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Case Report

Eccentric osteolytic lesion of the proximal tibia secondary to solitary bone plasmacytoma managed with reconstruction surgery: a case report

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ABSTRACT

Solitary bone plasmacytoma (SBP) is a rare plasma cell neoplasm characterized by localized monoclonal proliferation without systemic involvement, most commonly affecting the axial skeleton, while involvement of long bones such as the tibia remains distinctly uncommon. We report a case of a 51-year-old male presenting with progressive pain in the right proximal leg and difficulty in weight-bearing for three months. Clinical examination revealed localized tenderness over the medial proximal tibia with restricted knee motion. Radiographs demonstrated a well-defined eccentric osteolytic lesion with cortical breach and pathological fracture, while advanced imaging confirmed an intramedullary lesion with cortical destruction. Histopathological evaluation revealed sheets of malignant plasma cells, confirming plasmacytoma. Comprehensive systemic work-up, including skeletal survey, bone marrow biopsy, and biochemical analysis, excluded multiple myeloma. The patient underwent intralesional curettage followed by polymethylmethacrylate cement augmentation and proximal tibial locking plate fixation to restore structural stability. SBP involving the tibia is uncommon and may mimic other osteolytic lesions, necessitating thorough diagnostic evaluation to exclude systemic disease. Surgical management becomes essential in cases with structural compromise, where cement augmentation provides immediate mechanical stability, facilitates early mobilization, and may contribute to local tumor control. Intralesional curettage combined with cement-augmented internal fixation represents an effective reconstructive strategy for tibial SBP, enabling early weight-bearing and favorable functional outcomes. Long-term surveillance remains essential to monitor for progression to multiple myeloma.

Keywords: Solitary plasmacytoma, Osteolytic lesion, Cementoplasty, Pathological fracture, Orthopaedic oncology, Intralesional curettage

INTRODUCTION

Solitary plasmacytoma is a localized proliferation of monoclonal plasma cells arising from bone marrow, without evidence of systemic plasma cell dyscrasia. It accounts for approximately 5-10% of all plasma cell neoplasms and is broadly categorized into SBP and extramedullary plasmacytoma.[1,2] SBP predominantly involves the axial skeleton, particularly the vertebral column and skull, due to their high red marrow content.[3] In contrast, appendicular skeleton involvement is relatively uncommon, with tibial localization being particularly rare and infrequently reported in literature.[4] Clinically, patients present with localized pain, swelling, or mechanical symptoms, and in advanced cases, pathological fractures may occur due to cortical destruction.[5] Radiologically, SBP typically appears as a well-defined osteolytic lesion with minimal periosteal

reaction, often mimicking other benign and malignant conditions such as giant cell tumor, metastasis, or infection.[6] Therefore, histopathological confirmation is essential. The differentiation of SBP from multiple myeloma is critical, as management strategies and prognosis differ significantly. Diagnostic work-up includes skeletal survey, bone marrow biopsy, serum protein electrophoresis, immunofixation studies, and biochemical evaluation.[2,7] While radiotherapy remains the primary treatment modality owing to the radiosensitive nature of plasma cells, surgical intervention is indicated in cases with structural compromise, impending fracture, or established instability.[8] This case report highlights a rare presentation of SBP in the proximal tibia managed successfully with intralesional curettage, cement augmentation, and internal fixation, emphasizing both diagnostic challenges and therapeutic considerations.

