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CASE REPORT

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Primary giant liposarcoma of the gallbladder: a case report and literature review

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Abstract

Background Liposarcoma of the gallbladder is an exceptionally rare malignancy originating from adipose tissue. Its rarity and diagnostic challenges make this case noteworthy. Liposa rcomas exhibit diverse histological subtypes, each with distinct biological behaviors, and there is limited consensus on optimal treatment approaches. This report emphasizes the importance of accurate diagnosis, effective therapeutic strategies, and detailed analysis of clinical outcomes in managing such rare cases.

Case Presentation A 35-year-old woman presented with a two-month history of a palpable abdominal mass accompanied by mild bloating. She reported no significant discomfort, systemic symptoms, or changes in bowel habits. Imaging revealed a large abdominal mass displacing adjacent organs. Magnetic resonance imaging suggested a mixed-signal lesion originating from the gallbladder, and laboratory tests showed elevated inflammatory markers. The patient underwent successful surgical excision of the mass and cholecystectomy. Pathological examination confirmed a well-differentiated liposarcoma closely associated with the gallbladder. Immunohistochemistry indicated positivity for CDK4, MDM2, P16, S-100, and CD34, with a low proliferation index (Ki-67 ~ 10%). Postoperative recovery was uneventful, and the patient showed significant improvement. Long-term management, including genetic testing and follow-up, was planned to monitor recurrence risk and explore potential targeted therapies.

Conclusions This case underscores the importance of considering rare malignancies like liposarcoma of the gallbladder in the differential diagnosis of abdominal masses. Early diagnosis through imaging and histopathological confirmation is crucial for optimal management. Complete surgical excision remains the cornerstone of treatment, particularly for well-differentiated subtypes, which generally have favorable prognoses. The findings highlight the need for multidisciplinary care and further research into genetic and molecular mechanisms to guide future targeted treatments.

Keywords Liposarcoma, Gallbladder, Abdominal tumor, Surgical resection, Rare malignancy

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Introduction

Liposarcoma, the most common subtype of soft tissue sarcomas, originates from adipocytes [1, 2]. Liposarcoma of the gallbladder is exceedingly rare, with only a handful of cases reported globally, highlighting its clinical rarity and unique presentation [3–5]. Liposarcomas are histologically classified into well-differentiated, dedifferentiated, myxoid, and pleomorphic subtypes [6]. However, the diagnostic challenges specific to gallbladder-origin liposarcomas remain underexplored, primarily due to their extreme rarity and the lack of distinctive imaging or clinical features that differentiate them from more common gallbladder pathologies such as carcinoma or benign lipomatous tumors. Genetic alterations, particularly MDM2 and CDK4 amplification, are often implicated in their pathogenesis, alongside potential environmental factors such as radiation exposure or chemical carcinogens [7–10].

Clinically, liposarcoma often presents as a deep-seated, painless, and progressively enlarging mass [11–13]. For gallbladder-origin liposarcomas, their clinical presentation is particularly challenging to identify, as symptoms often overlap with other biliary tract disorders or remain entirely absent until the tumor reaches an advanced stage. CT, MRI, and immunohistochemistry are essential for diagnosis [14–16]. Surgical excision remains the mainstay of treatment, particularly for well-differentiated subtypes, which generally have favorable prognoses [17, 18].

This necessitates a high degree of clinical suspicion and histopathological confirmation to avoid misdiagnosis. Several case reports have highlighted the diverse clinical presentations and treatment outcomes of gallbladder liposarcomas. These cases, such as those reported by Zentralbl Allg Pathol (1983) [5] and World J Surg Oncol (2018) [19], demonstrate the challenges of diagnosis and recurrence risks. Detailed analysis of these cases can be found in Table 1, which summarizes their diagnosis, treatment approaches, and patient outcomes. This case report highlights the diagnostic and therapeutic challenges associated with gallbladder liposarcoma. By focusing on the unique diagnostic hurdles of liposarcomas of the gallbladder, this report seeks to address existing gaps in the literature and provide a clearer framework for distinguishing these tumors from other gallbladder pathologies through imaging, histology, and immunohistochemistry.

