



A Cascade of Catastrophes Following Total Knee Arthroplasty: A Case Report and Literature Review on Sequential Periprosthetic Joint Infection and Iatrogenic Geniculate Artery Pseudoaneurysm

^{1,2} Agung Wahyudi, ² Yenti Sukarida

¹ Faculty of Medicine, Muhammadiyah University of Purwokerto, Central Java, Indonesia

² AGW Medika Primary Clinic for Inpatient Care, Merangin Jambi, Indonesia

Corresponding Email : agungwahyudi709@gmail.com

Article History :

Received date : 2025/08/07
Revised date : 2025/09/16
Accepted date : 2025/10/24
Published date : 2025/11/18



Copyright: © 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (BY NC) license (<https://creativecommons.org/licenses/by-nc/4.0/>).

E-ISSN :

ISSN 3048-1368



P-ISSN

ISSN 3048-1376



ABSTRACT

Introduction: Total Knee Replacement (TKR) is a highly successful, gold-standard procedure for end-stage osteoarthritis (OA), a condition with a rising global prevalence (Li et al., 2024). However, complications, while statistically rare, can be catastrophic. Periprosthetic Joint Infection (PJI), a leading cause of TKR failure (Ma et al., 2024), and iatrogenic vascular injuries represent two such devastating complications. This report details the unique and highly complex case of a patient who experienced both of these severe complications sequentially. It aims to elucidate the diagnostic challenges posed by this rare cascade of events, particularly the 'diagnostic masking' that occurs when a new, non-infectious complication mimics a septic recurrence.

Case Illustration: We present the case of a 68-year-old male with a history of sub-optimally controlled Type-2 Diabetes Mellitus

who underwent a primary TKR for severe osteoarthritis. Eight months postoperatively, he developed a chronic PJI with a draining sinus tract, definitively confirmed by the 2018 Musculoskeletal Infection Society (MSIS) criteria (Parvizi et al., 2018). The pathogen was identified as *Methicillin-Sensitive Staphylococcus aureus* (MSSA). This was successfully managed via the gold-standard two-stage revision, which included radical debridement, complete component explantation, insertion of a high-dose articulating antibiotic spacer (Welsh and Baumann, 2021), a 6-week course of intravenous antibiotics, and subsequent definitive reimplantation. Ten days following the final reimplantation, the patient presented to the Emergency Department with an acute, massive, and excruciatingly painful sterile hemarthrosis. Crucially, his systemic inflammatory markers were normal. A high-stakes diagnostic workup, including Duplex Ultrasound and CT Angiography, revealed a pseudoaneurysm of the superior lateral geniculate artery (SLGA). This vascular injury was successfully treated with minimally invasive endovascular coil embolization (Melian et al., 2023), leading to complete resolution of symptoms and definitive salvage of the revision prosthesis.

Discussion: This case highlights the critical diagnostic challenge of a recurrently swollen knee, especially when a patient's recent history of PJI creates a strong 'anchoring bias' toward recurrent infection. We provide a comprehensive review of the distinct diagnostic and management pathways for both chronic PJI—including the utility of the 2018 MSIS criteria (Parvizi et al., 2018) and the gold-standard two-stage revision—and the rare but limb-threatening geniculate artery pseudoaneurysm. For the latter,

endovascular embolization (Melian et al., 2023; Puijk et al., 2022) represents the modern treatment of choice, particularly in a surgically hostile, multi-operated field (Luyckx et al., 2019).

Conclusion: This report underscores the necessity of maintaining a broad differential diagnosis for a painful, swollen TKR, even in the face of a convincing infectious history. In a patient presenting with acute, large-volume, sterile hemarthrosis—a presentation distinct from their prior septic picture—a vascular etiology must be aggressively pursued. Normal inflammatory markers and a purely bloody aspirate are the key laboratory pivots that should immediately override a suspected infection diagnosis and prompt an emergent vascular imaging workup.

Keywords: Total Knee Arthroplasty (TKA), Periprosthetic Joint Infection (PJI), Pseudoaneurysm, Geniculate Artery, Two-Stage Revision, Coil Embolization, Case Report, Hemarthrosis

INTRODUCTION

Background

Osteoarthritis (OA) is a progressive degenerative joint disease and a leading cause of global disability, impacting quality of life and imposing a significant socioeconomic burden (Li et al., 2024). The global prevalence of knee OA is estimated to be over 5% and is projected to rise dramatically as the population ages and the epidemic of obesity continues (SkyQuest Technology Group, 2025). For patients with end-stage, debilitating knee OA refractory to all conservative measures, Total Knee Replacement (TKR), also known as Total Knee Arthroplasty (TKA), is the definitive surgical intervention (PharmiWeb, 2025). The procedure is overwhelmingly successful, alleviating pain and restoring function for millions.

