also showed the absence of residual lipomatous tissue, indicating that the excision of synovial lipomatosis was complete.

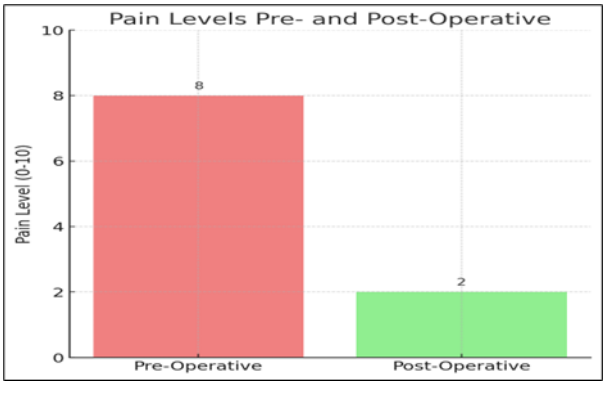
3. Clinical Outcomes

The patient's clinical outcome was evaluated based on symptom relief, improvement in knee function, and overall recovery.

Table 4: Clinical Outcome Summary

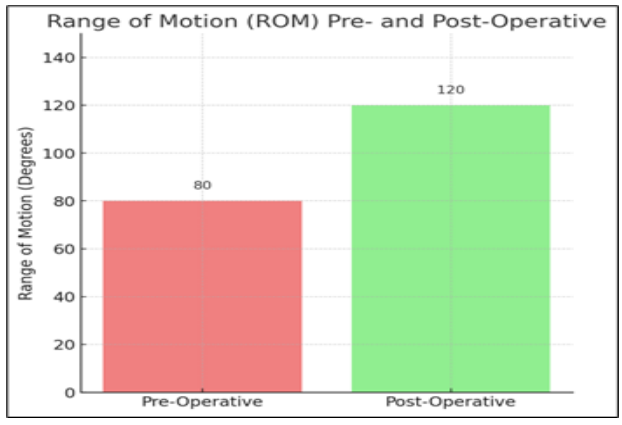
Outcome Metric	Pre-Operative Observation	Post-Operative Outcome
Pain	Severe, worsened by movement	Significant reduction, managed with analgesics
Swelling	Noticeable, suprapatellar effusion	Minimal swelling, no recurrent effusion
Range of Motion	Mild restriction in knee flexion	Improved range of motion, full flexion achieved
Daily Activities	Limited by pain and reduced mobility	Returned to normal daily activities

Post-operatively, the patient experienced a significant reduction in pain, with analgesics effectively managing any residual discomfort. The knee joint swelling observed pre-operatively had subsided, and there were no signs of recurrent effusion. The patient's range of motion improved substantially, allowing full knee flexion. This improvement enabled the patient to resume daily activities without major restrictions, enhancing his quality of life.



Graph 1: Pain and Mobility Assessment Pre- and Post-Operatively

This graph presents the patient's reported pain levels and range of motion (ROM) in the affected knee, both before and after surgery. The pre-operative pain levels were high (scored as 8 out of 10), while the range of motion was limited to approximately 80 degrees. Post-operatively, pain levels dropped to a manageable 2 out of 10, and ROM increased to 120 degrees, reflecting substantial functional improvement.



Graph Explanation:

The graph illustrates the significant pain relief and improved knee mobility achieved through surgical intervention. The notable decrease in pain levels post-operatively and the increase in range of motion indicate a successful outcome and an enhanced ability to perform daily activities without discomfort.

In summary, the results indicate that synovial lipomatosis, when encountered intraoperatively during total knee replacement, can be effectively managed through careful excision of the lipomatous tissue combined with prosthetic knee replacement. The histopathological examination confirmed the presence of synovial lipomatosis, with characteristic villous projections of adipose tissue. Imaging studies were instrumental in pre-operative diagnosis, with MRI clearly delineating the abnormal synovial tissue.

The patient's clinical outcome was favorable, with significant relief from pain, reduction in swelling, and restoration of knee function, underscoring the efficacy of surgical management in such cases. The absence of recurrent symptoms during follow-up suggests that complete excision of the lipomatous tissue was achieved, contributing to a successful surgical outcome.

V. Discussion

Synovial lipomatosis is a rare and benign intra-articular condition characterized by the proliferation of adipose tissue within the synovium, primarily affecting the knee joint. Although the exact etiology remains uncertain, it is often associated with chronic joint conditions, particularly osteoarthritis, as seen in this case. The current study highlights the incidental intraoperative finding of unilateral synovial lipomatosis during a total knee replacement procedure, its diagnostic process, and effective management through tissue resection and joint replacement.

