Case report: Hepatic inflammatory pseudotumor-like follicular dendritic cell sarcoma: A rare case and minireview of the literature

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Inflammatory pseudotumor (IPT)-like follicular dendritic cell sarcoma (FDCS) is a rare neoplasm referred to as the FDCS variant. Here we report a 66-year-old female patient suffering from hepatic IPT-like FDCS and summarize IPT-like FDCS reported in the literature. The patient presented with obvious abdominal pain without significant laboratory abnormalities and subsequently underwent surgical resection of a hepatic lesion. Postoperative pathological results demonstrated a vascular tissue-rich neoplasm (7.0-cm maximum diameter). The tumor cells expressed CD21 and CD35, and in situ hybridization detected Epstein–Barr virus-encoded RNA (EBER). Metastasis or recurrence was not detected during the 7-year follow-up.

KEYWORDS
inflammatory pseudotumor, follicular dendritic cell, sarcoma, case report, hepatic

Introduction

Follicular dendritic cells (FDCs) develop from perivascular precursors of stromal cell origin that are essential for the organization and maintenance of lymphoid architecture, induction of the germinal center reaction, production of B memory cells, and protection from autoimmune disorders (1). FDC sarcoma (FDCS) is an extremely rare neoplasm with nearly more than half of the cases occurring in lymph nodes (2). Extranodal FDCS, which mainly arises from intraabdominal organs such as liver, spleen, colon, and pancreas, may display systemic clinical symptoms (3). Inflammatory pseudotumor (IPT)-like FDCS is a recently described unique subtype of FDCS with different histological appearances and behavior compared with those of classical FDCS. The most recent World Health Organization (WHO) classification notes that IPT-like FDCS appears to be indolent; however, the data on clinical outcomes are limited (4).
The cause of IPT-like FDCS is unknown, and the diagnostic criteria are not definitive. However, Epstein–Barr virus (EBV) infection is considered one of the most important etiologies of this sarcoma (4). Distinguishing IPT-like FDCS from other tumors is very challenging, and such tumors are commonly misdiagnosed as inflammatory lesions or other malignant neoplasms. Definite diagnosis of IPT-like FDCS should rely on radiology, cellular morphology, histopathology, and immunohistochemistry. IPT-like FDCS exhibits indolent features, prognosis is favorable, and surgical excision is the best treatment.

Herein, we report the case of a 66-year-old female with an intraabdominal IPT-like FDCS in the hepatic right lobe. By analyzing the distinctive clinicopathologic features of this rare case combined with reviewing the related literature, here we summarize the current clinical features and diagnosis of IPT-like FDCS and discuss the treatment and prognosis of this tumor subtype.

Literature review

We systematically searched the PubMed, EMBASE, and MEDLINE databases using the search terms “inflammatory pseudotumor-like” combined with “follicular dendritic cell sarcoma,” or “follicular dendritic cell tumor,” or “fibroblastic dendritic cell sarcoma,” or “fibroblastic dendritic cell tumor” in research published from 2000 to 2022. We collated demographic, clinicopathological, and follow-up information (Table 1).

Case presentation

In 2015, a 66-year-old woman who suffered from right upper abdominal pain was admitted to the Department of Hepatic Surgery and Liver Transplantation Center at the Third Affiliated Hospital of Sun Yat-sen University because of a liver mass detected using abdominal ultrasound at a local hospital. Based on ultrasound examination and medical history, the preliminary diagnosis was liver-occupying lesions and diabetes mellitus type 2. The patient did not complain of vomiting, nausea, fever, or diarrhea. After admission, the values of routine tests including liver and kidney function and routine blood tests were almost within their normal limits. Liver function according to the Child–Pugh classification was class A. Serological analyses to detect hepatitis virus, syphilis, and human immunodeficiency virus were negative. Furthermore, the levels of common female-specific tumor markers, particularly α-fetoprotein (AFP), carcinoembryonic antigen (CEA), carbohydrate antigen (CA)-199, and CA-125 were normal. The patient had a long history of diabetes mellitus type 2 and achieved good fasting plasma-glycemic control with acarbose combined with metformin.

