# Classic Hodgkin lymphoma in pelvis
## A case report highlights diagnosis and treatment challenges

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**Abstract**

**Rationale:** Classic Hodgkin lymphoma with pelvic involvement is a rare entity. Diagnosis and treatment for such an uncommon disease are challenging. Here we report a special case of classic Hodgkin lymphoma in pelvis.

**Patient Concerns:** A 20-year-old woman was admitted to our department due to left hip symptoms. The patient reported a history of drenching night sweats, low-grade fever, pruritic rash on the body, and an almost 15% weight loss during the previous 3 months.

**Diagnoses:** Imaging studies revealed osteolytic destruction of the left hemi-pelvic with a huge soft-tissue mass. Open biopsy established the pathological diagnosis of classic Hodgkin lymphoma.

**Interventions:** Considering the B symptom, bulky disease, and high risk of pathological fracture of the patient, we performed limb-salvage surgery and 6 cycles ABVD chemotherapy with 2 cycles before surgery.

**Outcomes:** Up to now, at the 3-year follow-up, there is no sign of disease relapse and metastasis. Besides, her limb function recovered well.

**Lessons:** Based on this case and literature we reviewed, diagnoses for primary bone Hodgkin lymphoma should be cautious. For the treatment, chemotherapy was the main treatment option. Classic Hodgkin lymphoma patients seldom received tumor resection surgery, but for the special bone classic Hodgkin lymphoma individual with a huge tumor volume and high risk of pathological fracture in our study, limb-salvage surgery based on ABVD chemotherapy provided a satisfying clinical outcome.

**Abbreviations:** CHL = classic Hodgkin lymphoma, CT = computed tomography, HL = Hodgkin lymphoma, HRS = Hodgkin and Reed-Sternberg, IPS = International Prognostic Score, ISOLS = International Society of Limb Salvage, iv = intravenous injection, MRI = magnetic resonance imaging, NCCN = National Comprehensive Cancer Network, NHL = non-Hodgkin lymphoma, PD-1 = programmed death 1, WBC = white blood cell.

**Keywords:** ABVD chemotherapy, classic Hodgkin lymphoma, Hodgkin disease, limb-salvage surgery, pelvis

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## 1. Introduction

Hodgkin lymphoma (HL) is a kind of lymphatic cancer that is characterized by the presence of Hodgkin and Reed-Sternberg (HRS) cells. Classic Hodgkin lymphoma (CHL) is one major type of HL and accounts for 95% of all HL cases.[1] In late stage HL, bone involvement has been found in 10% to 20% of cases with <2% of cases showing skeletal lesions as the initial presentation.[2–4] Primary bone lymphoma is referred to non-Hodgkin lymphoma (NHL) as WHO defined in 2013. However, primary bone HL actually exists and only very limited literatures reported no more than 30 cases of primary bone HL.[5–9] Discriminating solitary bone lesion in HL patients from "primary" to "secondary" is challenging as the diagnosis of primary bone HL should be made based on strict histological and clinical manifestation. Treatment strategies of such a rare entity depend on disease stage and prognostic factors. Primary solitary bone HL is considered as an early stage disease, but secondary bone involvement indicates that the disease has developed into an advanced stage. So, it is cautious to make a primary Hodgkin disease diagnosis when HL presents as a solitary bone lesion. Here we presented a CHL case with the subtype of nodular necrosis that initially presented as pelvic involvement. After the limb-salvage surgery and 6 cycles ABVD (doxorubicin,
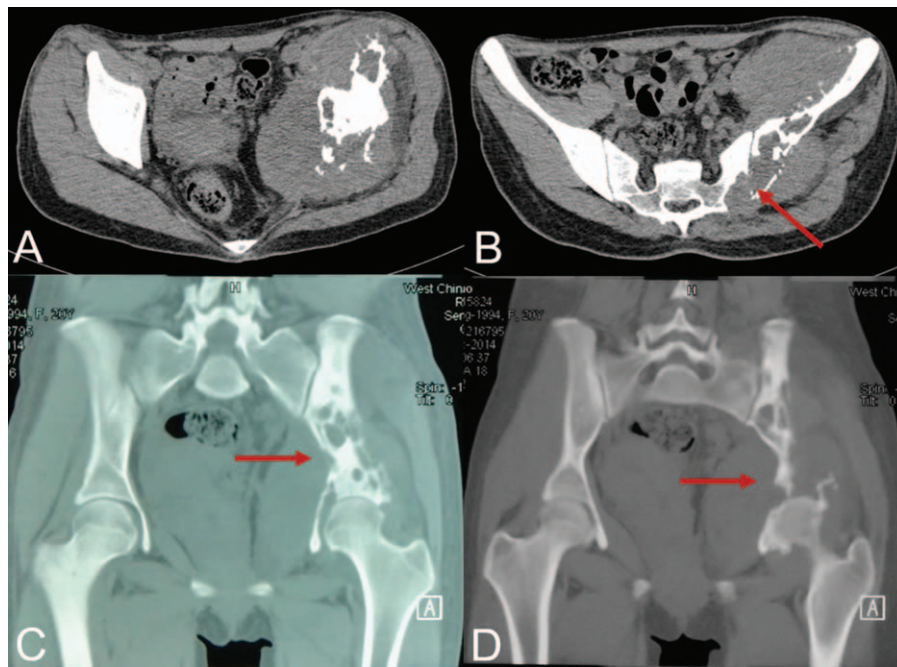
**Figure 1.** CT scans of the patient. (A) Showing left pelvic acetabular involvement with a huge soft-tissue mass. (B) Showing sacroiliac joint and left sacrum was destructed. (C) Showing the lytic lesion spreading form left ilium to sacroiliac joint. (D) Showing severe lytic destruction lead to a high risk of pathologic fracture.