CASE REPORT

We illustrate a rare case of a 51-year-old gentleman who presented to the outpatient department with a chief complaint of pain in his right upper leg for duration of 3 months. The pain was insidious in onset and gradually progressive in nature, associated with inability to bear weight on the affected limb. Clinical examination revealed significant pinpoint tenderness over the medial aspect of the proximal tibia just below the joint line. The knee range of motion was painful and limited, without any distal neurovascular deficit. Plain radiographs of the right knee joint with upper leg anteroposterior and lateral views were obtained (Figure 1), which demonstrated an extra-articular, well-defined, solitary expansile eccentric osteolytic lesion in the medial aspect of the proximal tibia with cortical breach and pathological fracture of the medial wall, without any obvious periosteal reaction. A CT scan (Figure 2), along with plain and contrast-enhanced MRI (Figures 3 and 4), revealed a well-defined heterogeneously enhancing eccentric intramedullary lesion in the metadiaphyseal region of the proximal tibia with cortical destruction leading to a pathological fracture. The patient underwent a pre-operative needle biopsy to ascertain the nature of the lesion, and histopathological examination revealed sheets of malignant plasma cells with CD138 positivity, suggestive of plasmacytoma. To differentiate it from multiple myeloma, a comprehensive work-up was performed (Table 1). Skeletal survey did not reveal any additional lesions. Immunofixation electrophoresis demonstrated increased IgG kappa with a raised kappa-to-lambda ratio, consistent with monoclonal gammopathy, while bone marrow biopsy showed no evidence of infiltration. Considering the structural compromise, surgical management was planned. After obtaining fitness clearance from the anesthetist, hematologist, and medical oncologist, and administering appropriate prophylactic antibiotics, the patient was taken up for surgery. With the knee in slight flexion, a standard medial approach was utilized through a curvilinear incision over the medial tibial plateau. Following exposure, the pes anserinus tendons were identified and reflected posteriorly to expose the posteromedial aspect of the proximal tibia (Figure 5). An osteolytic lesion measuring approximately 32×26 mm was identified at the metadiaphyseal junction with significant cortical destruction. Extensile intralesional curettage was performed using sequential curettes, and the cavity was further cleared using a high-speed burr until healthy cortical bone was reached. The curetted material was sent for histopathological analysis. The cavity was thoroughly irrigated with normal saline and hydrogen peroxide. A 3.5 mm proximal tibial locking compression plate (MERIL Life Sciences Pvt Ltd, India) was then applied, with cortical screws placed distally and metaphyseal screws proximally, leaving the defect area unfilled initially (Figure 6). Bone cement (polymethylmethacrylate, PALACOS®, Heraeus Medical, Germany) was subsequently used to fill the defect (cementoplasty), and the remaining screws were inserted through the cement to augment fixation (Figure 7). Wound closure was performed in layers. Postoperatively, a standard rehabilitation protocol was followed. The patient was encouraged early mobilization and allowed assisted full weight-bearing with walker support from the second postoperative day, along with physiotherapy. Sutures were removed on the 15th postoperative day. Immediate postoperative radiographs demonstrated satisfactory cement-augmented plate fixation (Figure 8). At 3 months follow-up, the patient had regained independent ambulation with a pain-free functional range of motion. The Oxford knee score improved from a preoperative value of 17 to 42, indicating excellent functional outcome. Follow-up radiograph demonstrated a well-aligned and stable construct with no evidence of implant loosening (Figure 9). The patient continues to maintain good functional recovery and is currently undergoing adjuvant radiotherapy.

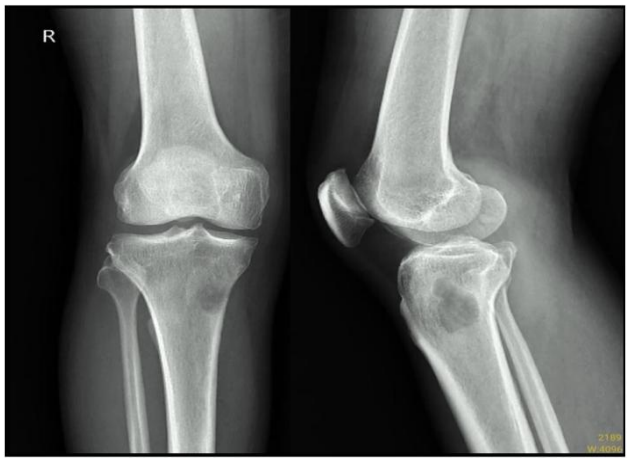

Figure 1: Anteroposterior and lateral radiographs of the right knee and proximal tibia.

*Illustrates a well-defined, eccentric, expansile osteolytic lesion located in medial aspect of proximal tibial metadiaphysis. The lesion shows cortical thinning and breach with a pathological fracture of the medial cortex, without periosteal reaction.