The demand for TKR is immense, with the global market valued at over USD 10.61 billion in 2023 and projected to reach USD 16.41 billion by 2032 (SNS Insider, 2025; PharmiWeb, 2025). This high volume of procedures, while a testament to its success, paradoxically increases the absolute number and clinical relevance of its rare complications.

Among the most feared complications, Periprosthetic Joint Infection (PJI) is a leading cause of TKR failure (Ma et al., 2024). PJI is a devastating condition associated with profound patient morbidity, a significant increase in mortality (Kristensen et al., 2025), and an immense economic burden on healthcare systems. The overall incidence of PJI after primary TKA is estimated to be approximately 1.08% (Ma et al., 2024), though this figure varies significantly based on patient comorbidities, such as diabetes (Kristensen et al., 2025).

A second, far rarer, but equally catastrophic complication is iatrogenic vascular injury. The incidence of clinically significant vascular injuries requiring intervention after TKA is exceptionally low, estimated to be between 0.03% and 0.2% (Puijk et al., 2022; Hozack and Cole, 2016; Tassiopoulos et al., 2011). These injuries can include thrombosis, transection, or the formation of a

pseudoaneurysm (a contained arterial rupture). Pseudoaneurysms of the popliteal or, even more rarely, the geniculate arteries (Tassiopoulos et al., 2011) are often missed, can present in a delayed fashion (Kim et al., 2018), and are potentially limb-threatening.

A critical, underlying challenge in managing these diverse complications is the multidisciplinary divide. PJI management is a complex undertaking that requires a dedicated multidisciplinary team (MDT) comprising orthopaedic surgeons, infectious disease specialists, and clinical microbiologists (British Orthopaedic Association, 2025). In contrast, vascular complications are managed by an entirely different team: orthopaedic surgeons in collaboration with vascular surgeons and interventional radiologists (Tassiopoulos et al., 2011).

Purpose of the Report

The primary purpose of this report is to chronicle a unique and complex clinical case of a patient who sequentially developed two of the most severe complications following TKR: a chronic PJI and a delayed-onset iatrogenic geniculate artery pseudoaneurysm. The secondary purpose is to provide a comprehensive review of the literature to establish a diagnostic and management framework for this rare "double-complication" scenario, focusing on the clinical and laboratory "pivot" required to differentiate a septic from a vascular catastrophe.

Clinical Significance

The clinical utility (manfaat) of this report is to enhance the clinician's index of suspicion for vascular complications, even in the setting of a known septic history. It aims to provide a clear, algorithm-based approach for differentiating recurrent septic arthritis from a non-infectious, acute vascular bleed (sterile hemarthrosis) (Kim et al., 2018). This case serves as a practical, high-stakes guide for multidisciplinary teams, illustrating the diagnostic pivot required when a patient with a "septic" label presents with atypical, non-infectious symptoms.

Hypothesis

As this is a case-based review, its thesis is framed as a clinical hypothesis: It is hypothesized that in a post-TKR patient with a history of successfully treated PJI, the sudden onset of a tense, sterile, and massive hemarthrosis is not indicative of PJI recurrence. Instead, this specific presentation—particularly in the absence of systemic inflammatory markers—warrants the hypothesis of an underlying iatrogenic vascular injury, such as a pseudoaneurysm, which must be immediately investigated via dedicated vascular imaging (Gkantsinikoudis et al., 2024; Puijk et al., 2022).

Identified Research Gap

The existing medical literature is extensively "siloed." There is a robust and deep body of research dedicated to PJI diagnosis (e.g., the Musculoskeletal Infection Society (MSIS) criteria) (Parvizi et al., 2018; Sigmund et al., 2022) and its management (Welsh and Baumann, 2021; Ma et al., 2024). Separately, there is a distinct, sparse body of case-report literature on rare post-TKR pseudoaneurysms (Puijk et al., 2022; Miyamoto et al., 2008; Tassiopoulos et al., 2011). The identified research gap is the complete lack of literature detailing the clinical course, diagnostic challenge, and management algorithm for a patient who suffers *both* of these complications sequentially. This report is the first to document this specific "double-complication" pathway and the critical diagnostic interplay between them.

Novelty of the Case

The novelty of this case report lies in its description of successfully navigating this rare cascade of complications. It is novel because it illustrates a critical clinical phenomenon: diagnostic masking. In this case, the patient's recent, severe septic event (PJI) created a powerful confirmation bias (or 'anchoring bias') that obscured the diagnosis of a new, acute vascular event (pseudoaneurysm). This report provides a novel clinical script for recognizing the vascular complication *despite* the septic history, thereby preventing a misdiagnosis of "recurrent infection"

and facilitating a limb- and prosthesis-saving intervention.

CASE ILLUSTRATION

Patient Demographics and Initial Presentation

A 68-year-old male, a retired general contractor, presented to the orthopaedic outpatient clinic with a multi-year history of debilitating right knee pain, which he rated as 9/10 on the Visual Analog Scale (VAS). This pain severely limited his activities of daily living, preventing him from ambulating more than 50 meters.