bleomycin, vinblastine, and dacarbazine) chemotherapy, the patient got a satisfying clinical outcome to date. Meanwhile, we briefly reviewed the recent literatures about bony HL and discussed the diagnosis and current treatment options for such a rare case.

## 2. Case report

The patient provided informed consent for the publication of her clinical and radiological data. This study was approved by medical ethical committee of West China Hospital, Sichuan University, Chengdu, China.

### 2.1. General information

A 20-year-old woman was admitted to our department with a chief complaint of 2 months of left hip pain. The patient reported a history of drenching night sweats, low-grade fever, pruritic rash on the body, and an almost 15% weight loss during the previous 3 months. Also, she found an enlarging mass in her left hip during the latest month. She did not report any previous surgical history. Physical examination suggested the compression of sciatic nerve. Standard blood test after admission showed that the WBC (white blood cell) count was $21.23 \times 10^9 \, \mathrm{L}^{-1}$ (normal $3.5–9.5 \times 10^9 \, \mathrm{L}^{-1}$) with the neutrophils rate of 84.3% (normal 40–75%) and lymphocyte rate of 11.2% (normal 20–50%), Hgb was 104 g/L (normal 115–150 g/L), platelet count was $491 \times 10^9 \, \mathrm{L}^{-1}$ (normal $125–350 \times 10^9 \, \mathrm{L}^{-1}$). Epstein-Barr virus test was negative. Bone marrow aspiration from other hospital revealed a hyperactive hyperplasia of karyocyte. Osteolytic erosion in the left hemipelvis (zone I-II-IV, defined by Enneking and Dunham)[10] was identified on pelvic x-ray. Three-dimensional computed tomography (CT) imaging showed a severe lytic lesion spreading from left ilium and acetabulum to sacroiliac joint and finally affecting part of the left sacrum (Fig. 1). Surprisingly, a huge soft-tissue mass almost

$25.0 \times 16.0 \times 9.0$ cm in size was found. Magnetic resonance imaging (MRI) showed the mass had a slightly higher signal on T1-weighted spin-echo images compared with neighboring muscle groups and had a relatively long signal on T2-weighted spin-echo images in the left pelvis, zone I-II-IV (Fig. 2).

To ascertain the histopathology of this lesion and give the guidance for formulating a therapeutic plan, an open biopsy was performed instead of core needle biopsy. The histopathology was consistent with a diagnosis of CHL. Enhanced CT of the neck, chest, and abdomen showed no evidence of involvement of the cervical, mediastinal, or retroperitoneal lymph nodes. Prognostic factors according to the adapted International Prognostic Score (IPS) were determined (Table 1). After discussing with hematologists and considering the patient's general condition, relative high IPS, high risk of pathologic fracture, and sciatic nerve compression symptoms, a treatment protocol of limb-salvage surgery using en bloc resection followed by modular hemipelvic prosthesis reconstruction and 6 cycles ABVD course chemotherapy (doxorubicin, 25 mg/m², intravenous injection [iv] Day 1 and 15; bleomycin, 10,000 units/m², iv Day 1 and 15; vinblastine, 6 mg/m², iv Day 1 and 15; dacarbazine, 375 mg/m², iv Day 1 and 15) with 2 cycles before surgery was performed for this patient.

