Primary diffuse large B-cell lymphoma of the patella in an 85-year-old patient: A case report

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Abstract. Primary diffuse large B-cell lymphoma (DLBCL) of the patella is rare, with only ten prior cases reported. The present study describes an 85-year-old woman presenting with progressive left knee pain, swelling and limited mobility due to a pathological fracture. Imaging revealed moth-eaten osteolysis of the patella (radiographs), T1-hypointense/T2-hyperintense marrow replacement (MRI) and intense FDG uptake (SUVmax 29.9; PET/CT), with multifocal lesions confirming Ann Arbor stage IV, non-GCB DLBCL (incisional biopsy; Hans algorithm). Intrapatellar curettage with polymethylmethacrylate cementation stabilized the fracture, followed by adjuvant radiotherapy (30 Gy) and dose-reduced R-CHOP-like chemotherapy (six cycles). Complete remission was achieved, with no recurrence at 2-year follow-up, good knee function (0-120˚ motion), and International Society of Limb Salvage score of 28. This case suggests that knee-preserving surgery combined with multimodal therapy may be a viable option in selected elderly patients with patellar primary bone lymphoma, and emphasizes the importance of early biopsy.

Introduction

Primary lymphoma of bone (PLB) is a rare malignancy that arises exclusively within bone tissue and is characterized by the presence of a solitary osseous lesion or multiple bone lesions without involvement of visceral organs or lymph nodes (1). It accounts for <3% of all malignant bone tumors (2) and approximately 1% of all lymphomas, representing up to 7% of primary malignant bone tumors (3). The femur is the most frequently affected site, followed by the pelvis and spine (2-4). PLB typically occurs in adults and may present at any age; however, most cases are reported in individuals aged 45-60 years, with a slight male predominance (5). An analysis of 1,222 patients revealed that the incidence of PLB peaked around 1992 and subsequently declined, although it remains uncommon compared with other lymphomas and bone tumors (6). Diffuse large B-cell lymphoma (DLBCL), not otherwise specified (NOS), is the predominant histological subtype, accounting for >80% of PLB cases (5).

The mainstay of treatment for PLB is combination chemotherapy, typically using cyclophosphamide, doxorubicin, vincristine, and prednisone (CHOP) or R-CHOP (CHOP plus rituximab) (3). However, limitations in access to advanced imaging modalities (e.g., magnetic resonance imaging [MRI]) and challenges in obtaining diagnostic tissue via needle biopsy may delay definitive diagnosis and appropriate therapy (7). Clinically, PLB often mimics benign bone lesions, infections, or other malignancies, leading to diagnostic uncertainty and delayed management (5). To the best of our knowledge, only ten detailed case reports involving patients aged 30-76 years have been published to date (Table I), each treated using different approaches, and the available evidence remains limited (1,8-16). Herein, we present a rare case of PLB involving the patella in an 85-year-old patient.

Case report

An 85-year-old woman presented with a two-month history of progressive anterior knee pain and swelling of the left knee, which gradually limited her ability to walk. She was initially evaluated at a local clinic, where osteoarthritis was suspected; however, persistent symptoms and increasing difficulty with ambulation prompted referral to our department. On physical examination, localized tenderness over the patella, mild swelling, and a reduced range of motion (0˚-90˚) were observed. No erythema or systemic symptoms such as fever or weight loss were noted.

Plain radiographs of the left knee demonstrated a moth-eaten osteolytic lesion involving the entire patella (Fig. 1A, B). Laboratory findings, including complete blood count and serum lactate dehydrogenase (LDH), are summarized in Table II. MRI revealed diffuse marrow replacement of the patella, showing homogeneous low signal intensity on

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T1-weighted images (Fig. 2A) and high signal intensity on T2-weighted images (Fig. 2B). A non-displaced pathological fracture of the patella was identified. No joint effusion, intra-articular extension, or extraosseous soft-tissue mass was observed.

