Clinical Case Report

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Percutaneous microwave ablation liver partition and portal vein embolization for planned hepatectomy due to large gastrointestinal stromal tumor metastases

A case report

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Abstract

Rationale: The liver is the most frequent site of relapse of gastrointestinal stromal tumors (GISTs). Surgery is always considered to be unsuitable because of the multiple metastases.

Patient concerns: In this report, we describe a case of large, multiple GIST liver metastases that were treated with percutaneous microwave ablation liver partition and portal vein embolization for planned hepatectomy (PALPP). A 44-year-old woman had undergone pancreaticoduodenectomy 4 years previously because of the diagnosis of a large duodenal GIST. Large, multiple liver metastases were observed 2 years later.

Diagnoses: GIST liver metastasis was diagnosed using percutaneous ultrasound-guided biopsy.

Interventions: After 6 months of treatment with imatinib, the liver metastasis was stable. PALPP was performed because of insufficient future liver remnant (FLR) and right trisegmentectomy was successfully completed 10 days later.

Outcomes: The patient has had no signs of local or systemic disease during 17 months of postsurgical follow-up.

Lessons: PALPP provides a new methodology for treatment of GIST liver metastasis in patients with insufficient FLR, and may have benefit in prolonging a durable remission.

Abbreviations: FLR = future liver remnant, GIST = gastrointestinal stromal tumor, PALPP = percutaneous microwave ablation liver partition and portal vein embolization for planned hepatectomy, PMA = percutaneous microwave ablation, PVE = portal vein embolization.

Keywords: associating liver partition and portal vein ligation, gastrointestinal stromal tumor, liver metastases, microwave ablation, portal vein embolization

1. Introduction

Gastrointestinal stromal tumors (GISTs) are the most common type of mesenchymal tumors of the gastrointestinal tract. Approximately, 15% to 47% of patients with GIST present with overt metastatic disease.[1,2] The liver is the most common site of GIST metastasis, and approximately 20% to 65% of metastases occur in the liver.[3,4] Surgery is always considered to be not suitable because of the multiple liver metastases. Here, we describe the first known case of large, multiple GIST liver metastases treated with percutaneous microwave ablation liver partition and portal vein embolization for a planned hepatectomy (PALPP).

2. Case presentation

A 44-year-old woman had been referred to our hospital 4 years previously because of a large duodenal tumor. Pancreaticoduodenectomy was performed because of involvement of the pancreas; GIST of the duodenum was confirmed through pathological examination and immunohistochemical analysis. She was considered high-risk based on clinical practice

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The study participant provided informed written consent for this study.

The authors report no conflicts of interest.