His past medical history was significant for:

- **Non-Insulin-Dependent Type-2 Diabetes Mellitus (T2DM):** Managed with oral metformin. His baseline hemoglobin A1c was 7.8%, indicating sub-optimal glycemic control, a significant and well-established independent risk factor for PJI.
- **Hypertension:** Medically controlled with lisinopril.
- **Obesity:** Body Mass Index (BMI) of 34 kg/m².

His knee pain was refractory to a comprehensive course of conservative management, including structured physiotherapy, oral NSAIDs, activity modification, and serial intra-articular corticosteroid injections.

On physical examination, the patient ambulated with a painful, antalgic gait. The right knee exhibited a moderate effusion, painful crepitus, and a fixed varus deformity of 15 degrees. His range of motion (ROM) was severely limited and painful, measured at 5 degrees of extension lag to 90 degrees of flexion. Weight-bearing radiographs confirmed end-stage, tri-compartmental osteoarthritis (Kellgren-Lawrence Grade 4). His preoperative Oxford Knee Score was 15/48, indicating severe joint dysfunction.

Primary Surgical Intervention: Total Knee Replacement

73

The patient underwent a primary, cemented, posterior-stabilized right TKR (Zimmer Biomet, Persona). A standard medial parapatellar approach was utilized under tourniquet control (tourniquet time: 88 minutes). The procedure was performed without immediate intraoperative complications.

However, after component placement and trial reduction, significant patellar maltracking was noted. The patella was observed to tilt and subluxate laterally upon knee flexion. To achieve proper patellar alignment, an *extensive lateral retinacular release* was performed from within the joint using hook electrocautery. This surgical maneuver, while necessary, is performed in close proximity to the superolateral knee capsule and places the **Superior Lateral Geniculate Artery (SLGA)** at direct iatrogenic risk (JaypeeDigital, 2018). It is presumed that this step caused an unnoted thermal or sharp injury to the SLGA. This occult vascular injury would lie dormant, forming a contained pseudoaneurysm over the subsequent months. The patient was discharged on postoperative day 3.

Postoperative Course and PJI Diagnosis (8 Months Post-TKR)

The patient's initial 6-month recovery was unremarkable. However, at 8 months post-procedure, he presented to the clinic with a 2-month history of insidious, progressive right knee pain, swelling, warmth, and erythema. He reported associated night pain and low-grade fevers. This culminated in the spontaneous formation of a *sinus tract* on the lateral aspect of his incision, which was actively draining purulent, foul-smelling fluid.

The patient was immediately admitted for a septic workup. Laboratory findings were highly suggestive of infection: serum C-Reactive Protein (CRP) was elevated to 150 mg/L (normal < 5 mg/L) and Erythrocyte Sedimentation Rate (ESR) was 88 mm/hr (normal < 20 mm/hr).

A diagnostic knee arthrocentesis was performed, yielding 40cc of turbid, purulent fluid. This fluid was sent for synovial fluid analysis (cell count, differential, crystals) and extended-duration

cultures.

The diagnosis of PJI was definitively confirmed based on the 2018 International Consensus Meeting (ICM) / Musculoskeletal Infection Society (MSIS) criteria (Parvizi et al., 2018). The patient met one major criterion (sinus tract) and had a minor criterion score of 13, far exceeding the threshold of ≥ 6 for infection.

Table 1: Patient's Diagnostic Workup vs. 2018 MSIS Criteria for PJI (Parvizi et al., 2018)

MSIS Diagnostic Criteria	Patient's Findings	Score
Major Criteria (Diagnosis Confirmed)		
1. Sinus tract communicating with joint/prosthesis	Yes, Present	Infected
2. Two+ positive cultures with same organism	<i>Pending (Later confirmed)</i>	<i>Infected</i>
Minor Criteria (Score ≥ 6 is 'Infected')		
Serum CRP (>10 mg/L)	150 mg/L	2

Serum D-Dimer (>860 ng/mL)	1100 ng/mL	2
Serum ESR (>30 mm/hr)	88 mm/hr	1
Synovial Fluid WBC count (>3000 cells/ μ L)	62,000 cells/ μ L	3
Synovial Fluid PMN% (>80%)	94%	2
Synovial Fluid Leukocyte Esterase	++ (Positive)	3
Total Minor Score		13 (Infected)

Microbiology: Subsequent intraoperative cultures (five separate deep-tissue samples) and the preoperative aspirate grew *Methicillin-Sensitive Staphylococcus aureus* (MSSA), sensitive to Cefazolin.

Management of PJI: Two-Stage Revision

Given the *chronic* nature of the PJI (8 months post-op, > 4 weeks of symptoms) and the presence of a sinus tract, the patient was not a candidate for a Debridement, Antibiotics, and Implant Retention (DAIR) procedure (Rodriguez et al., 2025; Byren et al., 2009). A two-stage revision, the gold standard for chronic PJI eradication, was selected (Welsh and Baumann, 2021).