^{18}F-fluorodeoxyglucose positron emission tomography-computed tomography (FDG-PET/CT) demonstrated intense FDG uptake in the left patella (maximum standardized uptake value [SUVmax] 29.9; Fig. 3). Additional FDG-avid lesions were detected in the right iliac bone (SUVmax 16.4), right chest wall (SUVmax 17.7), and seventh cervical vertebra (SUVmax 6.1). The chest wall lesion involved the right sixth rib and was confined to the bone, without an extraosseous soft-tissue component; accordingly, all extranodal lesions in this patient were skeletal. Marked tracer accumulation was also observed in the right ureter (SUVmax 78.3), which was interpreted as physiologic urinary excretion of ^{18}F-FDG rather than pathological uptake after urological evaluation.

An incisional biopsy of the patella was performed. Histopathological examination revealed diffuse proliferation of atypical large lymphoid cells with prominent nucleoli (Fig. 4A). Immunohistochemistry showed positivity for cluster of differentiation (CD)20, BCL6, CD79a, and BCL2, while CD3-positive cells represented background reactive T lymphocytes (Fig. 4B-F). CD10 was negative, and the cell of origin was classified as non-germinal center B-cell (non-GCB) type according to the Hans algorithm (17). Bone marrow aspiration and biopsy revealed no evidence of lymphoma involvement.

Based on clinical, radiological, and pathological findings, the patient was diagnosed with DLBCL, stage IV according to the Ann Arbor classification (18). The International Prognostic Index score was 4 (age >60=1, stage IV=1, extranodal sites ≥2=1, LDH level=0, Eastern Cooperative Oncology Group performance status=1).

Because the pathological fracture caused pain and impaired mobility, surgical intervention was performed to stabilize the patella and improve function. Extended intralesional curettage using a high-speed burr was followed by polymethylmethacrylate (PMMA) cement filling (Fig. 5A, B). No cement leakage into the fracture line or joint space was observed.

After surgery, the patient received adjuvant radiotherapy to the patella, with a total dose of 30 Gy delivered in ten fractions, targeting the patella and surrounding soft tissue for local control. Systemic chemotherapy was subsequently administered. Owing to advanced age, a modified regimen was selected, consisting of rituximab (375 mg/m^2, day 1), cyclophosphamide (400 mg/m^2, day 1), vindesine (1.4 mg/m^2, day 1), doxorubicin (25 mg/m^2, day 1), and prednisone (40 mg/m^2, days 1-5), with dose reductions applied for anthracycline. Six cycles were completed without major complications.

Response to therapy was assessed by FDG-PET/CT performed 2 months after the completion of chemotherapy, which demonstrated a complete metabolic response according to the Lugano classification (19) (Fig. 6). The patient achieved complete remission, and follow-up radiographs at two years postoperatively showed no evidence of recurrence (Fig. 5C, D). Knee range of motion improved to 0°-120°, and she was able to ambulate independently with a cane. An International Society of Limb Salvage score (20) of 28 indicated good postoperative function.

Discussion

PLB is a rare disease involving malignant lymphocytes that typically presents as one or more bone lesions without involvement of lymph nodes or other extranodal sites (5). To date, only ten cases of primary malignant lymphoma of the patella have been reported (Table II) (1,8-16). The novelty of this case lies in the presence of multifocal osseous involvement (stage IV disease), the patient's advanced age, and the performance of a knee-preserving surgical procedure. The diagnosis of patellar bone tumors is often challenging because symptoms such as anterior knee pain, swelling, and reduced range of motion are non-specific and overlap with more common conditions, including osteoarthritis, infection, giant cell tumor, and metastatic disease (16). In our case, the initial clinical presentation mimicked degenerative disease, contributing to diagnostic delay. Radiographically, PLB typically demonstrates a permeative or moth-eaten osteolytic pattern, consistent with the findings in our patient (21). MRI commonly shows homogeneous marrow replacement with low T1 and high T2 signal intensity (22), while FDG-PET/CT is highly sensitive for detecting additional osseous lesions (23). In nearly half of PLB cases, PET reveals multifocal bone involvement, as observed in this case (23). Since PLB is defined by the absence of visceral or lymph node involvement rather than by the presence of a solitary lesion, multifocal skeletal involvement is compatible with this diagnosis (5). The intense FDG accumulation in the ureter was ultimately attributed to physiologic urinary excretion rather than malignancy, underscoring the importance of careful interpretation of PET findings.