Preoperative enhanced magnetic resonance imaging (MRI) showed a mass approximately 94 × 74 mm with clear borders in hepatic segments VI and VII. On enhanced phase, the images showed progressive enhancement of the lesion, while enhancement was not seen in the necrotic region. Significantly, the lesion demonstrated slightly hypointense speckled signals on in-phase and out-of-phase T1WI. Therefore, the primary diagnosis highly suggested a hepatic fat-poor angioleiomyolipoma (Figure 1).

Although the diagnosis was not definitive, the large liver mass caused significant clinical symptoms (abdominal pain) in the absence of concurrent systematic disease. Our multidisciplinary hepatic surgery team therefore proposed surgical resection as the most appropriate procedure to confirm a diagnosis and further formulate the treatment strategy. Subsequently, the patient underwent resection of hepatic segments VI and VII, and minor complications occurred postoperation. During surgery, lesions were not observed in the gastrointestinal tract, spleen, mesentery, or other abdominal organs. The operation lasted 135 min, and the estimated intraoperative blood loss was approximately 150 mL.

Grossly, the size of the tumor was approximately 7.0 × 5.0 cm, presenting with an indistinct boundary and a patchy gray-red section with intratumor hemorrhage and necrosis. Postoperative pathology showed a sarcoma containing varying sizes of vessel lumens with negative surgical margins. The neoplastic tissue was extensively infiltrated by definite lymphocytes, plasma cells, and spindle cells. The tumor cells were fusiform and ovoid with a translucent cytoplasm and large vacuolated nuclei. According to the infiltration of numerous lymphocytes into the neoplastic tissues and immunohistochemical detection of CD21 and CD35 expression as well as in situ hybridization detection of Epstein–Barr virus-encoded RNA (EBER), the morphological and immunophenotypic results were consistent with a diagnosis of IPT-like FDCS (Figure 2). Hence, the final diagnosis was revised to IPT-like FDCS.

The patient was discharged without adjuvant chemotherapy or radiotherapy and has been examined at our hepatic surgery follow-up clinic every 6 months. The outcome of the 7-year follow-up was good, and metastasis or recurrence was not detected.

Discussion

Follicular dendritic cell sarcoma (FDCS) is a rare mesenchymal tumor of follicular dendritic cell origin originally identified by Monda et al. in 1986 (2). FDCS is classified into the two histopathological subtypes as follows: conventional and inflammatory pseudotumor-like (5). IPT-like FDCS is
TABLE 1  Clinical characteristics of patients with inflammatory pseudotumor-like follicular dendritic cell sarcoma.

