



Physiotherapy Rehabilitation Protocol for Pseudomonas-Induced Knee Septic Arthritis: A Single Subject Research

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ABSTRACT

A 20-year-old male diagnosed with knee septic arthritis caused by *Pseudomonas aeruginosa* underwent arthrotomy and synovectomy to address the infection. Timely physiotherapy was critical to prevent rapid joint damage and long-term disability. A structured rehabilitation program began with cryotherapy, passive range of motion exercises, and isometric strengthening to reduce inflammation and maintain joint mobility. Over eight weeks, the program advanced to active range of motion, resistance exercises, balance, and proprioception training to enhance strength and function. By week four, the patient achieved 90° of knee flexion, with reduced pain and swelling. By week eight, knee flexion reached 120°, with restored strength and stability, allowing the patient to resume daily activities without complications. This case highlights the importance of early, tailored physiotherapy in managing septic arthritis caused by aggressive pathogens, emphasizing its role in preventing disability, optimizing joint function, and supporting a full recovery.

KEYWORDS:

Septic arthritis, young male, Physiotherapy, Chronic, Rehabilitation, *Pseudomonas aeruginosa*

INTRODUCTION

Septic arthritis, a severe condition, can extensively damage joint cartilage and bone, leading to permanent loss of joint function. Its incidence ranges from 4 to 12 cases per 100,000 people. *Staphylococcus aureus* is the most common causative pathogen, but *Pseudomonas aeruginosa*, a Gram-negative bacterium, also contributes significantly to septic arthritis cases (1). Only 2% of patients in a combined series had *Pseudomonas* as the cause, indicating its rarity (2). The knee joint is commonly affected, accounting for at least 50% of cases (3). Infection may enter joints via the bloodstream or directly through injuries or medical procedures. Immunosuppressed or hospitalized patients, particularly those with invasive procedures, intravascular devices, or urinary catheters, face higher risks of bacteremia. Compromised immunity or pre-existing joint damage increases infection likelihood. Risk factors include rheumatoid arthritis, osteoarthritis, low socio-economic status, intravenous drug use, alcoholism, diabetes, joint prostheses, cutaneous ulcers, or prior intra-articular corticosteroid injections (4). Joint pain typically appears 3 to 7 days after infection onset (5). Symptoms like pain, swelling, tenderness, fever, redness, and reduced range of motion are common. Delayed treatment can lead to poor prognosis, making prompt diagnosis via arthroscopy and immediate intervention, such as arthrotomy washout, critical. Early physiotherapy rehabilitation is essential to reduce pain, enhance stability, decrease swelling, and improve strength and mobility in the affected limb. Physiotherapy also supports functional independence and daily activities (6). This case report examines a 20-year-old male with *Pseudomonas aeruginosa*-induced septic arthritis, highlighting physiotherapy's critical role in recovery.

PATIENT INFORMATION

On 24/08/2024, a 20-year-old male experienced sudden left knee pain, swelling, and trouble bearing weight on the affected leg. Symptoms started days earlier, progressively intensifying, without fever or systemic symptoms. He reported no recent trauma, injury, or surgical procedures and denied intravenous drug use, recent infections, or skin lesions. On 28/08/2024, he underwent arthrotomy and synovectomy. The patient had no history of chronic conditions, autoimmune diseases, or frequent infections. He had no prior surgeries and took no regular medications. His family history showed no notable conditions like arthritis, immune disorders, or genetic predispositions to joint problems. Previously, the patient maintained an active lifestyle with no knee issues or joint-related complaints before this incident.

CLINICAL FINDINGS

Examination of the left knee showed swelling, tenderness, and warmth, indicating inflammation. No open wounds, skin discoloration, or sinuses were observed around the knee. Palpation confirmed significant tenderness and a positive patellar tap test, suggesting joint effusion. The left knee's range of motion was severely limited, with flexion restricted to 60°, while the right knee exhibited normal motion, ranging from 0-135°. Pain prevented the patient from bearing weight on the affected leg, but distal neurovascular evaluation showed no abnormalities, with sensation and pulses equal in both lower limbs.

TIMELINE

DATE	CONSULTATION	CLINICAL MANIFESTATION	MANAGEMENT
18/08/2024	-	The onset of swelling in the left knee	-
21/08/24	Medical	Pain and swelling in the left knee	X-ray, Medications for pain and swelling.
24/08/2024	Medical	Increased swelling	MRI, Arthrocentesis, X-ray, and admission.
28/08/24	Surgical	Positive for <i>Pseudomonas aeruginosa</i>	Arthrotomy and Synovectomy
31/08/2024	Physiotherapy	Post-op pain, swelling	Exercises
8/10/2024	Follow up		

Table 1: Timeline of events

**DIAGNOSTIC ASSESSMENT:**

Investigation	Result	Normal Range	Interpretation
WBC Count	13,000 cells/ μ L	4,000 - 11,000 cells/ μ L	Elevated, indicating infection
Platelet Count	651,000/ μ L	150,000 - 450,000/ μ L	Elevated, often seen in response to infection
Absolute Neutrophils	9,100/ μ L	1,500 - 8,000/ μ L	Elevated, indicating a bacterial infection
Absolute Eosinophils	520/ μ L	0 - 500/ μ L	Within normal limits
Total Protein (Serum)	8.60 g/dL	6.0 - 8.3 g/dL	Slightly elevated, may indicate inflammation
Globulin	4.50 g/dL	2.0 - 3.5 g/dL	Elevated, consistent with an inflammatory response
Prothrombin Time	1.27 seconds	1.0 - 1.3 seconds	Within normal limits

Table 2: Investigations report

Microbiology Report	Result	Interpretation
Acid-fast Bacilli	No acid-fast bacilli seen	No evidence of tuberculosis
Gram-negative Bacilli	No gram-negative bacilli were seen	No other gram-negative bacteria detected
Culture Result	Positive for <i>Pseudomonas aeruginosa</i>	Confirms bacterial septic arthritis

Table 3: Microbiology report



A recently described antibody screening technique demonstrated that *P. aeruginosa* was the infecting organism.