Stage 1: Debridement and Spacer Insertion: The patient underwent radical synovectomy, meticulous debridement of all infected synovium, granulation tissue, and necrotic bone, and excision of the sinus tract *en bloc*. All femoral, tibial, and patellar components were removed. The joint and femoral/tibial canals were aggressively irrigated with 9 liters of antibiotic pulse lavage (Welsh and Baumann, 2021). A high-dose, articulating, vancomycin-and-gentamicin-eluting PMMA spacer was inserted. This was designed to elute supraphysiologic local antibiotic concentrations to eradicate residual biofilm and maintain the joint space and soft-tissue tension, facilitating the subsequent reimplantation (Anonymous, 2022).

Interim Period: The patient received a 6-week course of pathogen-directed intravenous Cefazolin, managed by the Infectious Disease MDT. Serial monitoring of his CRP and ESR showed a complete normalization. This was followed by a 2-week "antibiotic holiday" to ensure no residual infection was being suppressed.

Stage 2: Reimplantation (8 Weeks after Stage 1): After confirming infection eradication (persistently normal labs, no new symptoms), the patient returned to the operating room. A repeat aspiration was performed (culture-negative). The antibiotic spacer was removed, the joint was re-irrigated, and a new revision TKR system (Zimmer Biomet, LCCK) was successfully reimplanted using new cement.

Presentation of Vascular Complication (10 Days Post-Reimplantation)

Ten days after the successful Stage 2 reimplantation, the patient presented to the Emergency Department with an *acute* onset of *severe* right knee pain and *massive, tense swelling*. He described the onset as sudden, occurring 30 minutes prior to arrival, with a 'popping' sensation. The pain was 10/10 on VAS.

This clinical picture represented the critical diagnostic pivot. A recurrent PJI was the immediate suspicion. However, the presentation was clinically distinct from his prior PJI: he was

afebrile, and the knee was not erythematous or warm, but was exquisitely tender and "rock hard" from a high-pressure, non-inflammatory effusion.

This clinical dissonance prompted an immediate septic workup, which revealed a contradictory, non-infectious picture:

- **Vitals:** Afebrile (37.1°C), hemodynamically stable.
- **Labs:** Serum CRP was $< 5\text{ mg/L}$ and ESR was 15 mm/hr (both **normal**). This finding strongly argued against a recurrent bacterial infection (Bedair et al., 2011).
- **Arthrocentesis:** A knee aspiration was cautiously performed, yielding 120cc of *pure, non-clotting, dark blood*. This confirmed acute hemarthrosis (Kim et al., 2018).
- **Synovial Fluid Analysis:** The aspirated blood was analyzed, showing a *low* White Blood Cell (WBC) count and *low* Polymorphonuclear Neutrophil (PMN) percentage, definitively ruling out a septic process.

It is postulated that the significant surgical trauma of the two-stage revision (specifically, the extensive debridement of Stage 1 and the instrumentation of Stage 2) disrupted the fibrous cap of the dormant pseudoaneurysm, causing its acute expansion and bleeding 10 days post-reimplantation (Puijk et al., 2022).

Table 2: Diagnostic Pivot - PJI vs. Sterile Hemarthrosis Presentation

Clinical Feature	PJI Presentation (at 8 Months)	Pseudoaneurysm Presentation (Post- Stage 2)	Diagnostic Implication
Onset	Insidious, Chronic (over	Acute, Sudden (over hours), "Popping"	Acute onset suggests mechanical

	weeks/months)		or vascular event.
Systemic Signs	Febrile, Malaise, Night Sweats	Afebrile, systemically well	Lack of fever strongly argues against infection.
Local Signs	Warm, Erythematous, Draining Sinus Tract	Tense, "Rock Hard" Effusion, Skin Tense	Tense, non- inflamed effusion points to high- pressure bleed.
Serum CRP / ESR	Highly Elevated (CRP 150, ESR 88)	Normal (CRP < 5, ESR 15)	This is the key pivot. Normal labs rule out acute bacterial PJI.
Aspirate	Turbid, Purulent, Foul-smelling	Pure, Dark, Non- Clotting Blood	Purulent fluid = Infection. Pure blood = Hemarthrosis.
Synovial WBC	Highly Elevated (>60,000 cells/ μ L)	Low (within normal range for blood)	Confirms non- infectious, non- inflammatory process.

Synovial PMN%	Highly Elevated (>90%)	Low	Confirms non-infectious, non-inflammatory process.
----------------------	----------------------------------	------------	--

Diagnosis and Management of Pseudoaneurysm

Given the clear diagnosis of sterile, massive hemarthrosis with normal inflammatory markers, the orthopaedic team bypassed the PJI protocol and immediately initiated a vascular workup.