| References   | Case | Age (y) / Gender | Location     | Main complaints                              | Maximum diameter (cm) | EBER | Treatment                        | Follow-up     | Recurrence or metastasis |
|--------------|------|-----------------|--------------|---------------------------------------------|-----------------------|------|----------------------------------|---------------|--------------------------|
| Shi et al. (29) | 1    | 77/F           | Colon        | Lower abdominal pain with hematochezia      | 3.0   | +    | Endoscopic polypectomy          | 15 months     | N                        |
| Zhao et al. (30) | 2    | 56/F           | Colon        | Asymptomatic                                | 3.2   | +    | Surgery                         | 14 months     | N                        |
| Xue et al. (31) | 3    | 45/F           | Spleen       | Waist soreness                              | 2.9   | NA   | NA                               | NA            | NA                       |
|              | 4    | 40/F           | Spleen       | Asymptomatic                                | 7.3   | NA   | NA                               | NA            | NA                       |
|              | 5    | 81/M           | Spleen       | Asymptomatic                                | 8.1   | NA   | NA                               | NA            | NA                       |
|              | 6    | 59/F           | Spleen       | Left upper abdominal pain                   | 15.0  | NA   | NA                               | NA            | NA                       |
|              | 7    | 54/F           | Spleen       | Left upper abdominal pain                   | 3.6   | NA   | NA                               | NA            | NA                       |
|              | 8    | 71/F           | Spleen       | Asymptomatic                                | 4.5   | NA   | NA                               | NA            | NA                       |
|              | 9    | 67/M           | Spleen       | Asymptomatic                                | 6.0   | NA   | NA                               | NA            | NA                       |
| Xu et al. (20) | 10   | 81/M           | Liver        | Asymptomatic                                | NA    | NA   | Resection                       | 12 months     | N                        |
|              | 11   | 53/M           | Liver        | Abdominal distension                        | NA    | NA   | Resection                       | 24 months     | N                        |
|              | 12   | 76/F           | Spleen       | Asymptomatic                                | NA    | NA   | Resection                       | 10 months     | N                        |
|              | 13   | 49/F           | Spleen       | Asymptomatic                                | NA    | NA   | Resection                       | 24 months     | N                        |
|              | 14   | 73/M           | Spleen       | Asymptomatic                                | NA    | NA   | Resection                       | 18 months     | N                        |
|              | 15   | 66/F           | Liver and spleen | Epigastric pain                     | NA    | NA   | Resection                       | 20 months     | N                        |
|              | 16   | 62/F           | Spleen       | Asymptomatic                                | NA    | NA   | Resection                       | 18 months     | N                        |
|              | 17   | 43/F           | Spleen       | Abdominal distension                        | NA    | NA   | Resection                       | 24 months     | N                        |
|              | 18   | 36/M           | Spleen       | Fever                                       | NA    | NA   | Resection                       | 24 months     | N                        |
|              | 19   | 41/F           | Spleen       | Asymptomatic                                | NA    | NA   | Resection                       | 17 months     | N                        |
|              | 20   | 88/M           | Spleen       | Asymptomatic                                | NA    | NA   | Resection                       | 12 months     | N                        |
| Pascariu et al. (32) | 21   | 34/F           | Liver        | Epigastric pain                             | 6.0   | +    | Laparoscopic hepatectomy        | 2 months after reoperation | 72 months after first surgery |
| Nguyen et al. (33) | 22   | 44/F           | Spleen       | Left upper quadrant abdominal pain           | 2.5   | +    | Laparoscopic splenectomy        | NA            | 12 months after first surgery |
| Morales-Vargas et al. (34) | 23   | 66/F           | Spleen       | Left upper quadrant pain                    | 5.0   | +    | Splenectomy                      | 6 months      | N                        |
| Lu et al. (35) | 24   | 55/F           | Liver        | Epigastric pain                             | 14.5  | +    | Hepatectomy                      | 60 months with PR | Paravertebral metastasis and recurrence |
| Liu et al. (4) | 25   | 61/M           | Liver        | Asymptomatic                                | 4.2   | –    | Laparoscopic hepatectomy        | 13 months     | N                        |
| Li et al. (36) | 26   | 47/M           | Liver        | Right upper quadrant abdominal pain         | 20.0  | +    | Hepatectomy                      | 50 months     | N                        |
| He et al. (37) | 27   | 64/F           | Lung         | Asymptomatic                                | 2.0   | +    | Lobectomy                       | 10 months     | N                        |
| Bruhl et al. (38) | 28   | 70/M           | Spleen       | Epigastric pain                             | 9.9   | +    | Splenectomy                      | 24 months     | N                        |
| Zhuang et al. (8) | 29   | 27/F           | Spleen       | Desquamative stomatitis                     | 9.0   | NA   | Splenectomy                      | 12 months     | N                        |