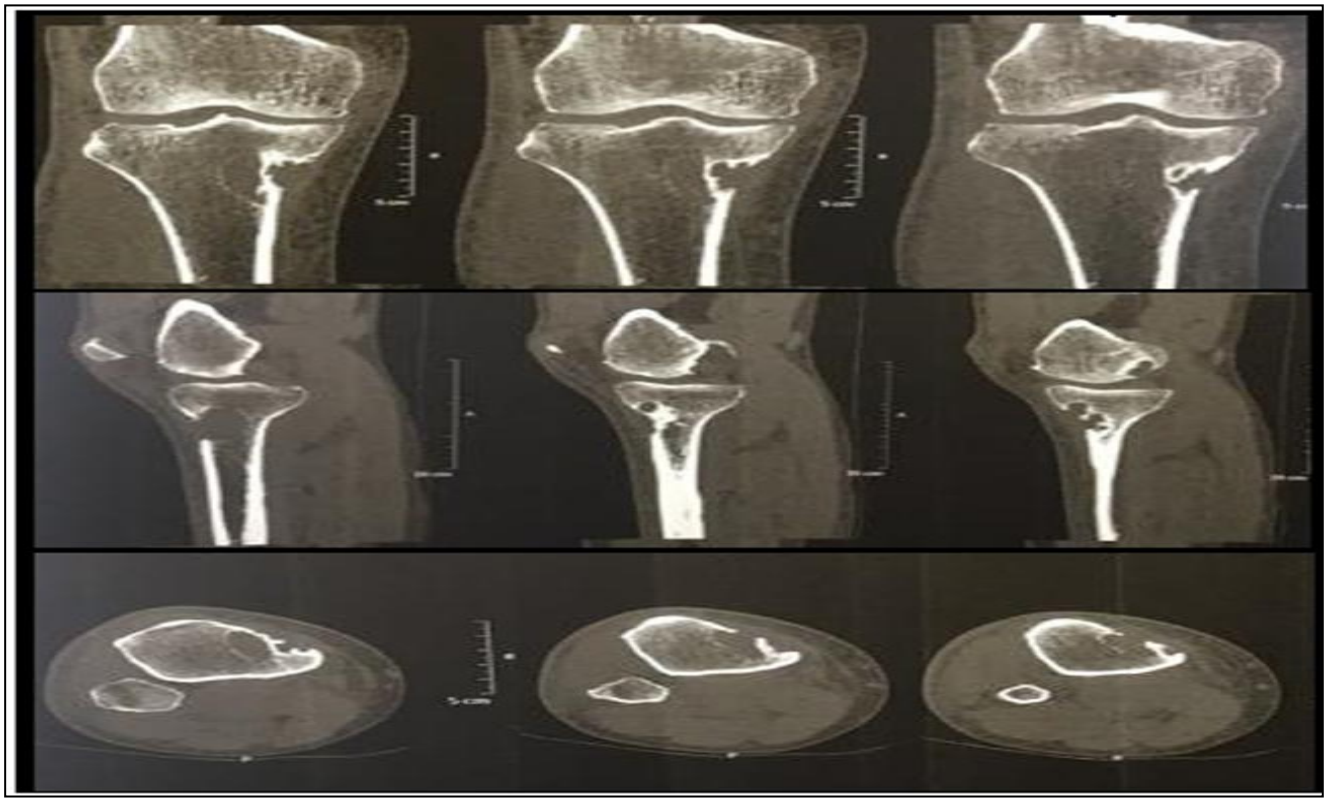

Figure 2: Computed tomography scan illustrating an expansile osteolytic lesion in the proximal tibia with cortical destruction and thinning.