Case report

A 35-year-old woman was admitted to our hospital for evaluation and treatment after noticing an abdominal mass two months earlier. She reported mild abdominal distention but denied any associated symptoms such as nausea, vomiting, or significant discomfort. On physical examination, the patient was alert and showed no signs of jaundice. The abdomen was flat with no visible venous distention, and it was soft to palpation without tenderness or rebound pain. A large mass was palpable in the right upper quadrant, though the liver and spleen were not palpable, and no Murphy's sign was observed. The patient's general condition was stable, with no weight loss or significant changes in daily activities.

On August 18, 2024, a series of laboratory and imaging studies were conducted to assess her condition. Laboratory results showed elevated AST (118 U/L) and inflammatory markers, including IL-6 (12.5 pg/mL), IL-10 (7.55 pg/mL), and CRP (16.72 mg/L). The bilirubin level was normal. Platelet antibody testing was positive (++), while urine and stool cultures were negative.

Preoperative staging included a CT thorax to exclude pulmonary metastases, which confirmed no evidence of distant metastasis. The case was discussed in a multidisciplinary team (MDT) meeting involving hepatobiliary surgeons, radiologists, and oncologists, where

Table 1 Summary of case reports on gallbladder liposarcoma: diagnosis, treatment, and outcomes

Reference	Case Description	Diagnosis	Treatment	Outcome
Zentralbl Allg Pathol, 1983 [5]	79-year-old man with myxoid liposarcoma; later developed diffuse peritoneal metastases.	Myxoid liposarcoma	Cholecystectomy	Recurrence and metastases noted post-surgery.
World J Surg Oncol, 2018 [19]	71-year-old woman with abdominal mass and fever, diagnosed with gallbladder liposarcoma intraoperatively.	Dedifferentiated liposarcoma	Cholecystectomy, liver resection	First reported case of dedifferentiated liposarcoma of the gallbladder.
J Surg Case Rep, 2021 [36]	53-year-old man with gallbladder myxoid liposarcoma; prior history of leg liposarcoma.	Myxoid liposarcoma	Laparoscopic cholecystectomy	Recurrence in leg after 16 months.
Front Surg, 2024 [37]	64-year-old woman with painless abdominal mass, suspected malignant gallbladder tumor.	Dedifferentiated liposarcoma	Cholecystectomy, mass resection	No recurrence after 15 months.
J Clin Ultrasound, 2024 [38]	Well-differentiated inflammatory liposarcoma in muscularis layer of the gallbladder, difficult to diagnose preoperatively.	Inflammatory liposarcoma	Surgical resection	Successful surgery, no complications, and no recurrence at 7 months follow-up.

This table summarizes various case reports of liposarcoma in the gallbladder, focusing on patient demographics, diagnosis, treatment methods, and outcomes. The majority of cases involved myxoid and dedifferentiated liposarcomas, treated primarily with cholecystectomy and sometimes additional surgical interventions. Recurrences were observed in several cases, but many patients remained disease-free for extended periods post-surgery. Outcomes varied significantly, highlighting the complexity of treating gallbladder liposarcoma and the importance of early diagnosis and complete surgical resection