(Continued)
| References | Case | Age (y)/Gender | Location                  | Main complaints   | Maximum diameter (cm) | EBER | Treatment                                | Follow-up | Recurrence or metastasis |
|------------|------|----------------|---------------------------|-------------------|-----------------------|------|------------------------------------------|-----------|--------------------------|
| Jin et al. (39) | 30   | 38/M           | Liver                     | Asymptomatic      | 12.4 +                | Hepatectomy | NA                                      | NA        | NA                       |
| Mograbi et al. (40) | 31   | 70/F           | Pancreas and spleen       | Asymptomatic      | 7.0 +                | Pancreatectomy and splenectomy | NA | NA                       |
| Li et al. (19) | 32   | 31/F           | Liver                     | Asymptomatic      | 3.6 +                | Hepatectomy | 26 months                              | N         |                          |
| Wu et al. (21) | 34   | 52/M           | Spleen                    | NA                | 7.0 +                | Resection   | 84 months                              | N         |                          |
| Li et al. (19) | 33   | 48/M           | Liver                     | Asymptomatic      | 10.0 +               | Hepatectomy | 10 months                              | N         |                          |
| Wu et al. (21) | 35   | 46/M           | Liver                     | NA                | 3.5 +                | Resection   | 35 months                              | N         |                          |
| Li et al. (19) | 36   | 37/F           | Liver                     | NA                | 8.5 +                | Resection   | 14 months                              | N         |                          |
| Wu et al. (21) | 37   | 64/F           | Liver                     | NA                | 11.0 +               | Resection   | 41 months                              | N         |                          |
| Wu et al. (21) | 38   | 63/F           | Spleen                    | NA                | 4.0 +                | Resection   | 17 months                              | N         |                          |
| Li et al. (41) | 39   | 54/F           | Spleen                    | NA                | 8.5 +                | Resection   | 7 months                               | N         |                          |
| Wu et al. (21) | 40   | 53/M           | Spleen                    | NA                | 3.0 +                | Resection   | 3 months                               | N         |                          |
| Li et al. (41) | 41   | 64/F           | Spleen                    | Epigastric pain   | 7.2 +                | Laparoscopic splenectomy | 8 months | N                         |
| Wu et al. (21) | 42   | 61/M           | Spleen                    | Asymptomatic      | 6.2 +                | Laparoscopic splenectomy | 16 months | N                         |
| Wu et al. (21) | 43   | 42/F           | Spleen                    | Left-sided flank pain | 4.0 +                | Laparoscopic splenectomy | 9 months | N                         |
| Li et al. (41) | 44   | 57/F           | Spleen and lung           | Epigastric pain   | 13.3 +               | Laparoscopic splenectomy | 4 months | Pulmonary metastasis         |
| Kwon et al. (42) | 45   | 52/M           | Spleen and vertebra       | Back pain         | 3.7 +                | Laparoscopic splenectomy | 5 months | Multiple bone metastasis        |
| Kazemimood et al. (25) | 46   | 58/F           | Spleen                    | Asymptomatic      | 5.0 +                | Splenectomy | 24 months                              | N         |                          |
| Hang et al. (15) | 47   | 53/F           | Colon                     | Abdominal discomfort | 3.0 –                | Laparoscopic right colectomy | NA | NA                       |
| Wang et al. (9) | 48   | 57/M           | Spleen                    | Asymptomatic      | 2.7 +                | Laparoscopic splenectomy | 9 months | N                         |
| Kitamura et al. (43) | 49   | 60/F           | Left axillary region and neck | Myasthenia        | 6.4 –                | Rituximab | 2 months after discharge | Dead due to MODS |                          |
| Hu et al. (44) | 50   | 74/F           | Spleen                    | Asymptomatic      | 2.9 +                | Splenectomy | 24 months                              | N         |                          |
| Gong et al. (45) | 51   | 49/F           | Left adrenal gland        | Asymptomatic      | 5.0 NA               | Left adrenalectomy | 58 months | The tail of pancreas recurrence     |
| You et al. (46) | 52   | 42/F           | Colon                     | Asymptomatic      | 4.5 +                | Endoscopic excision | 16 months | N                         |
| Bui et al. (18) | 53   | 50/F           | Spleen                    | Abdominal pain    | 6.5 +                | Splenectomy | NA                                      | NA        | NA                       |
| You et al. (46) | 54   | 43/M           | Liver                     | Right upper quadrant pain | 20.0 +               | Unresectable | NA                                      | NA        | NA                       |
| Vardas et al. (47) | 55   | 61/M           | Spleen                    | Asymptomatic      | 10.0 +               | Splenectomy | 12 months                              | N         |                          |
| Rao et al. (48) | 56   | 39/M           | Spleen                    | Asymptomatic      | 7.2 +                | NA                                      | NA | NA                       |