### 2.2. Surgical procedure

After 2 cycles ABVD chemotherapy in department of hematology, the limb-salvage surgery was performed until the patient got a relatively good condition. A standard iliofemoral approach was used, according to the classification of pelvic resections by Enneking and Dunham.[10] A lower abdominal aortic balloon occlusion was used during the resection procedure. Type I-II-IV left pelvic resection and total hip arthroplasty were performed to achieve clear margins. During the operation, a soft-tissue mass with a maximum volume of $26.0 \times 16.5 \times 9.0$ cm was visualized. It was bounded by the rear of the sacrum, and extended down to
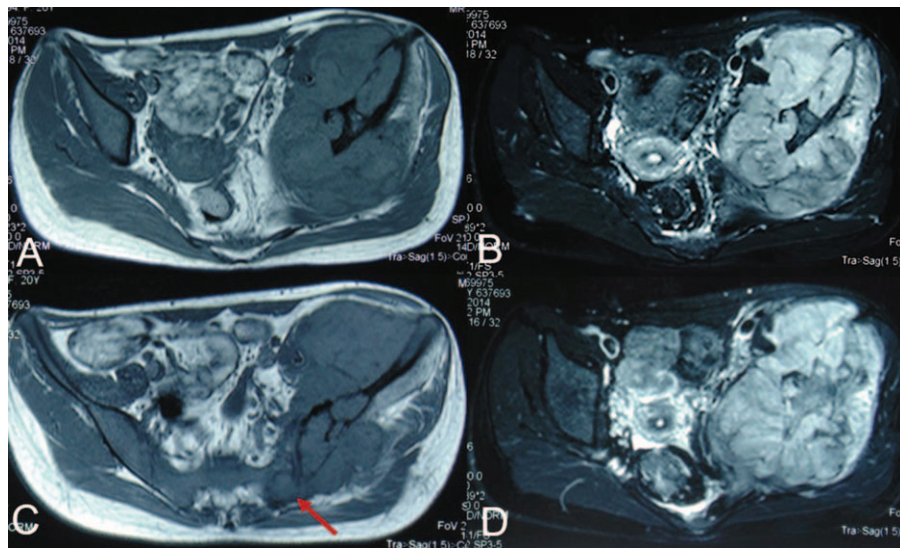
**Figure 2.** MRI of the patient. (A) A huge soft-tissue mass with a slightly long T1 signal. (B) A huge soft-tissue mass with a relative long T2 signal. (C) Soft-tissue mass involving sacroiliac joint and left sacrum. (D) Showing the huge volume tumor had a relatively clear boundary but pushed the uterus to the opposite side.

the femoral head, with involvement of lumbar muscle, the gluteus medius, and part of the S1 nerve root. During the procedure, a modular hemipelvic replacement system (Chun Li Zheng Da Co. Beijing, China) was implanted to reconstruct the left hemipelvis (Fig. 3). Three enlarged lymph nodes in the left inguinal region were dissected for biopsy. Finally, the muscles and soft tissues were sutured into the femoral prosthesis stem and acetabulum with 2–0 nonabsorbable sutures (Ethibond* Excel, Polyester Suture, Green Braided, Johnson & Johnson, New Jersey) to complete the in situ restoration and functional reconstruction. The surgery lasted 4.5 hours and blood loss was approximately 1500 mL for the entire procedure.

### 2.3. Postoperative management

The final pathological diagnosis was CHL with a subtype of nodular sclerosis (Fig. 4). The lymph nodes showed no cancer involvement but were confirmed to have reactive hyperplasia. The patient recovered well and was discharged after 10 days with no postoperative complications. The patient was restricted to bed rest for the first 2 weeks after surgery but was to exercise with quadriceps relaxation and contraction before getting out of bed. She started to stand with a lumbar-pelvic-hip brace 2 weeks

after surgery. Four weeks after surgery, she could walk with 2 crutches.

The patient commenced another 4 cycles of chemotherapy with ABVD 1 month after surgery. Patient follow-up visits occurred frequently over the first year, at 1, 2, 3, 6, 9, and 12 months after discharge, and every 6 months thereafter. Imaging studies were focused on tumor recurrence and the stability of the prosthetic implant. By 6 months after surgery, the patient was capable of all activities of daily living needed for self-care. Up to now, 3 years after the treatment, there is no sign of cancer recurrence and metastasis. The patient had largely recuperated from the surgery with an ISOLS (International Society of Limb Salvage) score of 23.0. The prosthetic positioning is good, with no loosening, fracture, or dislocation (Fig. 5).