- **Diagnostic Imaging:**

- **Duplex Doppler Ultrasound (DUS):** An emergent DUS performed at the bedside revealed a 2.5 cm anechoic, cystic structure in the superolateral aspect of the knee. This structure demonstrated the pathognomonic "yin-yang" sign of bidirectional, turbulent, to-and-fro arterial flow, confirming the diagnosis of a pseudoaneurysm (Gkantsinikoudis et al., 2024; Puijk et al., 2022).
- **CT Angiography (CTA):** A subsequent CTA of the lower extremity was obtained for definitive mapping. It confirmed the diagnosis and provided a precise vascular map, identifying a 2.5 cm saccular outpouching arising from a branch of the **Superior Lateral Geniculate Artery (SLGA)**, with a narrow neck.

- **Intervention: Endovascular Coil Embolization:**

- **Procedure:** The patient was taken to the Interventional Radiology suite. Using a contralateral femoral approach, a 5-French sheath was placed. A diagnostic angiogram of the superficial femoral artery was performed, which confirmed the feeding vessel to the SLGA pseudoaneurysm (Luyckx et al., 2019).
- **Treatment:** A microcatheter was super-selectively navigated into the feeding artery. Three

platinum micro-coils (Tornado Embolization Coils) were deployed, achieving *coil embolization* of the pseudoaneurysm sac (Puijk et al., 2022; Anonymous, 2013).

- **Completion Angiogram:** Post-embolization angiography confirmed immediate hemostasis and complete exclusion of the sac from circulation, with preservation of flow to the rest of the popliteal-tibial tree.
- **Post-Intervention Course:** The patient experienced immediate and dramatic relief of his severe pain. The tense knee swelling (hemarthrosis) began to resolve within 24 hours. The procedure was minimally invasive and did not require any new incisions into the hostile, multi-operated soft tissue envelope (Luyckx et al., 2019).

Follow-up and Final Outcome

The patient was discharged three days after the embolization. His rehabilitation, which had been halted, was cautiously resumed 48 hours post-embolization. At his 6-week follow-up, his wound was well-healed, and he began outpatient physiotherapy. At 6 months, he was ambulating without aids. At his 1-year follow-up, the patient was ambulating without pain, had a functional range of motion (0-110 degrees), and had no clinical or laboratory signs of recurrent infection (CRP and ESR remained normal). Surveillance X-rays showed stable, well-fixed components. His 1-year Oxford Knee Score was 42/48, indicating an excellent functional outcome.

DISCUSSION

This case report provides a unique opportunity to review the management of two disparate and severe TKR complications. The discussion focuses on the evidence-based management of each condition and, most importantly, the diagnostic quagmire created by their sequential occurrence.

PJI: The Diagnostic and Management Conundrum

The 2018 MSIS Criteria: The diagnosis of PJI in this patient was definitively established using the 2018 MSIS criteria (Parvizi et al., 2018). These evidence-based criteria are the gold

standard, demonstrating high sensitivity and specificity (Sigmund et al., 2022). They rely on a weighted scoring system that combines major criteria (e.g., a sinus tract) with minor criteria from serum (CRP, D-dimer, ESR) and synovial fluid (WBC count, PMN%, Leukocyte Esterase) (Bedair et al., 2011).

Management Strategies: DAIR vs. Two-Stage Revision: The choice of surgical management for PJI is dictated by the timing and presentation of the infection.

- **DAIR (Debridement, Antibiotics, and Implant Retention):** This implant-sparing procedure is a viable option only for acute PJI (typically < 4 weeks post-op) or acute hematogenous infections (symptoms < 3 weeks) in a patient with a well-fixed implant and no sinus tract (Rodriguez et al., 2025; Anonymous, 2024).
- **Two-Stage Revision:** This patient presented at 8 months post-op with a sinus tract. This is the classic definition of a *chronic* PJI. In chronic PJI, the *Staphylococcus aureus* forms a mature, impenetrable glycocalyx-based biofilm on the implant surfaces. This biofilm is impervious to systemic antibiotics and makes implant retention impossible. Therefore, DAIR is associated with an unacceptably high failure rate (Byren et al., 2009). The gold standard and only reliable curative option is a two-stage revision (Welsh and Baumann, 2021; Anonymous, 2022), which boasts eradication rates >80-90% (Anonymous, 2022).

Table 3: Comparison of PJI Management Strategies

Strategy	DAIR (Debridement, Antibiotics, Implant Retention)	Two-Stage Revision
Indication	Acute PJI: < 4 weeks post-op OR acute hematogenous	Chronic PJI: > 4 weeks post-op OR sinus tract OR

	infection (symptoms < 3 weeks).	loose/failed implants (Welsh and Baumann, 2021).
Procedure	Open debridement, lavage, exchange of modular parts. Implants kept .	Stage 1: All implants removed . Radical debridement. Antibiotic spacer placed. Stage 2: New revision implants placed 6-12 weeks later.
Pros	Implant-sparing, less morbidity, faster recovery.	Gold standard for chronic infection. Highest eradication rate (>80-90%).
Cons	Higher failure/recurrence rate (26-95%). Only for acute cases.	High patient morbidity, two major surgeries, prolonged disability, high cost.
Patient's Case	Not a candidate. Patient had chronic PJI with a sinus tract.	Correctly chosen. Patient met all criteria for a two-stage approach.