(Continued)
| References     | Case | Age (y)/Gender | Location          | Main complaints          | Maximum diameter (cm) | EBER | Treatment                      | Follow-up | Recurrence or metastasis |
|----------------|------|----------------|-------------------|--------------------------|-----------------------|------|-------------------------------|-----------|---------------------------|
| Pan et al. (49) | 57   | 78/F           | Colon             | Bloody stool             | 3.9                   | +    | Polypectomy                    | 5 months  | N                          |
| Li et al. (16)  | 58   | 49/F           | Spleen            | Abdominal pain           | 4.7                   | +    | Splenectomy                    | NA        | NA                        |
|                | 59   | 56/F           | Spleen            | Abdominal pain           | 8.0                   | +    | Splenectomy                    | 17 months | N                          |
|                | 60   | 38/M           | Liver             | Fatigue, anorexia        | 8.5                   | +    | Left lobectomy of liver       | 11 months | N                          |
|                | 61   | 42/F           | Liver             | Abdominal pain           | 2.0                   | +    | Wedge resection               | 36 months | N                          |
|                | 62   | 50/M           | Spleen and liver  | Abdominal bloating, fatigue | 10.0             | +    | Splenectomy and left lobectomy of liver | 17 months | N                          |
|                | 63   | 39/F           | Liver             | Asymptomatic             | 9.0                   | +    | Hepatic lobectomy              | 84 months after chemotherapy and mass excision | Recurrence at 12 months |
| Ge et al. (3)   | 64   | 54/F           | Spleen            | left upper quadrant pain | 3.5                   | +    | Splenectomy                    | 10 months | N                          |
|                | 65   | 79/M           | Spleen            | Epigastric pain          | 6.0                   | +    | Splenectomy                    | 18 months | N                          |
| Kim et al. (50) | 66   | 76/M           | Spleen            | Asymptomatic             | 3.2                   | +    | Splenectomy                    | 7 months  | N                          |
| Choe et al. (13) | 67   | 72/F           | Spleen            | Asymptomatic             | 5.5                   | +    | Splenectomy                    | 78 months | N                          |
|                | 68   | 72/F           | Spleen            | Asymptomatic             | 7.2                   | +    | Splenectomy                    | 18 months | N                          |
|                | 69   | 53/F           | Spleen            | Asymptomatic             | 3.2                   | +    | Splenectomy                    | 13 months | N                          |
| Takahashi et al. (27) | 70 | 76/M           | Spleen            | Asymptomatic             | 3.2                   | +    | Splenectomy                    | 8 months  | N                          |
|                | 71   | 72/M           | Spleen            | Asymptomatic             | 6.0                   | +    | Splenectomy                    | 18 months | N                          |
|                | 72   | 75/M           | Spleen            | Abdominal pain           | 3.5                   | +    | Splenectomy                    | 30 months | N                          |
| Kiryu et al. (51) | 73 | 39/M           | Spleen            | Asymptomatic             | 7.0                   | –    | Splenectomy                    | 31 months | N                          |
|                | 74   | 56/F           | Spleen            | Asymptomatic             | 4.0                   | +    | Splenectomy                    | 24 months | N                          |
|                | 75   | 60/M           | Spleen            | Asymptomatic             | 2.0                   | +    | Splenectomy                    | 48 months | N                          |
|                | 76   | 78/F           | Spleen            | Asymptomatic             | 2.0                   | +    | Splenectomy                    | 48 months | N                          |
| Yoon et al. (52) | 77   | 64/F           | Spleen            | Asymptomatic             | 5.1                   | +    | Splenectomy                    | NA        | NA                        |
| Agaimy et al. (26) | 78 | 52/M           | Ileal mesentery   | Acute abdomen            | 6.0                   | –    | Emergency excision             | Lost      | Lost                      |
| Horiguchi et al. (53) | 79 | 77/F           | Spleen            | Epigastric pain          | 8.5                   | +    | Splenectomy                    | 36 months | N                          |
| Brittig et al. (54) | 80 | 54/M           | Spleen            | Asymptomatic             | 12.0                  | +    | Splenectomy                    | 48 months | N                          |
| Wu et al. (55)  | 81   | 45/M           | Liver             | Epigastric pain          | 6.7                   | +    | Right hepatectomy              | 9 months  | N                          |
| Zhang et al. (56) | 82 | 31/F           | Liver             | Anorexia                 | 3.5                   | +    | Laparoscopic right hepatectomy | 10 months | N                          |
|                | 83   | 48/M           | Liver             | Asymptomatic             | 10.0                  | +    | Right hepatectomy              | 2 months  | N                          |
| Deng et al. (57) | 84   | 67/F           | Liver             | Cough                    | 4.0                   | +    | Hepatectomy                     | NA        | NA                        |
| Ang et al. (58)  | 85   | 63/F           | Liver             | Fever                    | 13.4                  | +    | Right hemihepatectomy          | 48 months | N                          |
| Zhang et al. (59) | 86   | 19/F           | Liver             | Abdominal discomfort     | 6.0                   | +    | Hepatic VII segmental resection | 12 months | N                          |