Histopathological confirmation remains essential for diagnosis (24). Of the ten previously reported patellar lymphoma cases, eight were classified as DLBCL, whereas one was a T-cell lymphoma (13) and one was adult T-cell lymphoma/leukemia (8) (Table II); our case was likewise diagnosed as DLBCL, non-GCB type, according to the Hans algorithm (17). CD3 positivity represented reactive background T cells rather than tumor cell expression. Bone marrow biopsy showed no involvement, although the patient was staged as Ann Arbor stage IV owing to multifocal bone lesions. Advanced age and stage IV disease are known adverse prognostic factors, contributing to lower disease-free survival rates in elderly patients.

The role of surgery in PLB is limited and primarily reserved for diagnostic biopsy or stabilization of pathological fractures (25). Historically, patellectomy has been performed in some cases, with reports suggesting favorable outcomes (12,14,15). However, patellectomy may compromise extensor mechanism function, particularly in elderly patients. Total knee arthroplasty with extensor mechanism reconstruction is a further alternative; however, it is a more extensive procedure and is associated with a higher perioperative burden in patients older than 80 years. In contrast, curettage and cementation can provide immediate mechanical stability while preserving patellar integrity. In our patient,

Table I. Reported cases of primary lymphoma of the patella.

Author/year	Age, years	Sex	Examination	Pathology	Multifocal/ systemic involvement	Treatment	Outcome	(Refs.)
Chandra and Eilender	52	F	Xr	DLBCL	-	CT, RT	CDF	(11)
Hughes and Spencer	50	F	Xr, CT, MRI, PET	DLBCL	-	Patellectomy, CT	CDF	(14)
Agarwal *et al*	30	F	Xr, MRI	T cell lymphoma	-	CT	CDF	(13)
Watson and Cross	74	M	Xr, CT	DLBCL	-	CT, RT, TKA	CDF	(15)
Wills *et al*	76	F	Xr, MRI, PET	DLBCL	-	CT	AWD	(9)
Jadidi *et al*	58	F	Xr, CT, MRI, PET	Adult T-cell lymphoma/ leukemia	-	RT, CT	N/A	(8)
Yamamoto *et al*	50	F	Xr, CT, MRI, PET	DLBCL	-	Patellectomy, CT	CDF	(12)
Cao and Chen	42	M	Xr, CT, MRI, PET	DLBCL	-	Patellectomy, CT	CDF	(10)
Wright *et al*	76	F	Xr, MRI	DLBCL	-	CT	CDF	(1)
Ben Rejeb *et al*	68	W	Xr, CT, MRI, PET	DLBCL	-	CT	AWD	(16)

F, female; M, male; Xr, X-ray; CT, computed tomography; MRI, magnetic resonance imaging; PET, positron emission tomography; DLBCL, diffuse large B-cell lymphoma; ChT, chemotherapy; RT, radiotherapy; CDF, continuously disease-free; AWD, alive with disease; N/A, not applicable.