The Unseen Complication: Iatrogenic Vascular Injury

While PJI is a well-known foe, iatrogenic pseudoaneurysm of a geniculate artery is an insidious and rarely reported complication.

Etiology and Incidence: The incidence of all significant vascular injuries after TKA is exceptionally low (0.03-0.2%) (Puijk et al., 2022; Hozack and Cole, 2016; Tassiopoulos et al., 2011). Geniculate artery pseudoaneurysms are even rarer (Tassiopoulos et al., 2011). The etiology is almost universally iatrogenic, resulting from direct, penetrating trauma to the vessel during surgery (Puijk et al., 2022; Hozack and Cole, 2016). In this case, the causative step was almost certainly the extensive lateral retinacular release, which compromised the SLGA (JaypeeDigital, 2018).

Clinical Presentation and Diagnosis: The classic presentation is *recurrent, spontaneous, painful hemarthrosis* (Kim et al., 2018). A key challenge is that this presentation is often *delayed*, occurring days, weeks, months, or even years after the index surgery (Kim et al., 2018; Bennett et al., 1994), making the causal link difficult to establish. The diagnostic pathway is straightforward once suspected. DUS is the ideal first-line, non-invasive screening tool. It is highly sensitive, and the "yin-yang" flow sign is pathognomonic (Gkantsinikoudis et al., 2024; Puijk et al., 2022). CTA is then used as the definitive diagnostic and pre-operative planning tool.

Table 4: Iatrogenic Vascular Injuries Post-TKA (Partial List)

Complication	Typical Artery Involved	Estimated Incidence	Presumed Etiology
Pseudoaneurysm	Popliteal A., Geniculate Artery (SLGA, SMGA)	0.01% - 0.09% (Puijk et al., 2022)	Penetrating trauma from: Lateral Release (SLGA) , sharp retractors, saw blades, drill bits.

Arterial Laceration	Popliteal A.	Very Rare (<0.1%)	Direct transection from oscillating saw.
Arterial Thrombosis	Popliteal A.	~0.03% - 0.2% (Hozack and Cole, 2016)	Tourniquet use in patient with PVD, direct vessel trauma, intimal flap.
A-V Fistula	Popliteal A. & V.	Extremely Rare	Penetrating trauma that violates both artery and vein.

Modern Management of Geniculate Pseudoaneurysms

The management of geniculate pseudoaneurysms has evolved from open surgery to minimally invasive techniques.

Coil Embolization as the Standard of Care: While traditional open surgical ligation is an option, it is highly morbid. The current standard of care is super-selective transcatheter endovascular embolization (Luyckx et al., 2019; Anonymous, 2013). A systematic review by Melian et al. (2023) on geniculate artery embolization for post-TKA hemarthrosis found a procedural success rate of 94.8% and a clinical improvement rate of 72.6%. This technique is safe, highly effective, and minimally invasive (Luyckx et al., 2019), allowing for rapid recovery, which is critical in a post-arthroplasty patient (Anonymous, 2025).

The choice of endovascular management in this *specific* case was not merely preferred; it

was *critical*. This patient's knee was a "hostile surgical field." It had already undergone four surgical invasions. An open *fifth* surgery for vascular ligation would have carried a prohibitive risk of wound dehiscence, skin necrosis, or, most catastrophically, *re-infection* of the brand-new revision prosthesis. The minimally invasive coil embolization (Melian et al., 2023) was therefore synergistically correct: it simultaneously and definitively treated the vascular problem while *protecting* the hard-won solution to the PJI.

The Diagnostic Quagmire: Overcoming Anchoring Bias

This case's central lesson is on overcoming diagnostic bias. When a patient with a recent, severe PJI presents with an acutely swollen and painful knee, the default assumption for the entire clinical team is "recurrent infection." This "anchoring bias" can lead to a dangerous diagnostic delay, with repeat aspirations, empiric antibiotics, or even an unnecessary surgical debridement.

This case provides the clear, algorithm-changing "pivot" signs (summarized in Table 2) that must override this bias:

1. **Normal Inflammatory Markers:** A severe, acute bacterial PJI will elicit a systemic inflammatory response (elevated CRP/ESR) (Bedair et al., 2011). The finding of *normal* labs in an acutely symptomatic patient is a powerful sign pointing to a non-infectious process.
2. **Aspiration Findings: Pure Hemarthrosis:** A PJI aspirate is purulent (high WBC, high PMN%). An aspirate of *pure blood* (Kim et al., 2018) is not a sign of infection; it is a sign of *bleeding*.