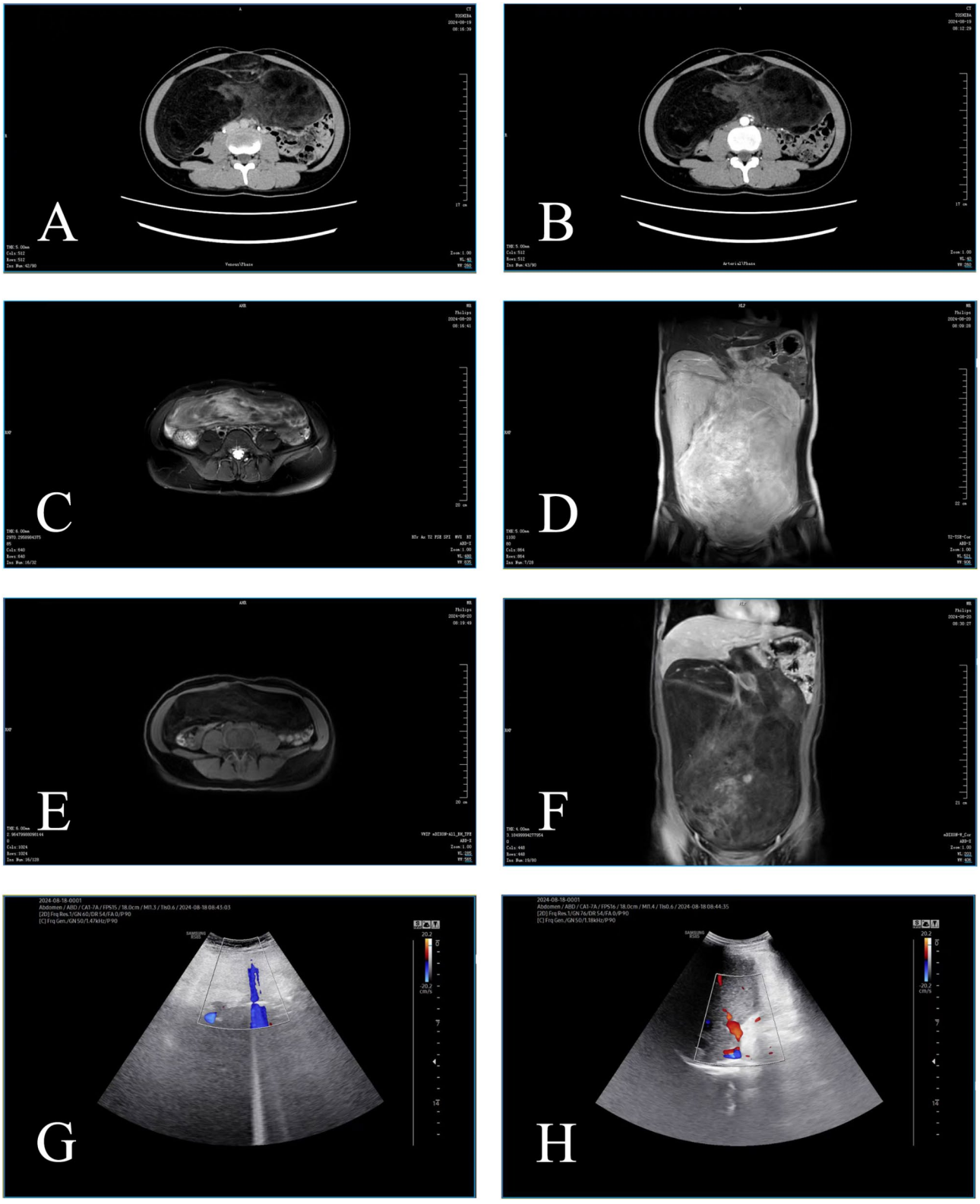

Fig. 1 (See legend on next page.)

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Fig. 1 Imaging Findings of Primary Giant Liposarcoma of the Gallbladder. (**A-B**) Enhanced CT scans show a large, mixed-density pelvic mass (23.1 × 8.5 × 31 cm) with predominantly fat density, irregular borders, and heterogeneous post-contrast enhancement. Mild biliary duct dilation. (**C**) MRI reveals a hyperintense mass with heterogeneous signal intensity, suggestive of a complex lesion, with marginal enhancement post-contrast. (**D**) Coronal T2-weighted MRI demonstrates the mass with heterogeneous signals, causing displacement of adjacent organs. (**E**) Axial MRI confirms the large, mixed-signal mass with marginal enhancement and significant organ compression. (**F**) Coronal MRI shows a hyperintense mass on T1 and T2 sequences with areas of low signal on fat-saturated imaging, indicative of adipose tissue involvement. (**G-H**) Ultrasound shows a well-defined right renal cyst (1.3 × 1.0 cm) without enhancement. The liver and biliary system appear normal, and the kidneys exhibit no abnormalities