### 3. Discussion

HL typically involves the lymphatic systems at 1 or more sites. Bony involvement in HL occurs through hematogenous spread or direct spread from the contiguous involved lymph node. WHO 2013 classification of bone tumor defined the primary NHL of bone as a neoplasm composed of malignant lymphoid cells, producing 1 or more masses within bone, without any supra-

| Table 1 | |
|---|---|
| **IPS of this patient.** | |
| IPS | Our case |
| Age >45 y | 0 |
| Male | 0 |
| IV stage | 1 |
| Albumin <4 g/dL | 1 |
| Hemoglobin <10.5 g/dL | 0 |
| Increased WBC (WBC count >15,000 mm$^{-3}$) | 1 |
| Lymphopenia (lymphocyte count <8% of white blood cell and/or lymphocyte count <600 mm$^{-3}$) | 1 |
| Total | 4 |

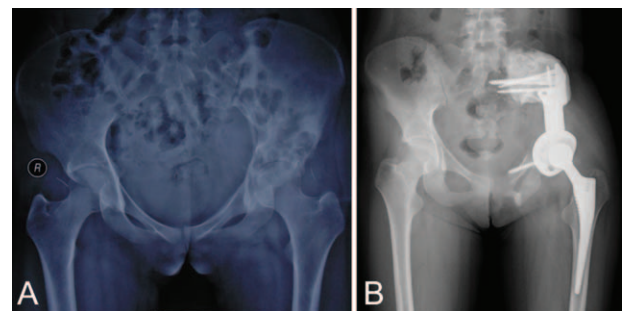IPS = International Prognostic Score, WBC = white blood cells.



**Figure 3.** Patient's x-rays. (A) Preoperative plain film showing left hemipelvis: zone I-II-IV involvement. (B) Postoperative plain film showing that the prosthetic positioning is good, with no loosening, fracture, or dislocation.
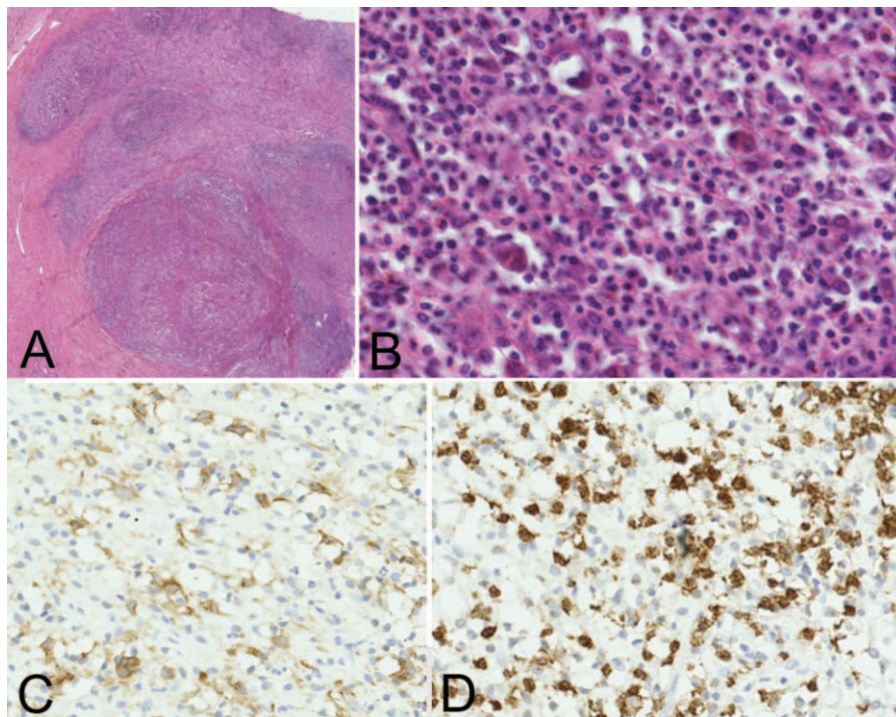
**Figure 4.** Biopsy images. (A) HE × 50 showing sclerosis nodules divided by fibrous bundles. (B) HE × 200 showing R-S cells presenting with huge volume body, round or oval-shaped, thick nuclear membrane, and obvious nucleoli. (C) Immunohistochemical stains showing positivity for CD30. (D) Immunohistochemical stains showing positivity for CD15.

