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**Case Report**

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# Primary bone lymphoma of the distal femur – a case report

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## ABSTRACT

Primary bone lymphoma (PBL) is a rare extranodal lymphoma that arises within skeletal structures, most often as diffuse large B-cell lymphoma (DLBCL). It typically presents with localized pain and swelling and requires a high index of suspicion for diagnosis. A 53-year-old man presented with pain and swelling over the distal femur. Imaging revealed a lytic-sclerotic lesion with cortical breach and soft-tissue extension. Biopsy confirmed large B-cell lymphoma, germinal center subtype. Staging workup showed no nodal or marrow involvement, consistent with Stage IE disease. The patient was treated with one cycle of CVP followed by six cycles of Rituximab, Cyclophosphamide, Hydroxydaunorubicin, Oncovin and Prednisone (R-CHOP) and involved-field radiotherapy (40 Gy/20 fractions). Post-treatment positron emission tomography-computed tomography (PET-CT) showed complete metabolic response. Combined-modality treatment with R-CHOP chemoimmunotherapy and radiotherapy offers excellent outcomes in localized PBL. Early diagnosis, accurate staging, and multidisciplinary management are crucial for durable remission and optimal survival.

**Keywords:** Primary bone lymphoma, Diffuse large B-cell lymphoma, R-CHOP chemoimmunotherapy, Involved-field radiotherapy, PET-CT

## INTRODUCTION

Primary bone lymphoma (PBL) is a rare extranodal manifestation of non-Hodgkin lymphoma (NHL) that arises within skeletal structures without initial involvement of lymph nodes or other extranodal sites. It accounts for approximately 3–7% of all primary bone tumors and less than 2% of adult NHLs.[1,2]

PBL most commonly presents in the fifth to sixth decade of life and demonstrates a slight male predominance. The femur, pelvis, humerus, tibia, and spine are the most frequently affected sites.[2-4] Histologically, the overwhelming majority of PBLs correspond to diffuse large B-cell lymphoma (DLBCL), particularly the germinal center B-cell (GCB) subtype.[5,6]

The disease often manifests with localized bone pain, soft-tissue swelling, or pathological fracture.[3,4] Radiologically, lesions are typically lytic or mixed lytic–sclerotic, occasionally with periosteal reaction and soft-tissue extension.[3] Magnetic resonance imaging (MRI) and 18F-FDG PET-CT play pivotal roles in disease staging and response assessment.[7,8]

The standard of care for localized PBL has evolved from radiotherapy alone to chemoimmunotherapy (R-CHOP) with or without consolidative radiotherapy, leading to markedly improved survival.[9-13] This case highlights a typical presentation of femoral PBL with excellent outcome following combined-modality therapy.

## CASE REPORT

A 53-year-old man presented with pain and swelling above the right knee joint for several weeks. There was no history of fever, weight loss, or night sweats. Plain radiography of the right knee demonstrated an ill-defined mixed lytic–sclerotic lesion in the distal femur (Figure 1).

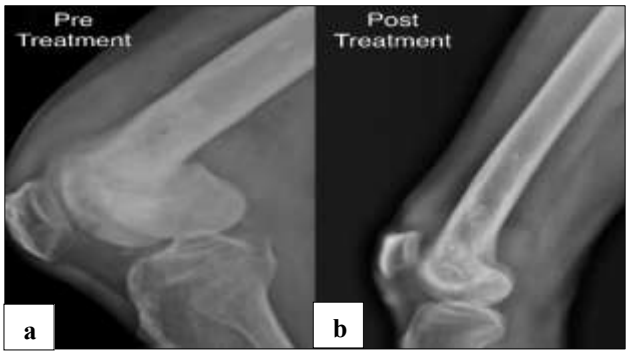


**Figure 1: Radiographic images of the distal femur showing (a) a lytic expansile lesion with cortical destruction before treatment, and (b) marked resolution with cortical remodeling following chemotherapy.**

Contrast-enhanced MRI revealed altered signal intensity involving the epi-metaphyseal region of the distal femur, heterogeneously hyperintense on T2W and STIR sequences and hypointense on T1W images, with cortical breach and soft-tissue extension but preservation of the neurovascular bundle. Open biopsy confirmed large B-cell non-Hodgkin lymphoma (Figure 2).

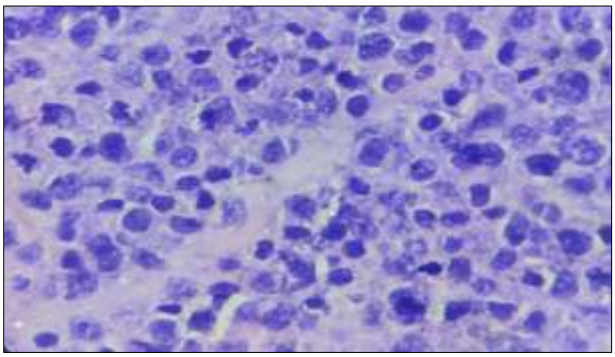

**Figure 2: Histopathological section showing diffuse sheets of large atypical lymphoid cells with vesicular nuclei, prominent nucleoli, and scant cytoplasm.**

Immunohistochemistry showed positivity for CD10, CD20, BCL2, BCL6, and negativity for MUM1, with a Ki-67 proliferation index of 70–75%, supporting a GCB-type DLBCL phenotype (Figure 3). Tc-99m bone scintigraphy revealed increased tracer uptake in the distal femur and proximal tibia, suggesting local extension, while contrast-enhanced CT of the chest, abdomen, and pelvis showed no lymphadenopathy or organomegaly (Figure 4). Bone marrow aspiration and trephine biopsy were normocellular and negative for infiltration, confirming Lugano and IELSG stage IE, CD20-positive DLBCL.[14]

The patient received one cytoreductive cycle of CVP (cyclophosphamide, vincristine, prednisolone) followed by six cycles of R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, prednisolone), and involved-field radiotherapy (IFRT) of 40 Gy in 20 fractions. Post-treatment 18F-FDG PET-CT demonstrated complete metabolic response with a Deauville score 1, indicating complete remission (Figure 5). Post-treatment X-ray of the right knee joint also demonstrated complete resolution of the previous lesion (Figure 1). The patient has remained in remission for over one year and continues on regular follow-up.