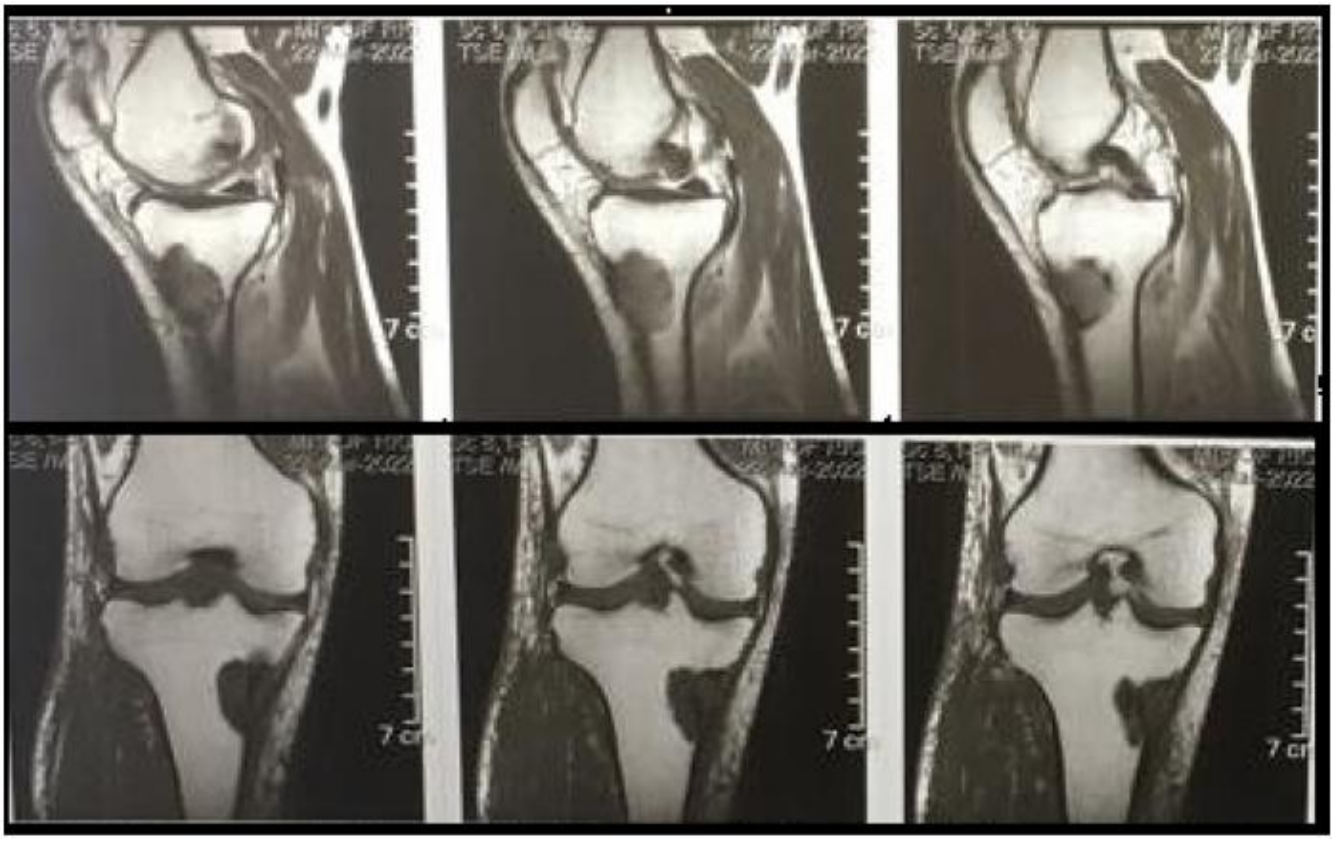

Figure 3: Magnetic resonance imaging (T1-weighted) showing a hypointense intramedullary lesion in the proximal tibial metadiaphyseal region, indicating marrow involvement.