regional lymph-node involvement or other extranodal lesions.[11] After concluding the clinical and pathological characters of our case, the evidence supporting the diagnose of primary bone HL in our study are as follows: Bone involvement was the initial symptom and the CT showed lesion obviously spreading from ilium to sacral through sacroiliac joint, supporting the lesion coming from ilium. The typical necrosis nodular from the HE stain and the HRS cells in tumor demonstrated a typical immunohistochemical profile with CD30 and CD15 positive. Chest, neck, and abdomen radiological studies showed no

involvement of lymph nodes in mediastinum, thoracic, and abdominal cavity. The lesion was predominant in bone with associated soft-tissue mass, without local positive adjacent lymph nodes, as the 3 enlarge lymph nodes in inguinal region were pathologically confirmed as reactive hyperplasia. No other extranodal lesions presented. But Dawson et al showed that primary extranodal HL should be diagnosed based on normal limits of the complete blood count and white cell differentiation.[12] This was supported by Yang et al who presented a primary bone HL with a normal level of the complete blood count
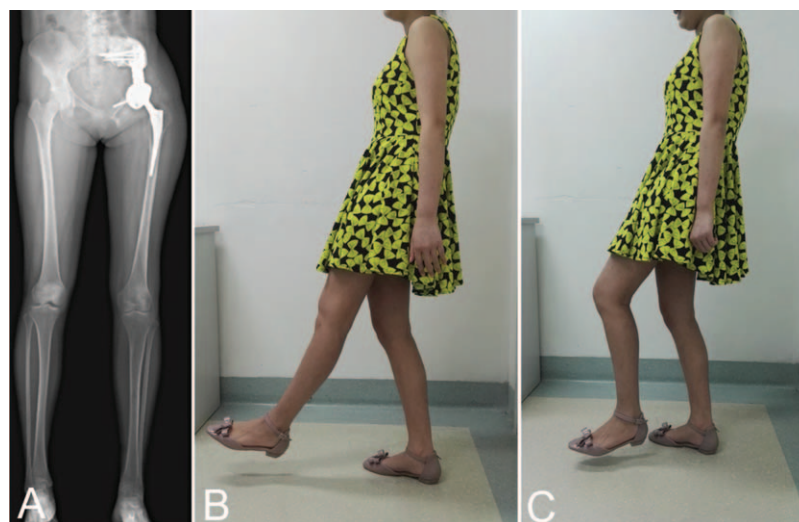


**Figure 5.** Patient 3 y after surgery. (A) Postoperative plain film showing equal limb length with no loosening, fracture, or dislocation. (B, C) Showing the patient had a relatively satisfying limb function.

**Table 2**

Current bone HL cases reported in literatures.

| Case | Year | Age/gender | Symptoms | B symptom | Bone site(s) | Pathological fracture/nerve comprehension | Treatment | Status | References |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1927 | 42/M | Right flank, abdomen, and shoulders pain | – | T4-T8 | – | Radiation | Alive for 10 mo, then LFU | [5] |
| 2 | 1936 | 39/F | Antecubital mass | – | Left humerus | – | Intralesional surgery | DOD after 12 mo | [16] |
| 3 | 1943 | 5/F | Left shoulder pain | – | Left scapula | – | Radiation | Disease free | [17] |
| 2 | 1958 | 53/M | Left shoulder pain | – | Left humerus Left ilium | – | Radiation | DOD at 4 mo | [5] |
| 4 | 1960 | 73/F | Right hip pain | – | Right femur | – | Radiation | Multiple recurrences DOD at 4 y | [5] |
| 5 | 1968 | 34/M | Left distal arm pain | – | Left humerus | – | Radiation | 10-y DFS, then LFU | [5] |
| 6 | 1979 | 25/W | Left shoulder pain | N | Left humerus | Y | Rush rod stabilization Radiotherapy | 4-y PFS Deformity of the arm | [19] |
| 7 | 1982 | 12/M | Knee pain | Y | Right femur | N | Chemotherapy Radiotherapy | 2-y PFS | [20] |
| 8 | 1982 | 18/M | Right wrist pain | Y | Distal ulna | N | Chemotherapy Radiotherapy | Symptomatic relief and improvement of disease | [20] |
| 9 | 1982 | 20/M | Back pain | Y | T11-L1 | Y | Radiotherapy Chemotherapy Laparotomy splenectomy | In treatment Decrease disease | [20] |
| 10 | 1982 | 11/F | Back pain | N | T8, T10, T3 | Y | MOPP | In treatment Symptom relief | [20] |
| 11 | 1989 | 61/M | Low back pain | – | Thoracic spine | – | Poly-chemotherapy | Complete remission | [21] |
| 12 | 1991 | 19/F | Left thigh pain | Y | Left femur | N | Chemotherapy Radiotherapy | 2-y PFS | [22] |
| 13 | 1995 | 61/F | Left thoracolumbar pain | – | T11 | – | Resection Radiotherapy | 22-mo PFS | [5] |
| 14 | 1995 | 21/F | Microcytic hypochromic anemia left shoulder pain | N | Left clavicle Left sacroiliac joint | N | 8 Cycles MOPP/ABV | 3-y PFS | [23] |
| 15 | 2001 | 54/F | Back pain and progressive lower-extremity weakness | Y | T4 | Y | Oral dexamethasone Radiotherapy | Symptoms release 15-mo PFS | [24] |
| 16 | 2005 | 74/M | Subcostal and back pain | – | T9, T10, L2, L5 | Y | Surgery | – | [25] |
| 17 | 2005 | 21/M | Left hip and left proximal tibia pain | N | Left proximal femur Left proximal tibia | N | BEACOPP Radiotherapy Curettage | 4-y PFS | [26] |
| 18 | 2006 | 7/M | Painless, firm 3-cm mass overlying his sternum | N | L1, Sternum Left SI joint Right acetabulum | Y | Chemotherapy | In treatment Dramatic decrease in tumor at 2 wk | [27] |
| 19 | 2009 | 12/– | Low back pain Progressive lower extremity weakness | N | L1-L3 | Y | 6 Courses ABVD Radiotherapy Laminectomy and | 7-y PFS Normal functional | [28] |