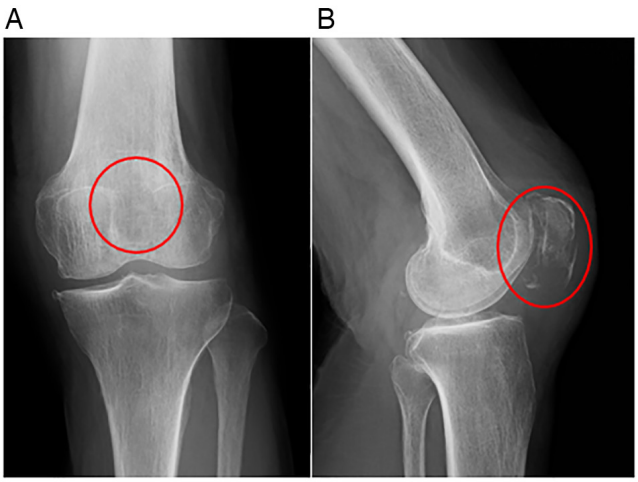


Figure 1. Knee radiographs. (A) Frontal and (B) lateral knee radiographs, respectively, at initial presentation, demonstrating patellar osteolysis (red circles).

the presence of a non-displaced pathological fracture and significant functional impairment justified surgical intervention. Extended intralesional curettage with high-speed burring followed by PMMA cementation successfully stabilized the patella without cement leakage. This approach allowed early mobilization and preserved knee function, representing a meaningful alternative to patellectomy. Among these options, curettage and cementation were selected because it was the least invasive procedure that provided immediate mechanical stability while preserving the extensor mechanism, which was considered particularly important for maintaining ambulation in this 85-year-old patient. To the best of our knowledge, this is the first reported case of patellar PLB treated with curettage and cementation, highlighting its potential utility in selected patients.

Systemic therapy remains the cornerstone of PLB management (18). R-CHOP is the standard regimen; however, treatment modification is often required in elderly or frail patients (26). In the present case, the regimen was modeled on R-mini-CHOP, a dose-reduced variant of R-CHOP developed for patients aged >80 years (27): the rituximab (375 mg/m^2), cyclophosphamide (400 mg/m^2), doxorubicin (25 mg/m^2) and prednisone (40 mg/m^2, days 1-5) doses were identical to those of R-mini-CHOP, whereas vindesine (1.4 mg/m^2) was substituted for vincristine (1 mg). Vindesine, a vinca alkaloid with the same mechanism of action as vincristine, was chosen according to institutional practice for elderly patients. Because the standard course of R-mini-CHOP comprises six 3-week cycles (27), the six cycles administered in the present case were consistent with this protocol. Adjuvant radiotherapy to the patella was administered to enhance local control, consistent with evidence suggesting improved outcomes with combined-modality therapy in PLB (28). Radiotherapy was added after surgery because microscopic residual disease cannot be excluded following intralesional curettage. In

Table II. Blood examination results.

Parameter	Result	Normal range
White blood cell count (x$10^3/\mu$l)	4.46	3.3-8.6
Hemoglobin (g/dl)	12.0	11.6-14.8
Platelet count (x$10^4/\mu$l)	20.9	15.8-34.8
Lymphocytes (%)	29.6	20.2-53.8
C-reactive protein (mg/dl)	0.365	0-0.14
Lactate dehydrogenase (U/l)	222	124-222
Soluble interleukin-2 receptor (U/ml)	424	121-613

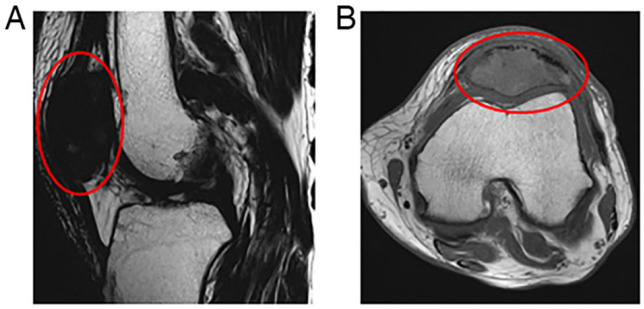


Figure 2. Magnetic resonance images. (A) Sagittal T1-weighted magnetic resonance image reveals homogeneous low-signal intensity within the patella (red circle). (B) Axial T2-weighted magnetic resonance image with homogeneous high signal intensity in the patella (red circle).