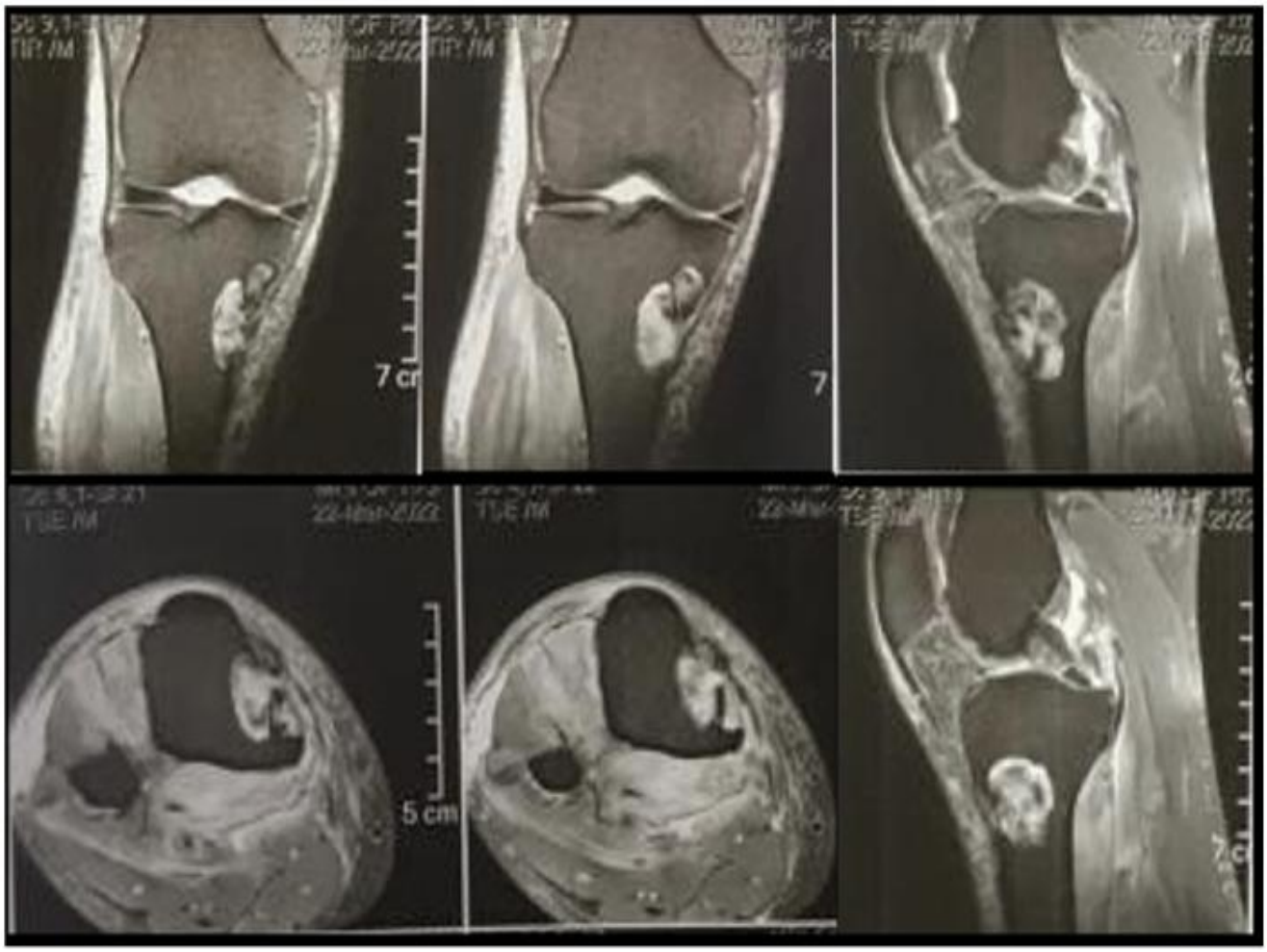

Figure 4: Contrast-enhanced MRI demonstrating heterogeneous enhancement of the lesion, confirming its neoplastic nature and extent within the bone.

Table 1: Summary of serological, microbiological, and histopathological investigations performed during diagnostic work-up.

Investigations	Reports with reference values
Total leukocyte count	8.1×109 /l (4-11×109 /l)
Haemoglobin	12.7 g/dl (13-17 g/dl)
Erythrocyte sedimentation rate	5 mm/hour (0-20 mm/hour)
c-reactive protein	3.9 mg/l (0-6 mg/l)
Total serum protein	7.10 g/dl (6-8 gm/dl)
Serum albumin	4.52 g/dl (3.5-5 gm/dl)
Serum calcium	9.5 mg/dl (8.9-10.3 mg/dl)
Serum phosphorus	3.7 mg/dl (2.4-4.7 mg/dl)
Alkaline phosphatase	98 U/l (50-140 U/l)
Serum urea	25 mg/dl (10-40 mg/dl)
Serum creatinine	0.9 mg/dl (0.6-1.4 mg/dl)
Bence Jones protein (Urine)	Negative
Culture and sensitivity	No growth
Serum electrophoresis	No M band seen
CD138	Positive for tumour cells
Tissue biopsy	Sheets of malignant plasma cells seen
Immunofixation electrophoresis	Increased IgG kappa High Kappa-to-lambda(K/L) ratio
Bone marrow aspirate and biopsy	No evidence of Infiltration

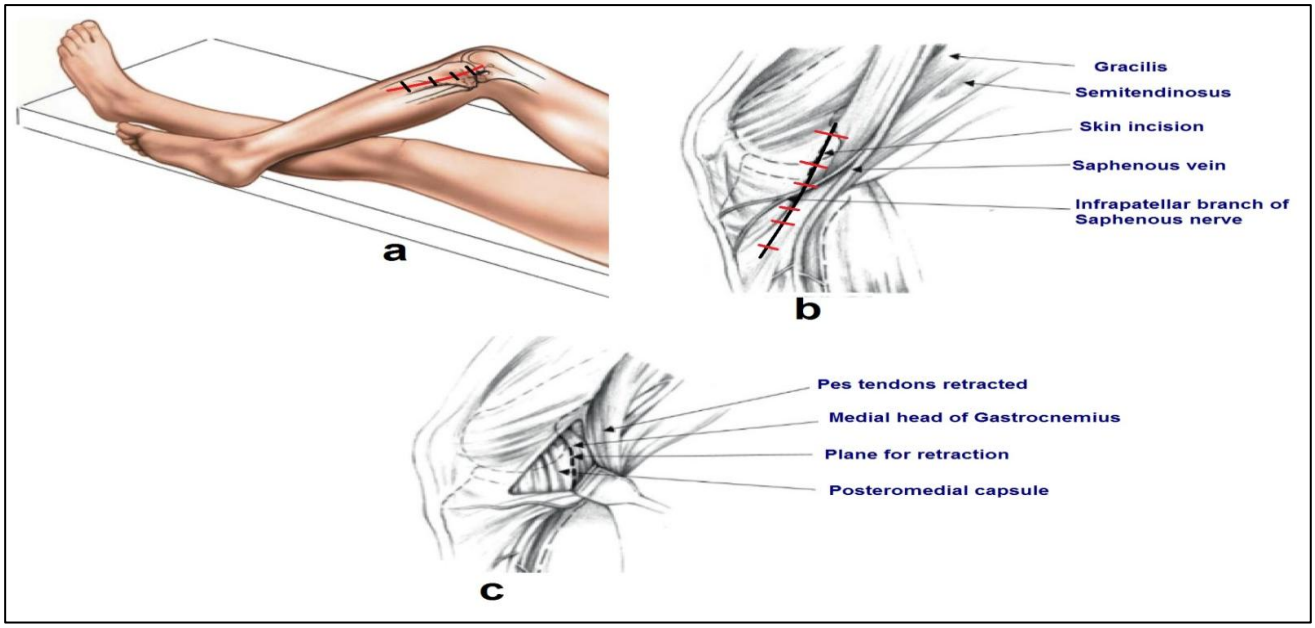

Figure 5 (a-c): Illustrations demonstrating patient positioning, skin incision, and medial surgical approach to the proximal tibia, including identification and retraction of pes anserinus tendons to expose the lesion site.