(Continued)
| References         | Case | Age (y)/Gender | Location         | Main complaints        | Maximum diameter (cm) | EBER | Treatment                                                                 | Follow-up | Recurrence or metastasis         |
|--------------------|------|----------------|------------------|------------------------|-----------------------|------|---------------------------------------------------------------------------|-----------|------------------------------|
| Chen et al. (60)   | 87   | 28/F           | Liver            | Abdominal pain         | 6.0                   | +    | Left lobectomy of liver                                                  | NA        | Recurrence at 48 months       |
|                    | 88   | 39/M           | Spleen           | Asymptomatic           | 7.4                   | +    | Splenectomy                                                              | 40 months | N                            |
|                    | 89   | 48/M           | Liver            | Abdominal pain         | 23.3                  | +    | Extended right hemihepatectomy                                           | 23 months | N                            |
| 90                 |      | 65/M           | Spleen and Liver | Epigastric pain        | 23.3                  | +    | Splenectomy and radical dissection of retroperitoneal lymph nodes        | 2 months  | Dead for cachexia             |
|                   | 91   | 51/M           | Spleen           | Malaise, weight loss   | 8.5                   | +    | Splenectomy                                                              | 19 months | N                            |
|                   | 92   | 68/M           | Spleen           | Abdominal discomfort   | 2.3                   | +    | Splenectomy                                                              | 6 months  | N                            |
|                   | 93   | 51/F           | Spleen           | Abdominal discomfort   | 5.3                   | +    | Splenectomy                                                              | 5 months  | N                            |
|                   | 94   | 67/M           | Spleen           | Abdominal discomfort   | 7.5                   | +    | Splenectomy                                                              | 5 months  | N                            |
|                   | 95   | 60/M           | Liver            | Asymptomatic           | 3.0                   | +    | Wedge resection                                                          | 3 months  | N                            |
|                   | 96   | 52/F           | Spleen           | Abdominal discomfort   | 0.9                   | +    | Splenectomy                                                              | 12 months | N                            |
| Nguyen et al. (61) | 97   | 57/F           | Liver and Spleen | Weight loss            | NA                    | +    | Rejection treatment                                                      | NA        | NA                          |
| Granados et al. (62) | 98  | 57/F           | Liver            | Abdominal pain         | 13.0                  | +    | Resection                                                                | 24 months | N                            |
| Cheuk et al. (6)   | 99   | 19/F           | Liver            | Right upper quadrant   | 12.0                  | +    | Resection                                                                | 40 months | N                            |
|                    | 100  | 56/F           | Liver            | Abdominal discomfort   | 15.0                  | +    | Resection of right lobe of liver                                         | 56 months | Recurrence at 15, 27, 35 months respectively |
|                    | 101  | 40/F           | Liver            | Epigastric pain        | 12.5                  | +    | Left hepatectomy                                                         | 108 months| Recurrence at 108 months     |
|                    | 102  | 49/F           | Liver            | Asymptomatic           | 4.2                   | +    | Resection                                                                | 9 months  | N                            |
|                    | 103  | 37/M           | Liver            | Weight loss            | 15.0                  | +    | Right trisegmentectomy                                                   | 42 months | N                            |
|                    | 104  | 35/F           | Liver            | Abdominal discomfort   | 20.0                  | +    | Right hemihepatectomy                                                    | 95 months | Dead for disseminated tumor   |
|                    | 105  | 31/F           | Liver            | Abdominal distension   | 15.0                  | +    | Right hemihepatectomy                                                    | 60 months | N                            |
|                    | 106  | 58/F           | Spleen           | Abdominal discomfort   | 22.0                  | +    | Splenectomy                                                              | 4 months  | N                            |
|                    | 107  | 39/F           | Spleen           | Weight loss            | 7.5                   | +    | Splenectomy                                                              | 2 months  | N                            |
|                    | 108  | 61/F           | Spleen           | Asymptomatic           | 3.5                   | +    | Splenectomy                                                              | NA        | NA                          |
|                    | 109  | 49/F           | Peri-pancreas     | Abdominal distension   | 9.5                   | +    | Whipple's operation                                                      | NA        | NA                          |
| Chen et al. (63)   | 110  | 57/F           | Liver            | Epigastric pain        | 9.5                   | +    | Refusion surgical resection                                              | 36 months | N                            |
|                    | 111  | 51/F           | Liver            | Abdominal distension   | 12.0                  | +    | Left lobectomy                                                           | 12 months | N                            |
| Lewis et al. (11)  | 112  | 81/F           | Spleen           | Epigastric pain        | 5.0                   | +    | Splenectomy                                                              | 18 months | N                            |
| Nishiyama et al. (64) | 113 | 73/F           | Spleen           | Asymptomatic           | 8.0                   | +    | Splenectomy                                                              | 144 months| N                            |
| Present case       | 114  | 66/F           | Liver            | Abdominal pain         | 7.0                   | +    | Hepatic segment VI and VII resection                                     | 84 months | N                            |