| Case | Year | Age/gender | Symptoms | B symptom | Bone site(s) | Pathological fracture/nerve comprehension | Treatment | Status | References |
|------|------|-----------|----------|-----------|--------------|-------------------------------------------|-----------|--------|------------|
| 20 | 2012 | 68/F | numbness over the lower extremities / Low back pain | Y | L2-L5 | Y | posterior decompression / 6 Cycles ABVD | Complete remission 5 mo | [29] |
| 21 | 2012 | 38/F | Right upper chest pain | N | Right second rib | N | 5 Cycles COPP / Field radiotherapy | 2-y PFS | [11] |
| 22 | 2012 | 42/F | Swelling and pain in right shoulder | N | Acromion of the right scapula | N | 3 Cycles chemotherapy | In treatment | [29] |
| 23 | 2013 | 28/F | Upper back pain | N | T2, T3 | Y | 12 Cycles ABVD / Radiotherapy / Decompression surgery | 6-y PFS | [30] |
| 24 | 2013 | 35/M | Sacral pain | N | Ilium and sacrum | N | ABVD | — | [7] |
| 25 | 2014 | 22/F | Lumbar-sacral-pelvic area pain | Y | Each sacroiliac joint, left greater trochanter | N | ABVD | Symptom release / Stable disease for 6 mo | [31] |

DOD = dead of disease, DSF = disease-free survival, F = female, HL = Hodgkin lymphoma, LFU = lost follow-up, M = male, N = no, PFS = progression-free survival, Y = yes.

and differentiation.[13] So, there are also 3 points that revealed a systemic disease of our case: first is the B symptom that the patient showed 3 months before being admitted to our hospital; Second, the high WBC count with relatively high neutrophils rate and low Hgb; lastly, the bone marrow aspiration revealed a hyperactive hyperplasia of karyocyte. Previous study showed stage IV included patients with multiple bone involvement without evidence of distant nodal or visceral disease.[14] However, the adjacent multifocal lesions like ours and nonadjacent multifocal lesions suggested different disease stage, as adjacent multifocal lesions mostly come from local invasion but distant multifocal lesions revealed a hematogenous spread or direct spread from the contiguous involved lymph node. So, further work should focus on more details of this disease's diagnosis standard. As our patient had B symptom and the sacroiliac joint destruction (revealed 2 bone sites involvement), a finally diagnosis of unfavorable stage IV bone CHL (Ann Arbor staging criteria) was made.

HRS cells of HL are almost 100% positive for CD30 and 85% positive for CD15 on immunohistochemical staining.[15] The differential diagnosis of CD30 positive neoplasms that show the similar clinical and pathologic features with CHL were primary mediastinal large B-cell lymphoma (PMBCL) and gray zone lymphoma. Hoeller et al found that BOB.1, CD79a, and cyclin E are applicable immunohistochemical markers that can help distinguishing CHL from PMBCL.[16] B-cell lymphoma, unclassifiable, with features intermediate between diffuse large B-cell lymphoma (DLBCL) and CHL, was initially proposed in the 2008 WHO Classification of Tumors of Hematopoietic and Lymphoid Tissues, which was afterward named gray zone lymphoma. There are mainly 2 type of gray zone lymphoma. One is similar to CHL in shape, but the immunophenotype of tumor cells was closer to DLBCL. Another was tumor morphology was similar to that of DLBCL, but immunophenotype of tumor cells was closer to CHL; CD30 and CD15 were diffuse positive whereas CD20 and PAX5 expression levels are down.[17,18]