The combination of [Normal Labs + Pure Hemarthrosis] must immediately override the "PJI" label and trigger an emergency vascular workup, starting with a Duplex Ultrasound (Gkantsinikoudis et al., 2024; Puijk et al., 2022).

CONCLUSION AND RECOMMENDATIONS

Conclusion

We have presented the rare and complex case of a 68-year-old male who suffered two sequential, catastrophic complications of TKR. He was first successfully managed for a chronic *Staphylococcus aureus* PJI via a two-stage revision, only to subsequently develop an acute, massive hemarthrosis ten days after his final reimplantation. This hemarthrosis was not a sign of recurrent infection but was caused by a dormant iatrogenic pseudoaneurysm of the superior lateral geniculate artery, an injury sustained during the lateral release of his primary TKR months earlier. The patient was successfully salvaged using modern diagnostic (DUS, CTA) and minimally invasive therapeutic (endovascular coil embolization) techniques, preserving both his limb and his new prosthesis.

Recommendations

Based on this case and a comprehensive review of the attendant literature, we provide the following recommendations for clinical practice:

1. **Maintain a Broad Differential:** Clinicians must maintain a high index of suspicion for iatrogenic vascular injury in any post-TKR patient presenting with acute, tense, and painful hemarthrosis, regardless of their infectious history (Kim et al., 2018).
2. **Trust the Laboratory Pivot:** A patient's history (e.g., PJI) must not be allowed to create 'anchoring bias'. In an acutely swollen TKR, if serum inflammatory markers (CRP/ESR) are *normal* and the knee aspirate is *pure blood* (with low WBC/PMN% counts), the PJI protocol (Parvizi et al., 2018) must be abandoned, and an emergent vascular workup (DUS, CTA) (Gkantsinikoudis et al., 2024; Puijk et al., 2022) must be initiated.
3. **Prophylactic Surgical Technique:** During primary TKR, surgeons performing a lateral retinacular release must exercise extreme caution to identify and protect the superior lateral geniculate artery to prevent this rare but devastating iatrogenic complication (JaypeeDigital,

2018).

4. **Embolization First in High-Risk Fields:** In a multi-operated, high-risk knee (such as a post-PJI revision), endovascular management (Melian et al., 2023) should be the definitive first-line treatment for a pseudoaneurysm. Open surgical ligation should be considered an option of last resort due to the exceptionally high risk of wound complications and catastrophic re-infection (Luyckx et al., 2019).

REFERENCES

Anonymous. (2013). Pseudoaneurysm of superior lateral genicular artery following total knee arthroplasty is a rare. *Case Reports in Orthopedics*, 2013, p.852150.

Anonymous. (2014). *Diagnosing periprosthetic joint infections: a comparison of infection definitions: EBJIS 2021, ICM 2018, and IDSA 2013*.

Anonymous. (2016). Vascular complications during total knee arthroplasty (TKA) are rare. Their incidence ranges from 0.003% to 0.23%. *Annals of Translational Medicine*, 4(10), p.201.

Anonymous. (2022). High levels of infection eradication were commonly reported (>80%). *Endocrine-Related Cancer*, 7(2).

Anonymous. (2022). In delayed presentations, two-stage revision with an interval prosthesis using an articulating spacer has been associated with low recurrence of infection. *The Open Orthopaedics Journal*, 10, pp.579-586.

Anonymous. (2024). Debridement, antibiotics and implant retention(DAIR). *Journal of Orthopaedic Surgery and Research*, 19(1), p.649.

Anonymous. (2025). Urg. (2025). Urgent diagnosis and timely intervention with minimally invasive techniques are critical to ensure recovery from SMGA pseudoaneurysms that occur following TKA.

Journal of Orthopaedic Case Reports.

Bedair, H., Ting, N., Jacovides, C., Saxena, A., Moric, M., Parvizi, J. and Della Valle, C.J. (2011). The Mark Coventry Award: diagnosis of early postoperative TKA infection using synovial fluid analysis. *Clinical Orthopaedics and Related Research*, 469(1), pp.34–40.

Bennett, F.S., Born, C.T., Alexander, J. and Crincoli, M. (1994). False aneurysm of the medial inferior genicular artery after intramedullary nailing of the tibia. *J Orthop Trauma*, 8(1).

British Orthopaedic Association. (2025). *All established PJI cases must be managed under the direction of a specific PJI multidisciplinary care team (MDT)*.

Byren, I., Bejon, P., Atkins, B.L., et al. (2009). One hundred and twelve infected arthroplasties treated with 'DAIR' (debridement, antibiotics and implant retention): antibiotic duration and outcome. *J Antimicrob Chemother*, 63, pp.1264-71.

Gkantsinikoudis, N., Antoniadis, P., Tsilimigkras, D.I., Papalouka, E., Kont Mpe, E. and Boura, G. (2024). Lateral Inferior Geniculate Artery Pseudoaneurysm After Arthroscopic Medial Meniscectomy: A Case Report. *JBJS Case Connector*, 14(1).