complete surgical resection was deemed feasible. Imaging revealed a large abdominal mass. Magnetic resonance cholangiopancreatography (MRCP) provided an overview of the biliary tract, while MRI scans demonstrated a cystic, mixed-signal mass in the abdomen measuring approximately 24.5 cm × 7.6 cm × 31.2 cm. These imaging findings (Fig. 1) not only demonstrated the size and heterogeneity of the mass but also suggested its potential origin and relationship with adjacent structures, such as the gallbladder and liver. The hyperintense signals on MRI and absence of enhancement in certain regions supported the diagnosis of a predominantly adipocytic lesion, aligning with features of liposarcoma. Moreover, the observed biliary duct dilation further indicated secondary effects of the tumor's compression on surrounding anatomy. The MRI showed that the gallbladder was not visualized, and mild dilation of the intrahepatic and common bile ducts was noted. Contrast-enhanced ultrasound (CEUS) also failed to detect the gallbladder, with the mass appearing as a heterogeneous, predominantly low-signal area (Fig. 1).

Based on imaging and clinical findings, the patient was suspected to have a giant abdominal liposarcoma, potentially originating from the gallbladder. A US/CT-guided biopsy was considered but not performed due to concerns about false negatives and the risk of tumor seeding. However, due to the limitations of radiological diagnosis, the final confirmation relied on pathological examination and immunohistochemical analysis of the surgical specimen. On August 20, 2024, she underwent a successful abdominal mass excision and cholecystectomy under general anesthesia. To ensure a complete resection with negative margins, the surgical team carefully isolated the tumor along its boundary, preserving the surrounding organs and vasculature. The tumor was excised en bloc along with the gallbladder, including portions of the porta hepatis and its vascular pedicle. Intraoperative ultrasound was utilized to guide dissection and ensure no significant vascular or biliary injury. Additionally, lymph nodes at the porta hepatis were resected to confirm the absence of metastatic involvement. While the surgery was ultimately successful, several intraoperative challenges were anticipated and carefully managed. Given the tumor's large size and proximity to vital structures, potential complications such as significant bleeding, bile duct injury, or vascular involvement were meticulously evaluated during preoperative planning. Intraoperative ultrasound guided tumor boundaries, and vascular control minimized blood loss. Histopathological findings confirmed that the resection achieved R0 margins. A drainage tube was placed postoperatively, and cultures of the drainage fluid were negative for bacterial growth after two days.

Intraoperative strategies to prevent complications were thoroughly applied. The gallbladder was carefully separated from the tumor mass to avoid bile leakage, and a drainage tube was placed to monitor for potential postoperative bile collection or infection. Additionally, the use of hemostatic agents and meticulous suturing ensured adequate bleeding control during and after tumor resection. Postoperative recovery was uneventful, and the patient's condition improved significantly. To ensure early detection of recurrence or metastasis, the follow-up plan includes biannual imaging assessments using MRI and CT for the first two years, followed by annual imaging if no recurrence is detected. Inflammatory markers and ctDNA will be monitored biannually to detect disease progression. She was discharged in stable condition and advised to follow up for further treatment plans based on histopathological findings.

Gross examination of the excised abdominal mass revealed a large, gray-yellow nodular mass measuring 30 cm × 24 cm × 8 cm (Fig. 2). The gross morphology of the mass (Fig. 2) revealed its well-encapsulated nature with regions of hemorrhage, consistent with the imaging findings. The partially intact capsule and bile leakage observed during dissection confirmed the tumor's close association with the gallbladder, which was subsequently evaluated for potential infiltration. This highlights the importance of correlating imaging features with gross pathology to understand tumor behavior and involvement of adjacent structures. The cut surface was solid and gray-yellow, with areas of hemorrhage and a partially intact capsule. Microscopic examination revealed well-differentiated adipocytes arranged in sheets, with occasional hyperchromatic nuclei and atypical fat cells. Immunohistochemistry confirmed the adipocytic origin (CDK4, MDM2, P16, S-100, CD34; Ki-67 ~ 10%) (Fig. 3). Such histopathological and immunohistochemical insights are critical in differentiating liposarcoma from benign lipomatous tumors or high-grade variants with worse prognoses. Fibrous septa were seen within the tumor, along with mild chronic inflammatory infiltration. To further investigate the molecular characteristics