Figure 3. Positron emission tomography-computed tomography image. The image reveals intense ^{18}F-fluorodeoxyglucose accumulation in the left patella (red circle). We observed notable accumulation in the right ureter (red arrowheads).

modern combined-modality therapy for lymphoma, the International Lymphoma Radiation Oncology Group recommends reduced doses of approximately 30-36 Gy for disease in complete remission after effective systemic therapy, rather than the 40-55 Gy used when radiotherapy constitutes the sole local treatment (29). In the present case, because the intralesional procedure had removed the bulk of the tumor and effective systemic chemotherapy was planned, a total dose of 30 Gy in ten fractions was selected as the lower end of this range, balancing local control against the risk of late toxicity in an elderly patient. With this multimodal approach, a complete metabolic response was achieved on FDG-PET/CT performed 2 months after the completion of chemotherapy, as described in the Case report section. The patient achieved complete remission and maintained good functional status at 2 years post-treatment.

This case underscores several important clinical considerations. First, malignant lymphoma should be included in the differential diagnosis of osteolytic patellar lesions, particularly in older adults. Second, multifocal bone involvement does not exclude the diagnosis of PLB and may be detected only through comprehensive imaging such as FDG-PET/CT. Third, curettage and cementation may serve as a function-preserving surgical option for pathological fractures of the patella in PLB, especially in elderly patients for whom patellectomy may result in significant morbidity.

In conclusion, we report a rare case of primary DLBCL of the patella in an elderly patient with multifocal bone involvement, successfully treated with multimodal therapy, including curettage and cementation. This case expands the spectrum of reported patellar PLB and suggests that function-preserving surgical stabilization may be a viable option in selected patients, although this approach should be applied cautiously because the present observation is based on a single case. Further accumulation of cases is needed to clarify optimal management strategies for this rare entity.