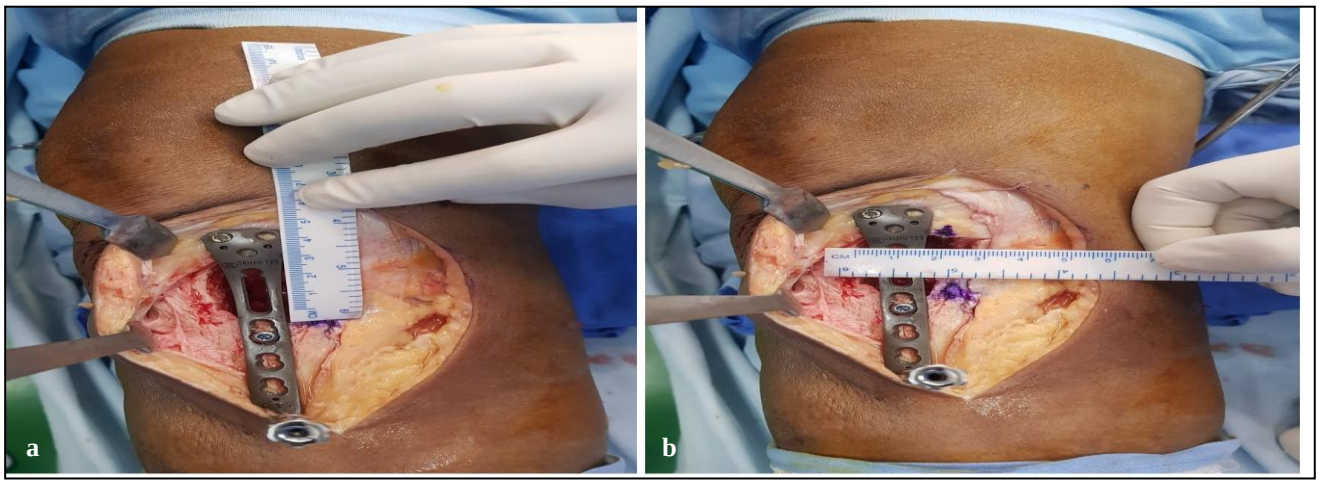

Figure 6 (a and b): Intra-operative images.

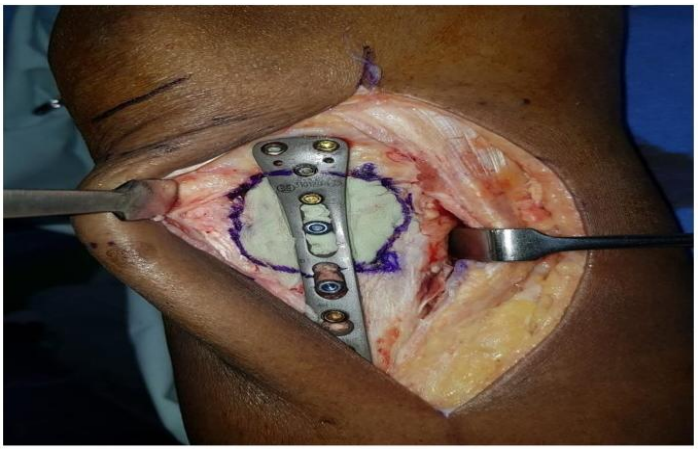

Figure 7: Intra-operative image illustrates cementoplasty using polymethylmethacrylate filling the defect cavity, with screws embedded through the cement to enhance fixation stability.