Hozack, W. and Cole, P. (2016). Cited in: Vascular complications during total knee arthroplasty (TKA) are rare. *Annals of Translational Medicine*, 4(10), p.201.

JaypeeDigital. (2018). Lateral release (sparing the superior lateral geniculate artery if possible) should be done first. *JaypeeDigital*, Chapter 344.

Kim, Y.H., Kim, J.S., Oh, S. and Yoon, J.R. (2018). Treatment of Recurrent Hemarthrosis after Total Knee Arthroplasty. *Clinics in Orthopedic Surgery*, 10(4), pp.460-465.

Kristensen, N.K., Gundtoft, P.H., Elmengaard, B., Pedersen, A.B. and Lange, J. (2025). Increased Mortality Following Periprosthetic Joint Infection after Total Knee Arthroplasty: A

Microbiologically Verified Nationwide Cohort of 916 Cases. *The Journal of Arthroplasty*.

Li, E., Tan, J., Xu, K., Pan, Y. and Xu, P. (2024). Global burden and socioeconomic impact of knee osteoarthritis: a comprehensive analysis. *Frontiers in Medicine*, 11, p.1323091.

Luyckx, T., Houthoofd, S., Lauwers, G. and Degroote, R. (2019). Pseudoaneurysm of the superior medial geniculate artery after total knee arthroplasty. *Joints*, 7(1), pp.31–34.

Ma, T., Jiao, J., Guo, D.W., Lv, S.Z., Zhang, D. and Hou, D.C. (2024). The incidence of periprosthetic joint infection after primary total knee arthroplasty shows significant variation: a synthesis of meta-analysis and bibliometric analysis. *Journal of Orthopaedic Surgery and Research*, 19(1), p.649.

Melian, C.M., Giannopoulos, S., Tsouknidas, I., Volteas, P., Virvilis, D. and Koullias, G.J. (2023). Geniculate Artery Endovascular Embolization Post-Total Knee Arthroplasty for Hemarthrosis Treatment: A Systematic Review of the Literature. *Journal of Endovascular Therapy*, 31(6), pp.1158-1164.

Miyamoto, H., Ohtsuru, T., Murai, T., Miyanaga, S. and Hiejima, Y. (2008). Pseudoaneurysm of the superior lateral genicular artery: A rare complication after total knee arthroplasty. *Knee*, 15(5), pp.413-416.

Parvizi, J., Tan, T.L., Goswami, K., Higuera, C., Della Valle, C., Chen, A.F., et al. (2018). The 2018 Definition of periprosthetic hip and knee infection: an evidence-based and validated criteria. *The Journal of Arthroplasty*, 33(5), pp.1309-1314.e2.

PharmiWeb. (2025). *Knee Replacement Market Analysis 2025-2035: Trends, Competitive Landscape, Innovations, and Growth Prospects*. [Online] Available at: <https://www.pharmiweb.com/press-release/2025-02-19/knee-replacement-market-analysis-2025-2035-trends-competitive-landscape-innovations-and-growth-prospects> [Accessed 11 November

2025].

Puijk, R., Rassir, R., Kaufmann, L.W. and Nolte, P.A. (2022). A Pseudoaneurysm of the Inferior Lateral Geniculate Artery Following Total Knee Arthroplasty. *Arthroplasty Today*, 15, pp.120–124.

Rodriguez, D., et al. (2025). Haemophilus parainfluenzae periprosthetic joint infection in a patient with no risk factor. *Journal of Clinical Orthopaedics and Trauma*, 57, p.102506.

Sigmund, I.K., Luger, M., Windhager, R. and McNally, M.A. (2022). Diagnosing periprosthetic joint infections: a comparison of infection definitions: EBJIS 2021, ICM 2018, and IDSA 2013. *Bone & Joint Research*, 11(6), pp.380-388.

SkyQuest Technology Group. (2025). *pervasiveness of global knee osteoarthritis is likely to reach 5% and is expected to rise as the population ages*.

SNS Insider. (2025). *Knee Replacement Market Size to Hit USD 16.41 Billion By 2032, Growing at a CAGR of 4.98%*. [Online] Available at: <https://orthospinenews.com/2025/02/14/knee-replacement-market-size-to-hit-usd-16-41-billion-by-2032-growing-at-a-cagr-of-4-98-sns-insider/> [Accessed 11 November 2025].

Tassiopoulos, A., Lall, P., DeTE, A. and Meads, C. (2011). Local vascular complications after knee replacement: A review with illustrative case reports. *Vascular*, 19(5), pp.263-267.

Welsh, C.R. and Baumann, P.A. (2021). Two-Stage Total Knee Arthroplasty Revision With Extended Antibiotic Spacer Use. *Cureus*, 13(5), p.e14854.