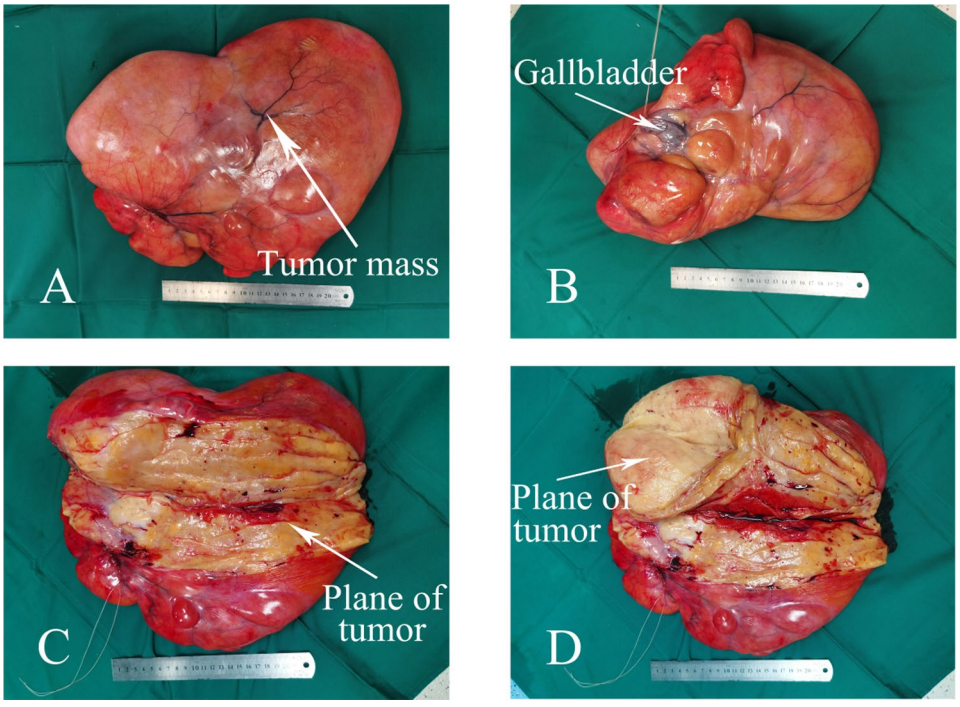

Fig. 2 Gross Pathology of Primary Liposarcoma Involving the Gallbladder. (**A-B**) Pre-operative images of the excised mass (30 × 24 × 8 cm) reveal a solid, gray-yellow nodular lesion with focal hemorrhages. The mass surface is smooth with multiple protrusions, surrounded by a partially intact capsule. (**C-D**) Post-operative dissection shows areas of smooth, intact capsules and a staple line marking the excision margin. Greenish bile leakage from the cut surface indicates possible gallbladder involvement. The bile duct tissue (3.5 × 2.5 × 1.5 cm) appears irregular and gray-white, while the gallbladder wall is closely adhered to the mass

of the tumor, additional genetic and molecular tests were planned. These included fluorescence in situ hybridization (FISH) to assess MDM2 amplification and next-generation sequencing (NGS) to identify other potential driver mutations or therapeutic targets. Preliminary discussions with genetic research teams have initiated protocols to standardize molecular testing in similar cases. The mass was closely associated with the gallbladder, which showed no significant histological abnormalities aside from areas of fibrosis and serosal involvement by the tumor.Immunohistochemistry showed that the tumor cells were positive for CDK4, MDM2, P16, S-100, and CD34, with SMA (vascular +) indicating vascular involvement. Ki-67 was positive in approximately 10% of tumor cells, indicating a relatively low proliferation index. Based on these findings, the tumor was diagnosed as a low-grade/well-differentiated liposarcoma (Fig. 3).