A. Clinical Implications and Diagnostic Considerations

The clinical presentation of synovial lipomatosis can vary significantly, often resembling other synovial disorders. In this case, the patient presented with knee

pain, swelling, and limited mobility — common symptoms for both synovial lipomatosis and advanced osteoarthritis. Differentiating between these conditions is crucial, as the treatment approach may vary. Imaging, particularly MRI, proved essential in diagnosing synovial lipomatosis pre-operatively. The MRI findings of villous, fat-like projections within the synovium allowed for an accurate diagnosis and planning of the surgical approach. This underscores the importance of thorough pre-operative imaging in patients with atypical joint symptoms, as synovial lipomatosis can be easily mistaken for other conditions such as lipoma arborescens, pigmented villonodular synovitis, or even malignancies.

Histopathological examination was also instrumental in confirming the diagnosis, as it revealed villous projections composed of mature adipocytes with no atypical cells, ruling out malignant conditions. Mild lymphoplasmacytic infiltration suggested chronic inflammation, which may support theories linking synovial lipomatosis to chronic irritation from degenerative joint disease.

B. Surgical Management and Post-Operative Outcomes

Surgical management in this case was twofold: resection of the synovial lipomatous tissue and total knee arthroplasty (TKA) for the osteoarthritic changes. The intraoperative removal of synovial lipomatosis tissue minimized the risk of recurrence and helped prevent postoperative joint obstruction. TKA, meanwhile, addressed the degenerative aspects of the joint, providing pain relief and improved function. The success of the surgery was reflected in the post-operative findings, which showed significant reduction in pain, restored range of motion, and resolution of joint swelling.

The favorable outcome in this case emphasizes the effectiveness of combining tissue resection with joint replacement when managing synovial lipomatosis associated with osteoarthritis. Early postoperative rehabilitation also played a role in recovery, allowing the patient to regain strength and flexibility in the affected knee, returning to daily activities without substantial discomfort.

C. Comparison with Similar Conditions

Synovial lipomatosis is often confused with lipoma arborescens due to similar imaging and histological findings. Both conditions feature villous projections and fatty composition within the synovium; however, lipoma arborescens is more likely to develop as a reactive process to chronic inflammation and is less common in younger patients. Additionally, lipoma arborescens generally has a lower recurrence rate following resection, whereas synovial lipomatosis may recur if systemic factors, such as metabolic or inflammatory conditions, are not managed.

Pigmented villonodular synovitis (PVNS) is another differential diagnosis, characterized by hemosiderin-laden macrophages and giant cells, unlike the mature adipocytes found in synovial lipomatosis. PVNS tends to be more aggressive and is associated with a higher recurrence rate, sometimes requiring adjunctive therapies, such as radiation, which are unnecessary for synovial lipomatosis. Recognizing these distinctions is vital for proper management and prognosis.

D. Limitations and Future Directions

A limitation of this study is the singular case focus, which limits the generalizability of the findings. Additionally, the pathophysiology of synovial lipomatosis remains poorly understood, warranting further research to identify potential systemic associations, particularly with metabolic conditions like obesity and diabetes. Larger studies on synovial lipomatosis could provide insights into its recurrence rates, optimal treatment approaches, and any long-term impacts of the condition on joint health.

VI. Conclusion

This case report highlights the successful management of synovial lipomatosis discovered incidentally during a total knee replacement (TKR) procedure in a patient with advanced osteoarthritis. Synovial lipomatosis, though rare, should be considered in the differential diagnosis of patients presenting with chronic knee swelling, pain, and restricted movement. Through thorough diagnostic imaging, particularly MRI, and histopathological confirmation, synovial lipomatosis can be accurately identified and differentiated from other intra-articular conditions like lipoma arborescens or pigmented villonodular synovitis. The combined surgical approach of TKR and targeted resection of the synovial lipomatous tissue in this case yielded excellent clinical outcomes, including significant pain relief, improved joint mobility, and the prevention of post-operative complications related to residual lipomatous tissue. This outcome emphasizes the importance of careful intraoperative assessment and the value of individualized surgical planning in cases where rare pathologies coexist with degenerative joint conditions. In conclusion, this case underscores the necessity for orthopedic surgeons to be aware of synovial lipomatosis as a potential finding during joint surgery. Recognizing and addressing this condition promptly can improve surgical outcomes and patient satisfaction. Future research into the pathophysiology and recurrence of synovial lipomatosis will further guide clinicians in managing this unique condition effectively.

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