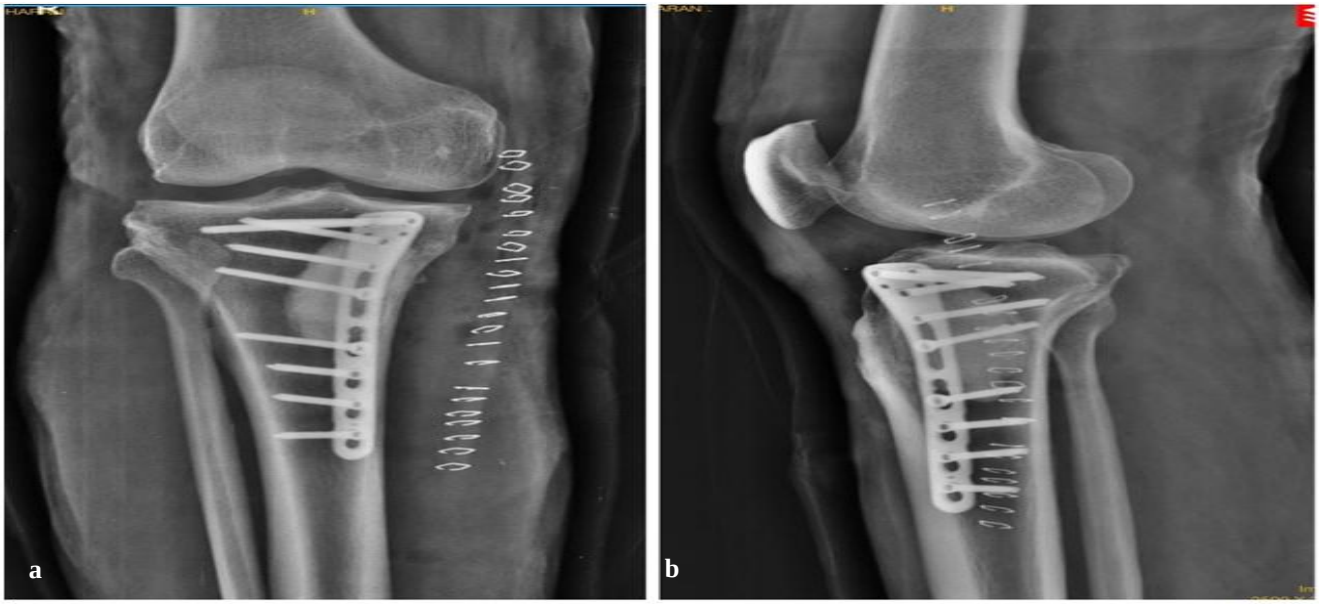

Figure 8 (a and b): Immediate postoperative radiographs illustrate satisfactory alignment and stable cement-augmented plate fixation of the proximal tibia.