The pathology report suggested that further molecular testing, including MDM2 gene amplification using FISH (fluorescence in situ hybridization), might be useful for confirming the diagnosis. However, due to the unavailability of such data in this case, this represents a limitation in the study and its depth of analysis. To address these limitations, prospective studies with a focus on molecular profiling and therapeutic trials are urgently needed. A multicenter collaboration is being considered to establish a comprehensive database of liposarcomas of the gallbladder, enabling more robust comparisons and treatment refinements. The patient was referred to a specialized center for soft tissue sarcoma management and genetic testing to determine the best course of action for her long-term care. A multidisciplinary tumor board has recommended a follow-up schedule comprising imaging every six months for two years, with concurrent evaluation of inflammatory markers and molecular diagnostics to optimize surveillance for recurrence or metastasis.

Discussion

The imaging, gross pathology, and histopathological findings (as shown in Figs. 1, 2 and 3) collectively illustrate the diagnostic process and provide a comprehensive understanding of this rare case. Liposarcoma of gallbladder is a rare and challenging malignancy originating from the biliary system, particularly the gallbladder [19]. Its diagnosis and treatment pose significant difficulties due to the tumor's rarity and the lack of extensive clinical experience. This case highlights critical aspects of liposarcoma of the gallbladder, including its diagnostic and therapeutic challenges.