It seems that primary bone HL most likely appears on spine or long bone, seldom occurs in pelvic (Table 2).[5,6,8,13,19–33] Nodular sclerosis CHL represents 70% of CHL in Europe and USA, and this figure in China is 32.6%.[34] Almost 54% of nodular sclerosis CHL cases present with a huge soft mass.[35] Fibrosis was another prominent feature in the nodular sclerosis case.[6] So, primary bone HL may be one differential diagnosis of osseous tumor which is with a fibrous stromal component. For example, the initial diagnosis of Hodgkin disease was malignant fibrous histiocytoma in a recent study.[36] The clinical manifestations and imaging are nonspecific with limitations to distinguish primary bone nodular sclerosis HL of pelvic involvement from other common primary pelvic sarcomas such as chondrosarcoma, Ewing sarcoma, osteosarcoma sarcoma, and malignant fibrous histiocytoma[37–41] (Table 3). Although the image features are sometimes similar, clinicopathologic characteristics and treatment options have obvious difference between CHL and other pelvic primary sarcomas.[9,40,42–44]

The IPS of our patient is 4, which indicates an unfavorable disease. IPS is the most widely accepted risk stratification model that can help to determine the clinical treatment as well as predict prognosis for stage III-IV cases.[45] It utilizes 7 adverse prognostic factors and each of these factors can decrease the survival rate by 7% to 8%.[45] According to the Memorial Sloan-Kettering Cancer Center experience, IPS ≥4 was a significant independent predictor of worse overall survival and progression-free survival for extensive or advanced HL.[46] The patient in our study

**Table 3**

Clinic and imaging features of the primary pelvic sarcomas.

| Tumor | Age, y | Gender (M/F) | Rate of pelvic malignances | X-ray or CT | MRI | Treatment | Efficient (5-y survival) | References |
|---|---|---|---|---|---|---|---|---|
| Our case | 20 | F | – | X-ray: Osteolytic erosion CT: Osteolytic erosion, no obvious periosteal reaction Spread from ilium to sacrum | T1: Slightly higher signal compared with neighboring muscle groups T2: Relative long signal that were associated with destructive changes in the left pelvis | Chemotherapy + limb-salvage surgery | 3-y DFS | – |
| Chondrosarcoma | 40–60 | – | 24–32% | An aggressive moth-eaten or permeative pattern of destruction with ill-defined margins, cortical destruction, pathologic fracture, aggressive periosteal reaction, and soft-tissue mass | T1: Relative low T2: Lobules of high signal chondroid matrix separated by low signal fibrovascular septa | 1. Surgery resection + radiotherapy 2. Low response to chemotherapy | 59–72% | [23] [42] |
| Ewing sarcoma | 10–20 | Mainly M | 16–22% | 1. Reactive sclerotic matrix periosteal reaction might have a multilamellated or onion-peel appearance with difficult to see Codman triangle 2. Large soft-tissue mass | T1: Hypointense or isointense T2: Variable signal. Cellular areas low to intermediate signal, and hemorrhage and necrosis display high signalExtension across the sacroiliac joint might be seen, but extension across the hip joint is rare | Chemotherapy Surgery resection | 37.1–46% | [39] [40] |
| Osteosarcoma | Media: 20 | M:F (3:2) | 9–20% | 1. Large aggressive lesion with a permeative or moth-eaten pattern of destruction and with mixed lytic/sclerotic appearance. 2. Aggressive periosteal reaction and soft-tissue mass | T1: Low to intermediate T2: High signal Osteoid matrix displays a low signal on all sequences. | Chemotherapy Surgery resection | 19–67% | [8] [23] [38] |
| MFH | Peak at 20–30 or 60–70 | M:F (3:2) | Almost 7% | 1. Aggressive lytic lesion with a permeative pattern of destruction and ill-defined margins. 2. Sometimes well-defined margins, sclerotic rim, dystrophic mineralization 3. Periosteal reaction and cortical expansion are variable. | T1: Isointense to hyperintense T2: Isointense to slightly hyperintense signal. A lower signal of fibrous tissue matrix and variable cellularity in these lesions | 1. Low response to chemotherapy 2. Surgery + radiotherapy + small molecular target drugs | 34–53% | [40] |

CT = computed tomography, DFS = disease-free survival, F = female, M = male, MFH = malignant fibrous histiocytoma, MRI = magnetic resonance imaging.