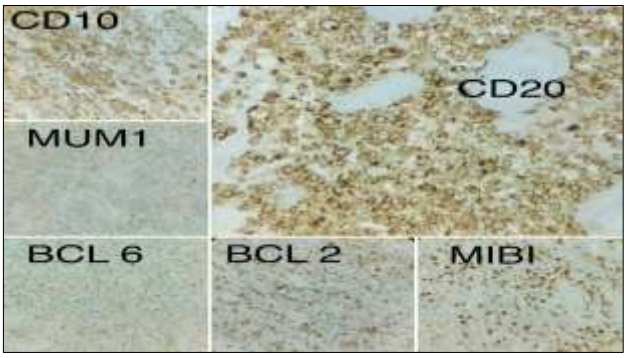


**Figure 3: Immunohistochemical profile showing tumor cells positive for CD20, CD10, BCL6, BCL2, and MIB1, and negative for MUM1, consistent with GCB subtype.**

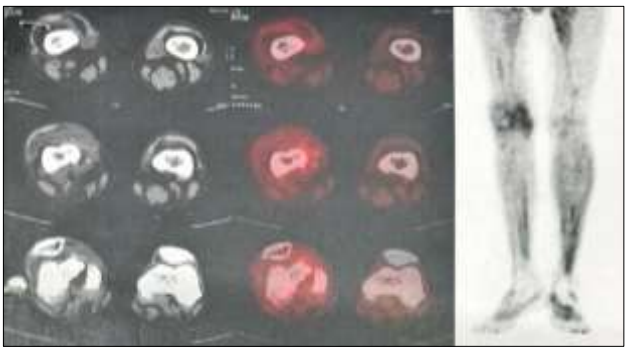

**Figure 4: PET-CT and bone scan images showing increased FDG uptake and radiotracer activity in the distal femur consistent with metabolically active lesion.**

**Figure 5: Post-treatment PET-CT and bone scan images showing complete metabolic response with resolution of FDG uptake and radiotracer activity in the distal femur.**

## DISCUSSION

PBL, historically termed reticulum cell sarcoma, was first reported by Oberling in 1928.[15] Since then, several large retrospective analyses have established it as a distinct clinicopathologic entity.[2,6,9] The disease most commonly affects long bones—particularly the femur—and tends to involve the metaphyseal and diaphyseal regions.[3] Clinical manifestations are nonspecific and may include dull pain, localized swelling, or, in advanced lesions, pathologic fracture due to cortical destruction.[4]

Radiologically, PBL presents as a lytic or mixed lesion with minimal periosteal reaction and often a soft-tissue component disproportionate to the degree of cortical destruction.[3,7] MRI is the modality of choice for local extent assessment, while PET-CT is superior for staging and post-therapy response evaluation.[7,8] Multifocal skeletal involvement at presentation, though rare, portends a less favorable prognosis.[13]

Histopathologically, DLBCL accounts for over 80–90% of PBL cases, and most belong to the GCB subtype, which generally carries a better prognosis.[5,6] Expression of CD20 permits the use of rituximab, which has significantly improved survival outcomes in the rituximab era.[9,11,13]

Therapeutic strategies have evolved over time. Earlier, radiotherapy alone provided local control but high systemic relapse rates.[9] The advent of anthracycline-based chemotherapy (CHOP), and subsequently R-CHOP, has dramatically changed the outlook. Multiagent chemoimmunotherapy is now the standard of care, with radiotherapy serving as consolidative treatment to enhance local control.[9-12]

Several single-center and population-based studies have demonstrated the benefit of combined-modality therapy. Beal et al reported improved disease-free and overall survival with R-CHOP followed by radiotherapy.[9] Tao et al found that consolidative radiotherapy improved local control and progression-free survival without added toxicity.[11] A multicenter rare cancer network study also supported this combined approach, particularly for early-stage disease.[12] Similarly, Ma et al noted that radiotherapy's benefit was stage-dependent, being most pronounced in localized PBL.[13]

Population-based SEER data revealed 5-year survival of 58% and 10-year survival of 48%.[6] Prognostic factors include age <60 years, localized disease, good performance status, GCB phenotype, and use of rituximab-containing regimens.[9,13]

Our patient's course illustrates the efficacy of R-CHOP followed by IFRT, leading to complete metabolic remission, in line with reported outcomes. Current consensus discourages surgery except for diagnostic biopsy or orthopedic stabilization when required.[4,9] Emerging evidence also supports the role of PET-CT–guided therapy adaptation, wherein treatment intensity or radiotherapy dose may be modulated based on interim metabolic response.[7,8,12]

Long-term follow-up is essential, as late relapses can occur even after 5–10 years, and survivors remain at risk for radiation-induced fractures or secondary malignancies.[4,9] However, with modern combined-modality therapy, most patients with limited-stage PBL achieve durable remissions and excellent quality of life.

## CONCLUSION

Primary bone lymphoma is a rare but potentially curable form of extranodal lymphoma. Early recognition, tissue diagnosis with immunophenotyping, and integrated treatment with R-CHOP chemoimmunotherapy plus involved-field radiotherapy yield optimal outcomes. PET-CT–guided response assessment is invaluable for evaluating treatment efficacy and long-term surveillance.

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