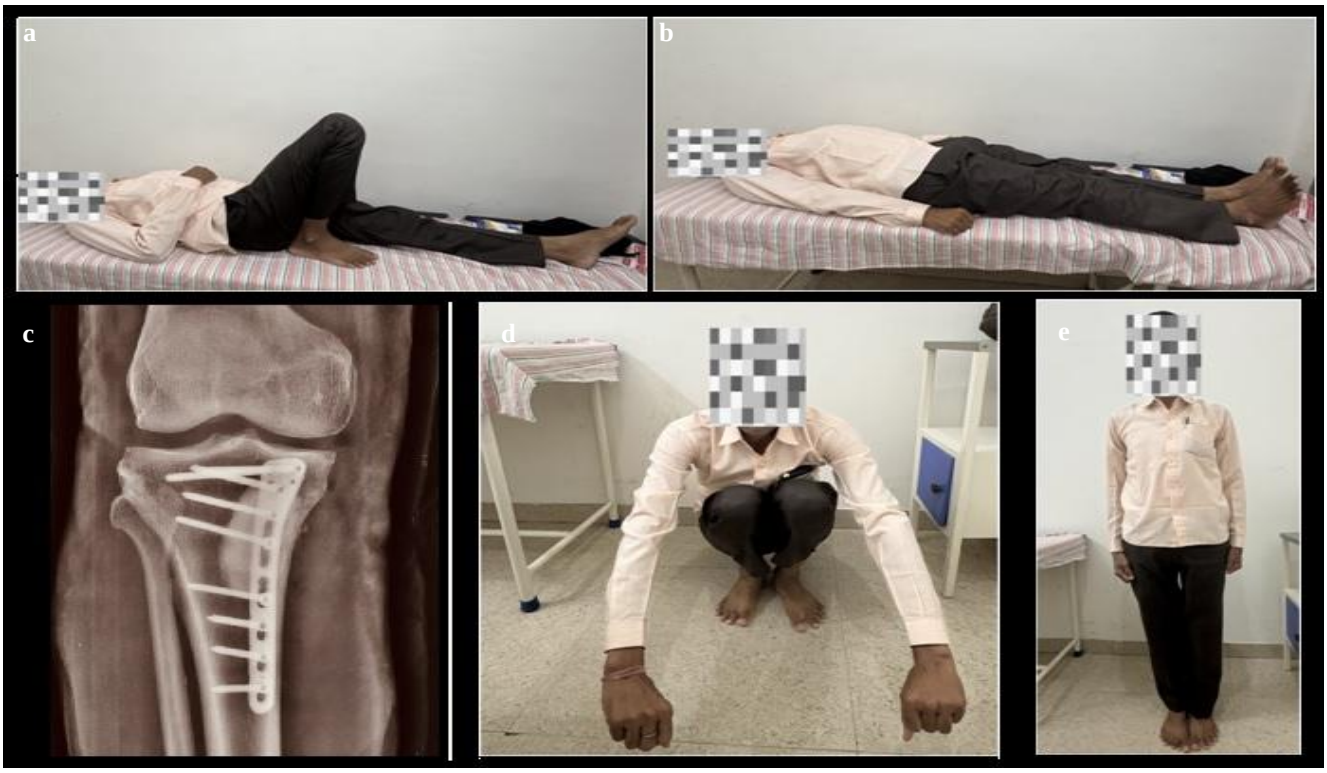

Figure 9 (a-e): Follow-up radiograph and clinical images at 3 months demonstrating maintained alignment, stable fixation, independent mobility, and a full pain-free functional range of motion, reflecting excellent clinical recovery.

DISCUSSION

Solitary plasmacytoma of bone is an uncommon plasma cell neoplasm, accounting for approximately 3-7% of all plasma cell dyscrasias, with a median age of presentation in the fifth to sixth decade.[1,2] It predominantly involves the axial skeleton, particularly the vertebrae and skull, owing to the abundance of hematopoietic marrow.

In contrast, involvement of long bones such as the tibia is rare and only limited cases have been reported in the literature.[3,4] The present case is notable for its unusual eccentric osteolytic presentation in the proximal tibial metadiaphysis with cortical destruction and associated pathological fracture. Previous studies by Ozsahin et al and Knobel et al have demonstrated that appendicular SBP is relatively uncommon and may present with

imaging features overlapping those of other osteolytic lesions, thereby posing diagnostic challenges.[9,10] Similarly, Dagan et al highlighted that plasmacytomas involving long bones can mimic both benign and malignant conditions, reinforcing the need for histopathological confirmation.[11] A critical step in the evaluation of such lesions is differentiating solitary plasmacytoma from multiple myeloma, as this distinction has important therapeutic and prognostic implications. Diagnostic criteria include the presence of a solitary lesion, normal bone marrow examination, absence of additional skeletal lesions on survey imaging, and lack of systemic features such as anemia, hypercalcemia, or renal dysfunction.[2,12] Comprehensive assessment using serum protein electrophoresis, immunofixation, and bone marrow biopsy is essential. The presence of an M-band, multiple osteolytic lesions, or end-organ damage is suggestive of multiple myeloma. Advanced imaging modalities such as MRI and PET-CT further improve diagnostic accuracy and staging.[13] The differential diagnosis of a solitary osteolytic lesion in the proximal tibia is broad and includes giant cell tumour, aneurysmal bone cyst, metastasis, osteosarcoma, enchondroma, adamantinoma, eosinophilic granuloma, osteoblastoma, and Brodie's abscess. Therefore, a multidisciplinary approach combining clinical, radiological, and histopathological findings is essential for accurate diagnosis. Radiotherapy remains the gold standard treatment for solitary plasmacytoma due to its radiosensitivity.[14] However, surgical intervention is indicated in cases of structural instability, impending fracture, or established pathological fracture. In the present case, the lesion had resulted in significant cortical destruction, necessitating reconstruction to restore mechanical stability. Intralesional curettage combined with polymethylmethacrylate cement augmentation provides immediate structural support, facilitates early weight-bearing, and may contribute to local tumor control through the exothermic effect of cement polymerization.[15] The addition of internal fixation further enhances biomechanical stability, particularly in weight-bearing bones such as the tibia. The choice of surgical technique depends on several factors, including the patient's general condition, life expectancy, extent of bone destruction, and anatomical location of the lesion. When cortical integrity is preserved, curettage and defect filling may suffice; however, in cases with significant structural compromise, reconstruction using plate fixation becomes necessary to prevent collapse and restore function. The strength of this report lies in the rare anatomical presentation, comprehensive diagnostic work-up excluding multiple myeloma, and successful surgical management with excellent early functional outcomes. The use of cement-augmented plating enabled early mobilization and rapid functional recovery. However, limitations include the short duration of follow-up and the inherent constraints of a single case report, limiting generalizability. Long-term surveillance is essential, as progression to multiple myeloma has been reported in up to 50-70% of cases over time.[10,16]

CONCLUSION

SBP involving the proximal tibia is a rare clinical entity requiring a structured multidisciplinary diagnostic approach to exclude systemic disease. In cases with cortical compromise or pathological fracture, intralesional curettage combined with polymethylmethacrylate cement augmentation and stable internal fixation enables immediate mechanical restoration, facilitates early weight-bearing, and yields excellent short-term functional outcomes. Long-term clinical, radiological, and hematological surveillance remains imperative due to the potential risk of progression to multiple myeloma.

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