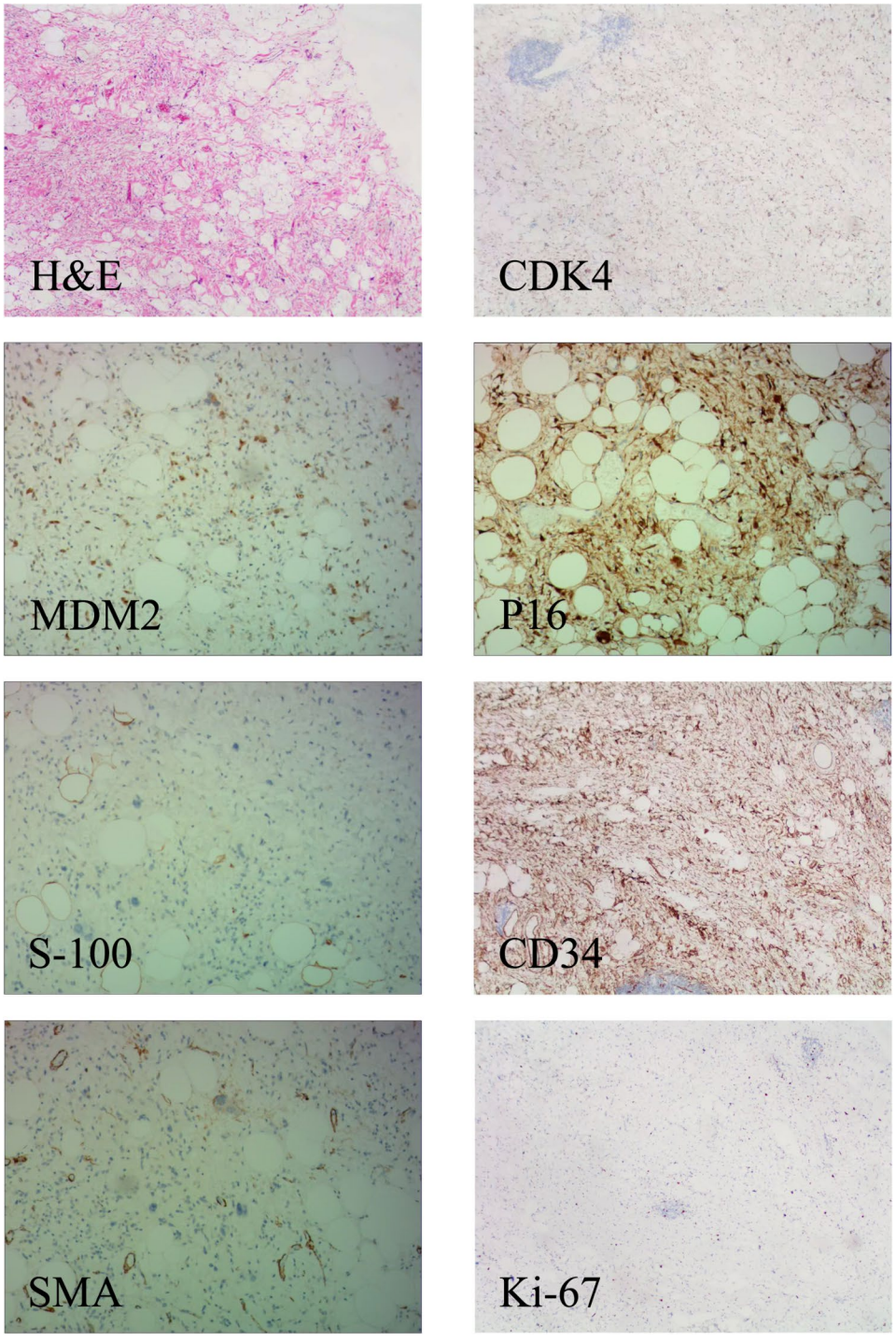

Fig. 3 Histopathological and immunohistochemical features. Hematoxylin and eosin (H&E) staining reveals well-differentiated adipocytes with thickened fibrous bands, focal atypical fat cells, and scattered atypical stromal cells. Chronic inflammatory infiltration and serosal surface blending are observed without distinct tumor boundaries or necrosis. Immunohistochemical staining shows strong positivity for CDK4, MDM2, P16, S-100, and CD34, confirming the tumor's adipocytic origin. Vascular smooth muscle staining is positive for SMA, and a Ki-67 index of approximately 10% suggests a low-grade liposarcoma. No invasion of the mucosa or muscular layer is detected

Etiology and risk factors

The exact cause of liposarcoma of the gallbladder remains unclear. However, several factors have been implicated in the development of liposarcomas in general. Genetic factors may play a crucial role [20]. Mutations in genes such as MDM2, CDK4, and HMGA2 have been associated with liposarcomas [17, 21, 22]. MDM2 amplification highlights the genetic basis of liposarcoma. CDK4 amplification often occurs in conjunction with MDM2 amplification, contributing to cell cycle dysregulation [23]. In this case, the patient exhibited positive immunohistochemical staining for CDK4 and MDM2, suggesting a genetic predisposition to the tumor [24]. MDM2 and CDK4/6 inhibitors may offer potential therapeutic options for liposarcomas of the gallbladder. This case should be included in a study exploring targeted therapies for rare adipose tumors [25].

Clinical presentation

The nonspecific symptoms make early diagnosis challenging [20]. In this case, the patient presented with only mild abdominal distention and no significant discomfort, highlighting the tumor's insidious nature.

Laboratory investigations

Laboratory investigations play a supporting role in the diagnosis of liposarcoma of the gallbladder. Elevated AST and CRP levels were observed but are not diagnostic.

Imaging

Imaging modalities are crucial for the diagnosis, staging, and treatment planning of liposarcoma of the gallbladder. While both CT and MRI are pivotal in the diagnostic evaluation of soft tissue tumors, they have distinct advantages [26]. MRI excels in providing superior soft-tissue contrast and detailed visualization of the tumor's internal architecture, such as fat components and fibrous septa [27]. This makes MRI the modality of choice for evaluating lipomatous tumors and determining the relationship of the tumor with adjacent organs, as seen in this case [28]. In this case, MRI with MRCP revealed a large mixed-signal mass consistent with liposarcoma, while ultrasound failed to visualize the gallbladder. The tumor's large size and compression of adjacent organs, as visualized through MRI and CT, underscored the complementary roles of these modalities in arriving at the diagnosis. On the other hand, CT scans are indispensable for detecting distant metastases and providing a comprehensive assessment of the tumor's impact on adjacent organs [29]. CT ruled out metastasis, while MRI confirmed the tumor's lipomatous nature and organ displacement. Imaging excluded gallbladder carcinoma and benign lipomas based on specific features. The large size, heterogeneous signals, and positive MDM2/CDK4 immunohistochemical findings in this case supported the diagnosis of liposarcoma over other potential pathologies.