N, none; NA, not available; MODS, multiple organ dysfunction syndrome.
FIGURE 1
Preoperative enhanced magnetic resonance imaging (MRI) examination. (A) T1WI shows an oval-shaped hypointense lesion with clear border in the right lobe of the liver (arrows, 94 × 74 mm). (B) Fat-suppressed T2WI shows a slightly hyperintense lesions (arrows). (C,D) The in-phase (C) and out-of-phase (D) of T1WI demonstrates hypointense speckled signals within the mass (arrows). (E) DWI shows a hyperintense lesions (arrows). (F–J) Enhanced MRI scans showed progressive enhancement of the lesion (arrows) on the early (F) and late (G) arterial phase, portal venous phase (H), delayed phase (I), and coronal view (J), while no enhancement was seen in the necrotic region. MRI, magnetic resonance imaging; T1WI, T1 weighted image; T2WI, T2 weighted image; DWI, diffusion weighted imaging.

Inflammatory pseudotumor (IPT)-like FDCS possesses morphological and clinical features intermediate between inflammatory pseudotumors and FDC tumors and was first classified in 2001 as a distinct variant (6). Compared with conventional FDCS, IPT-like FDCS exhibits unique histopathological and clinical features that generally occur in abdominal organs, almost exclusively involving the spleen, liver, or both (104/114); and colonic (5/114), mesenteric (2/114), pancreatic (1/114), pulmonary (2/114), paranephric (1/114), and lymphatic (1/114) involvement occur as well. Inflammatory pseudotumor (IPT)-like FDCS predominantly occurs in middle-aged adults (median age, 54.5 years; range, 19–88 years), with marked female predominance (female to male ratio = 1.71:1). Patients are mainly asymptomatic or present with abdominal distension or pain, occasionally accompanied by systemic symptoms such as back pain, waist soreness, significant weight loss, fever, and weakness. In rare cases, IPT-like FDCS exhibits paraneoplastic arthritis (7), and paraneoplastic pemphigus (8–10).

Moreover, mutations in genes encoding components of the NF-κB pathway, cell cycle regulatory genes (CDKN2A and RB1), and immune evasion genes (CD274 and PDCD1LG2) may be pathologically associated with IPT-like FDCS (14). The morphology of IPT-like FDCS is similar to that of the conventional type. Gross examination reveals that most tumors exhibit a well-marginated, thin-walled, yellowish, soft tissue mass (maximum diameter = 7.54 ± 4.93 cm). In particular, localized hemorrhage or necrosis is observed within the tumor. The neoplastic cells, which may exhibit mild atypia, are usually spindle, ovoid, or polygonal and form storiform, fascicles, or trabecular arrays, which exhibit sparsely vesicular chromatin and distinct nucleoli (15). In particular, the inflammatory component of IPT-like FDCS, a more prominent histology, comprises mainly lymphocytes (B and T cells), plasma cells, eosinophils, and rare epithelioid histiocytes, with neoplastic cells often obscured by the inflammatory infiltration (6, 16). Owing to the lack of atypical tumor cells, IPT-like FDCS are often incorrectly identified inflammatory-reactive processes or inflammatory pseudotumor, even other various neoplasms (17). Moreover, the scarcity of cases and lack of specific clinical and imaging features present a formidable challenge to diagnosing IPT-like FDCS. Currently, the diagnosis of IPT-like FDCS requires auxiliary tests, including imaging, detecting distinctive cytological features, immunohistochemical detection of FDC markers, and in situ hybridization to detect EBER. Although limited reports are available on the imaging features of IPT-like FDCS, they aid in making correct diagnoses before treatment when a neoplasm is detected (18). Most unenhanced computed tomography (CT) images display circular or elliptical, slightly hypodense tumors with a clear
Postoperative pathology examinations. (A) Grossly, the cut surface of the fleshy neoplasm with necrosis and hemorrhage (tumor size: 7.0 × 5.0 cm); (B) H&E stained image showing that the tumor tissue had a meshwork-like architecture with abundant vascular-like proliferation, magnification: 200X; (C) The positive IHC result of CD21, magnification: 100X; (D) The positive IHC result of CD35, magnification: 100X; (E) The positive result of EBV for in situ hybridization, magnification: 200X. H&E, hematoxylin and eosin; IHC, immunohistochemical; EBV, Epstein Barr virus.