DIAGNOSIS

The findings are in accordance with Septic Arthritis caused by *Pseudomonas aeruginosa*

THERAPEUTIC INTERVENTION

Physiotherapy rehabilitation started with educating the patient on exercise therapy's role in preserving surrounding musculature and soft tissue integrity, and strengthening affected muscles. The treatment protocol aimed to reduce pain, restore knee joint mobility, and strengthen surrounding muscles to recover functional mobility. For the first two weeks, the focus was on controlling inflammation and protecting the joint. Rest and joint protection were emphasized, using crutches or a walker to reduce weight-bearing on the affected leg. Cryotherapy was applied for 15-20 minutes, 3-4 times daily, to decrease swelling and pain. Gentle passive range of motion exercises, like pain-free knee flexion and extension, were introduced to prevent stiffness. Isometric quadriceps exercises and ankle pumps were included to maintain muscle activation and improve circulation.

In weeks 3 and 4, the emphasis shifted to enhancing mobility and strength while protecting the joint. Active-assisted and active range of motion exercises were used to progressively increase knee flexion and extension, targeting 90 degrees by week 4's end. Strengthening exercises, such as isometric quadriceps, hamstring exercises, and straight leg raises, began without resistance. Light resistance, like ankle weights or bands, was added as tolerated. Icing continued for pain management.

During weeks 5 and 6, the protocol advanced to more intensive strengthening and range of motion exercises, aiming for 120 degrees of knee flexion. Resistance for quadriceps, hamstrings, and hip muscles was gradually increased. Dynamic exercises, including squats, lunges, and step-ups, were introduced. Balance and proprioception training started on stable surfaces, progressing to unstable ones, to enhance joint stability. Gait training focused on reducing assistive device use as strength and confidence improved.

By weeks 7 and 8, the focus was on resuming functional activities, targeting full range of motion and strength recovery in quadriceps, hamstrings, and supporting muscles. Full range of motion exercises aimed for 135 degrees of knee flexion. Functional strengthening, including deep squats and higher step-ups, progressed as tolerated. Pain-free plyometric exercises, like mini jumps, were introduced. Proprioception and agility drills continued. Pain, swelling, range of motion, and strength were assessed every 1-2 weeks to track progress and adjust the protocol. Precautions ensured activities avoided increasing pain or swelling, with exercises introduced gradually to prevent joint overload.



Figure 1: Dynamic Quadriceps



Figure 2: Wall Squats



Figure 3: Pelvic Bridging



Figure 4: Prone knee extension with resistance



Figure 5: Continuous passive motion

PATIENT PERSPECTIVE

The 20-year-old male experienced sudden knee pain and swelling, making walking difficult and causing concern due to no prior injury. After being diagnosed with septic arthritis caused by *Pseudomonas aeruginosa*, he felt relieved but apprehensive about recovery. He is committed to following the physiotherapy plan to regain mobility and return to his normal activities.

INFORMED CONSENT

The patient was first informed about the study, and then informed consent was obtained.

DISCUSSION

This case report details septic arthritis of the knee in a 20-year-old male, emphasizing its rarity due to *Pseudomonas aeruginosa* in young individuals and outlining diagnosis and physiotherapy strategies. Septic arthritis results from pyogenic bacterial infection of a synovial joint, with the knee joint affected in at least 50% of cases (3). Infection by *P. aeruginosa* is uncommon (2). Wirtz et al. noted that early arthrotomy washout is the most effective treatment, with debridement improving functional outcomes (7). Research highlights that while medical and surgical interventions are vital for septic arthritis, physiotherapy is equally critical for restoring functional abilities (3). Hamstring and quadriceps strengthening began immediately in rehabilitation. Chabaud et al. recommended starting with isometric exercises, progressing to dynamic ones to enhance these muscle groups, beginning with open-chain exercises and advancing to closed-chain

exercises for improved strength (8). This report demonstrates that conventional physiotherapy significantly improved range of motion, strength, quality of life, and functional independence.

CONCLUSION

This case of septic arthritis caused by *Pseudomonas aeruginosa* in a healthy 20-year-old male without prior trauma or surgical intervention underscores the importance of early diagnosis and intervention in managing joint infections. Prompt medical treatment, including antibiotic therapy and joint aspiration, was crucial in controlling the infection and preventing long-term complications. Physiotherapy played a pivotal role in the patient's recovery, helping to restore knee function, strength, and mobility through a structured and progressive rehabilitation plan. This case highlights the need for interdisciplinary care in managing septic arthritis and ensuring optimal outcomes, especially in young, active individuals.

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