received a total of 6 cycles ABVD chemotherapy. The NCCN (2016) guidance for stage III-IV CHL patients revealed that ABVD or Stanford V for selected patients with IPS <3, or escalated-dose BEACOPP in selected patients <60 years with an IPS ≥4 are included as options for primary treatment for patients with stage III-IV disease.[46–49] Patients with 1 or multiple bone lesions usually respond well to combined-modality treatment, including chemotherapy and local radiotherapy. Up to now, 2 largest series patients with primary bone lymphoma studies demonstrated that patients with primary bone lymphoma treated with combined-modality versus single-modality therapy were found to have a superior outcome, with a significantly better survival.[50,51] Ding et al evaluated the antitumor activity of bortezomib in combination with IGEV (ifosfamide, gemcitabine, vinorelbine, and prednisone) chemotherapy in a young male with primary bone HL who achieved low response after ABVD and ECHOP chemotherapy. Complete response was achieved after 2 cycles. This event suggested that bortezomib in the therapy of young patient suffering from primary bone HL maybe effective and safe.[52] For many HL patients who relapse following a response to initial chemotherapy, high-dose chemotherapy followed by an autologous stem cell transplantation is the standard care.[53] In addition, small target drugs therapy showed promising outcome for relapsed HL cases in recent years. CD30 is expressed on the HRS cell and antibodies like brentuximab vedotin targeting this molecule have shown activity in vitro.[54,55] Recently reported clinical trials have shown that blocking interactions between the cell surface receptor programmed cell death 1 (PD-1) and its ligands PD-L1 and PD-L2 results in very high clinical-response rates.[56] Other agents with promising activity for this patients group include histone deacetylase inhibitors, PI3K inhibitors, and immunomodulatory agents.[57,58]

Surgery resection and limb-salvage reconstruction are seldom performed for such a hematologic malignancy. In most contexts, surgery was strictly used for biopsy, especially when needle biopsy was limited to get a significant outcome for some special sites such as pulmonary.[45] For bony HL, surgery was necessary for the treatment of actual or possible pathological fractures or spine cord and nerve comprehension.[52,59,60] Limb-salvage surgery in some special individuals got a satisfying clinical outcome. In a large series study, Khodamorad and colleagues suggested that combined-modality therapy for stage IE primary bone lymphoma resulted in good survival rate. In case of local recurrence, wide excision and limb-salvage reconstruction improved the clinical outcomes.[61] Alper et al reported in a young male diagnosed with primary bone lymphoma located in distal femur, distal femoral resection prosthesis was performed to prevent the risk of fracture and the patient was in remission and continued to attend school.[60] From the CT scan of our patient, we can see that the ilium, acetabular, and sacroiliac joint are severe destructed making the patient meet high risk of pathologic fracture. Furthermore, the patient showed a sciatic nerve comprehension symptom which was confirmed during surgery procedure. To sum up, as pelvic-ring is the central part of weight-bearing of our body and no other organs showing diseases involvement, tumor resection following limb-salvage reconstruction can get good local tumor control as well as preserve limb function to the greatest extent for our special individual.

The limb function of the patient recovered well so that she can take care of herself, study, and do some special works at 3-year follow-up. There are some key tips for such an extensive surgery to improve surgery success rate and limb function. First, the application of lower abdominal aortic balloon occlusion technique can effectively reduce an average blood loss of 1500 mL for pelvic sarcoma surgery, which typically shortens operative time to only 4 hours.[62] Second, "no touch" resection of the tumor, with a surgical margin of normal tissue at least 1.0 cm wide from the tumor pseudocapsule are recommended to reduce risks of seeding of cancer cells into the circulation. Third, muscle and soft tissue in situ reconstruction was mainly designed to achieve sufficient soft tissue coverage and functional recuperation after the hemipelvic prosthetic reconstruction. Moreover, we adopted LARS (ligament advanced reinforcement system, R06 × 400/s, France) to reconstruct the hip capsule and supply the point of attachment for muscles and soft tissues during reconstruction in recent years. Fourth, functional exercise and the time to early ambulatory activity should be based on the extent of resection, the hip stability after reconstruction with the hemi-pelvic prostheses, and the reconstruction of the periacetabular muscles.[63] The application of limb brace can reduce dislocation risk and help the patient for function exercise after surgery.[64]

## 4. Conclusion

CHL initially presenting as pelvic involvement with such a huge tumor volume is indeed rare. The diagnosis of primary bone HL should be made by strict histological and clinical manifestation. Chemotherapy is still the main treatment option for bony HL patient. Limb-salvage surgical resection is required only when bony HL patient meets a high risk of pathological fracture like our case. Overall, limb-salvage surgery combining 6 cycles ABVD chemotherapy got a promising 3-year clinical outcome in our study for such a late stage unfavorable patient. Mastering the surgery indication and fully assessing different therapy options risk is necessary for such a challenging case.

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