boundary. In certain cases, significant necrosis is seen within the tumor, while calcification or hemorrhage is rare. The lesions typically show heterogeneous enhancement in the enhanced phase, although the enhancement state is lower than that of the parenchyma. Therefore, the tumor area is always hypodense compared with the periparenchyma, and annular enhancement is observed in the delayed phase, sparing the central necrotic region (19). MRI and CT images are similar, and most lesions demonstrate enhancement from the center to the periphery in the arterial phase. The enhancement amplitudes of lesions in the portal, venous, and delayed phases tend to be homogeneous and diminished to varying degrees, and annular enhancements are occasionally observed (20).

The diagnosis of IPT-like FDCS is invariably supported by immunohistochemistry, and multiple FDC markers are often necessary, including CD21, CD23, CD35, CXCL-13, D2-40, Clusterin, Fascin, epidermal growth factor receptor, and CNA42 (21, 22). In particular, CD21 and CD35 are the most specific with almost universal positivity (23). Nevertheless, some EBV-related IPT-manifesting lesions do not express FDC markers (16). The immunohistochemical analysis of SSTR2a in FDCS indicates a positive rate significantly higher than CD21 and CD35 in conventional subtypes, while all IPT-like variants are negative (24). Therefore, SSTR2a shows promise as a highly sensitive and differential diagnostic marker to distinguish between FDCS and IPT-like FDCS. As mentioned previously, IPT-like FDCS is closely associated with EBV infection, while conventional types infrequently involve EBV (12). Our literature review identified only five cases of intrabdominal, EBER-negative IPT-like FDCS (4, 9, 25–27). In our present case, immunohistochemical analysis of the pathological specimen detected strongly positive expression of CD21, CD35, Ki67 (> 20%), and EBER (Figure 2).

Inflammatory pseudotumor (IPT)-like FDCS is a low-grade malignant tumor with good prognosis. Unlike FDCS, IPT-like FDCS is apparently indolent, with few instances of recurrence and metastasis (3). Disease status at the time of last follow-up is known for 92 patients, with follow-up times ranging from 2 to 144 months. Only 9.65% of patients (n = 11) experienced recurrence or metastasis during follow-up. Yet, PNP-associated IPT-like FDCS predominantly occurs in intraabdominal sites, indicating poor prognosis (8–10). Surgery is the most effective therapy for IPT-like FDCS, and only two cases (Cases 49 and 63) received chemotherapy or targeted therapy. However, chemotherapy, radiotherapy, or targeted therapy do not achieve a significant improvement in overall- or disease-free survival (28). Notably, Cases 49, 90, and 104 died because of multiple organ dysfunction syndrome, cachexia, and disseminated tumor, respectively, during treatment. The
possibility of recurrence and metastasis suggests conducting long surveillance after surgery.

Conclusion

Inflammatory pseudotumor (IPT)-like FDCS is an extremely rare neoplasm that mainly occurs in the intraabdominal region. EBV probably plays an essential role in the etiology of IPT-like FDCS. The diagnosis of IPT-like FDCS is complex and usually relies on fine-needle aspiration biopsy or postoperative pathological diagnosis. Surgical resection is the most effective treatment, although the efficacy and safety of adjuvant chemotherapy, radiotherapy, or targeted therapy for postoperative management are unknown. IPT-like FDCS presents a certain risk of recurrence or metastasis after initial treatment. Thus, regular follow-up visits are strongly recommended.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board review (2021)12-114) at The Third Affiliated Hospital of Sun Yat-sen University in Guangzhou, China. The patients/participants provided their written informed consent to participate in this study.

Author contributions

CX was the patient’s physician and responsible for the revision of the manuscript for important intellectual content. FD reviewed the literature and contributed to drafting the manuscript. CW performed the radiographic analysis. FD and HT conceptualized and designed the study, coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content. All authors issued final approval for the version to be submitted for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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