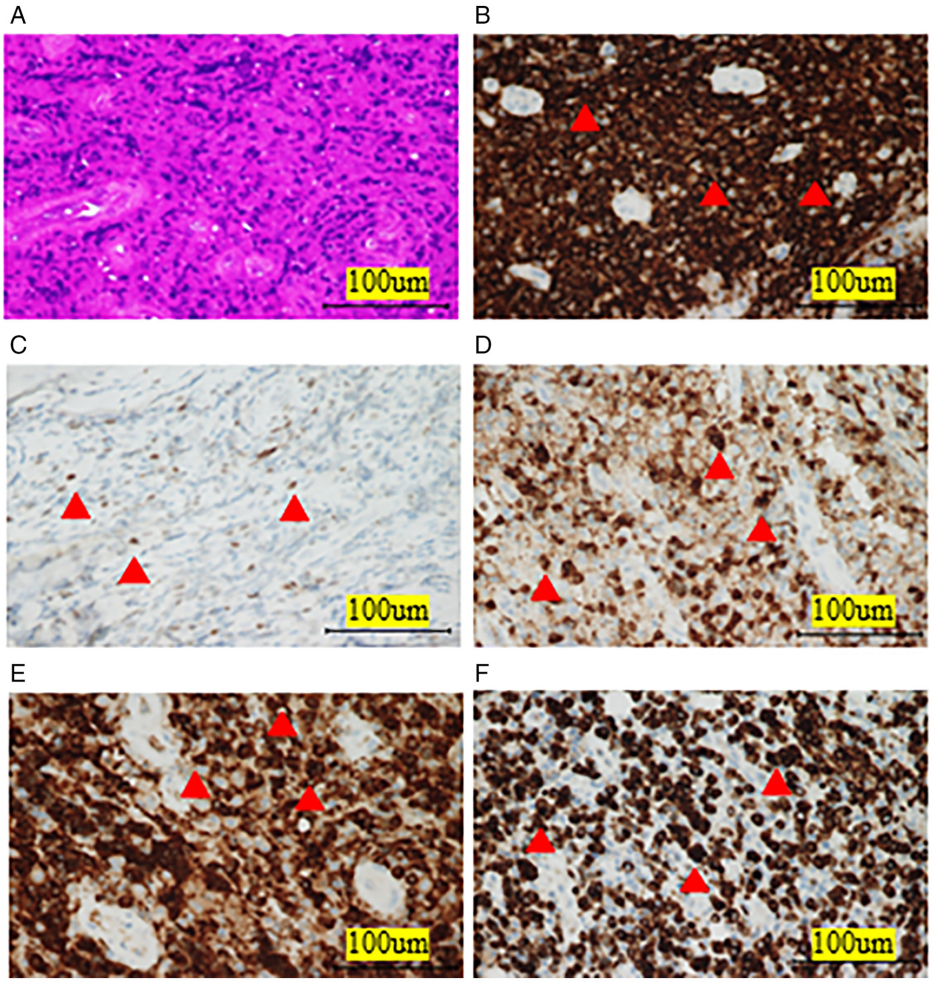


Figure 4. Hematoxylin and eosin and immunohistochemical staining. (A) The stained specimen reveals diffuse proliferation of atypical cells with enlarged nuclei. Immunohistochemical staining was positive for (B) CD20, (C) Bcl-6, (D) CD3, (E) CD79a, (F) Bcl-2. (B, C, E and F) Tumor cells were positive for all examined molecules (red arrowheads). (D) CD3-positive cells represented background reactive T lymphocytes; tumor cells were negative for CD3. Scale bar, 100 μm. CD, cluster of differentiation; Bcl, B-cell lymphoma.



Figure 5. Radiographs of the knee joint. (A) Coronal radiograph of the knee joint post-surgery. (B) Sagittal radiograph of the knee joint after surgery. (C) Coronal radiograph of the knee joint 2 years postoperatively. (D) Sagittal radiograph of the knee joint 2 years postoperatively.

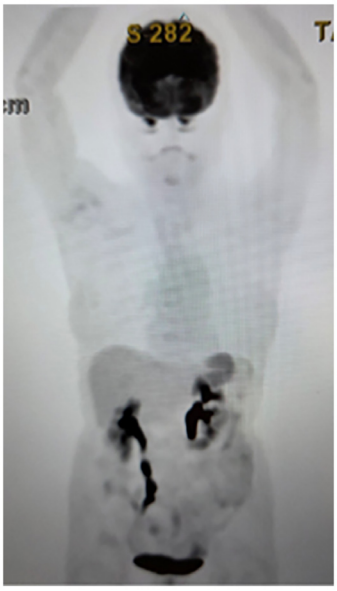


Figure 6. Post-treatment FDG-PET/CT. Positron emission tomography-computed tomography performed 2 months after the completion of chemotherapy, demonstrating no abnormal 18F-fluorodeoxyglucose uptake in the left patella or any other previously noted skeletal lesion, consistent with a complete metabolic response according to the Lugano classification (19).

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

KH, SN, MH and KG conceptualized the study and developed the overall research objectives and study design. KH, SN and TI developed the methodology, including the analytical and experimental procedures used in the study. KH, TI and KG were responsible for software-related work, including implementation of computational procedures, data processing and analysis tools. SN, TI, MH, KG and KH validated the study results by verifying the accuracy, reliability and reproducibility of the data and analyses. KH, SN and TI performed the formal analyses and interpreted the results. KH, SN, TI and KG conducted the investigation, including data collection and execution of the research activities. KH, SN, MH and KG curated the data by organizing, managing and maintaining the research dataset and associated records. KH, SN, TI, MH and KG prepared the original manuscript draft. KH, SN, TI, MH and KG critically reviewed and revised the manuscript for important intellectual content. KH and TI confirm the authenticity of all the raw data. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Written informed consent for participation and publication was obtained from the patient.

Patient consent for publication

Written informed consent was obtained from the patient for the publication of this case report, including all accompanying images and data.

Competing interests

The authors declare that they have no competing interests.

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