Histopathological examination

The gold standard for confirming liposarcoma of the gallbladder is histopathological examination. In this case, the tumor was confirmed as a well-differentiated liposarcoma through microscopic evaluation and immunohistochemical staining. CDK4 and MDM2 positivity confirmed the diagnosis.

Treatment and management

Given the identification of molecular markers like MDM2 and CDK4 in this case, there is increasing potential for developing targeted therapies. For example, MDM2 inhibitors, such as RG7388, and CDK4/6 inhibitors like palbociclib have shown promise in treating soft tissue sarcomas, including liposarcoma, by preventing cell cycle progression and promoting tumor cell apoptosis [25]. Emerging therapies may benefit patients with higher recurrence risks. However, clinical application of these agents in liposarcoma of the gallbladder remains to be explored, and further research is needed to establish their efficacy and safety in this specific context [30, 31]. In this case, the patient underwent successful removal of the abdominal mass along with a cholecystectomy. Complete surgical excision with clear margins is essential given the tumor's size and location. In this case, careful dissection of tumor boundaries and the use of intraoperative imaging ensured the removal of the mass with minimal disruption to surrounding tissues, thereby reducing recurrence risks [32]. The patient's recovery was uneventful, and no signs of immediate recurrence were observed.

Prognosis and long-term management

Long-term prognosis in patients with liposarcoma of the gallbladder depends on several factors, including tumor size, histological subtype, margin status after surgery, and the presence of metastases [33, 34]. Recurrence is common, particularly in cases of incomplete resection or higher-grade tumors [35]. Well-differentiated liposarcoma, as seen in this patient, generally has a better prognosis compared to more aggressive subtypes. Regular imaging is essential for monitoring recurrence.

Conclusion

Liposarcoma of the gallbladder is a rare malignancy requiring accurate diagnosis through imaging and histopathology. Complete surgical excision is essential, especially for well-differentiated subtypes, which have favorable prognoses. Genetic profiling, including MDM2 and CDK4 markers, supports diagnosis and future targeted therapies. Multidisciplinary care and regular

follow-up are critical to monitor recurrence and guide personalized treatment. Further research into molecular mechanisms and liquid biopsy technologies is needed to improve early detection and therapeutic options. Collaborative efforts can establish comprehensive genetic databases to enhance understanding and management of this rare tumor.

Abbreviations

AST	Aspartate Aminotransferase
CEUS	Contrast-Enhanced Ultrasound
CT	Computed Tomography
FISH	Fluorescence In Situ Hybridization
MRI	Magnetic Resonance Imaging
MRCP	Magnetic Resonance Cholangiopancreatography
SMA	Smooth Muscle Actin

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Author contributions
Yu Yang and Yiwei Hou, Li Yi contributed equally to this work and are considered co-first authors. Conceptualization: Rongchun Xing, Mingzheng Hu. Resources: Rongchun Xing, Mingzheng Hu, Lihua Tang. Supervision: Mingzheng Hu, Rongchun Xing, Yu Yang. Writing- original draft: Yu Yang, Yiwei Hou, Li Yi, Lihua Tang, Chongyuan Chen.

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Data availability
The data supporting the findings of this study are not publicly available due to patient privacy and confidentiality. Anonymized data can be made available from the corresponding author upon reasonable request and with appropriate permissions from the hospital's ethics committee.

Declarations

Ethics approval and consent to participate
This study was conducted with the approval of the Ethics Committee of Medical Ethics Committee of Yichang Central People's Hospital (Approval No: 2024-354-01). The study adhered to the principles of the Declaration of Helsinki. Written informed consent was obtained from the patient for her participation in the study.

Consent for publication
Written informed consent for publication of clinical details and imaging was obtained from the patient.

De-identification of subjects
All efforts have been made to de-identify the patient and her case details to ensure privacy and confidentiality. Identifiable information has been omitted from the manuscript.

Competing interests
The authors declare no competing interests.

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