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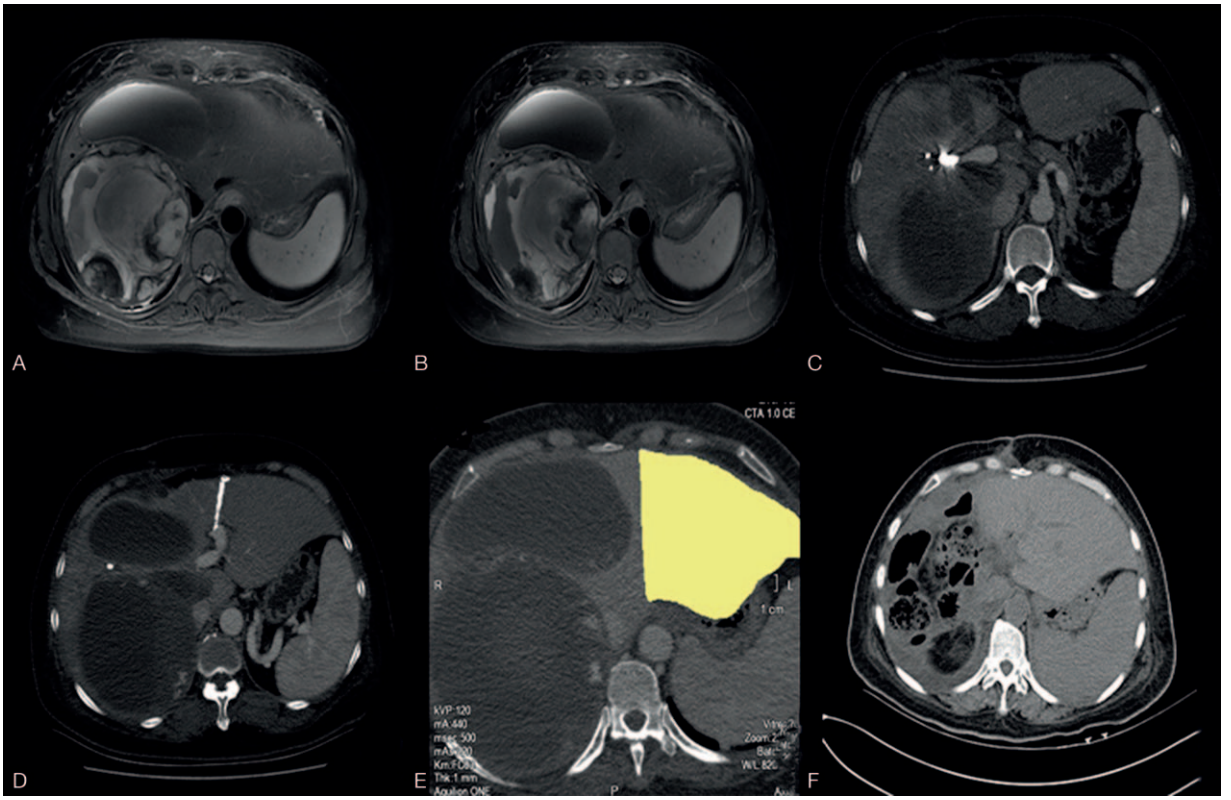

Figure 1. Computed tomography and magnetic resonance images of the liver. Liver metastasis was stable at the beginning of imatinib therapy (A) and 6 months later (B). Right portal vein embolization (C) combined with percutaneous microwave ablation (D) were performed as stage I before liver resection. Increased volume of the left lateral lobe (E) after stage I, and postoperative CT image (F).

guidelines, and imatinib treatment was suggested, but could not be carried out as the patient could not afford it. Outpatient clinic follow-up every 6 months was available and liver metastasis was observed 2 years after the surgery. Contrast-enhanced magnetic resonance imaging showed multiple masses occupying the liver, except in the left lateral lobe, of which the largest lesion was 10 × 12 cm, with necrosis and hemorrhage in the central area (Fig. 1A). A percutaneous ultrasound-guided biopsy revealed a tumor of mesenchymal origin. After 6 months of treatment with imatinib at an initial dose of 400 mg daily, the liver metastases were stable (Fig. 1B). A positron emission tomography-computed tomography scan was done to confirm that there were no other metastatic sites. Surgery was planned, but the future liver remnant (FLR) was only 326 mL, which was insufficient for liver resection and could easily result in postsurgical liver failure. In view of this, portal vein embolization (PVE) (Fig. 1C) combined with B ultrasound-guided percutaneous microwave ablation (PMA) liver partition was performed (Fig. 1D). A Cook balloon-assisted coiling was inserted into the right portal vein, followed by PMA at multiple points on the same cross-section between the tumor and the normal liver, under ultrasound guidance. This resulted in a rapid increase of the FLR from 34% to 50% in 10 days (Fig. 1E) and right trisegmentectomy was successfully performed (Fig. 1F). Macroscopically, large, multiple liver metastases and marks of the microwave ablation were evident (Fig. 2A); the tumor had a pseudocapsule and boundary tissue that was gray and unclear with intermediate hemorrhage and necrosis (Fig. 2B).The cut range between the left lateral lobe and the tumor was

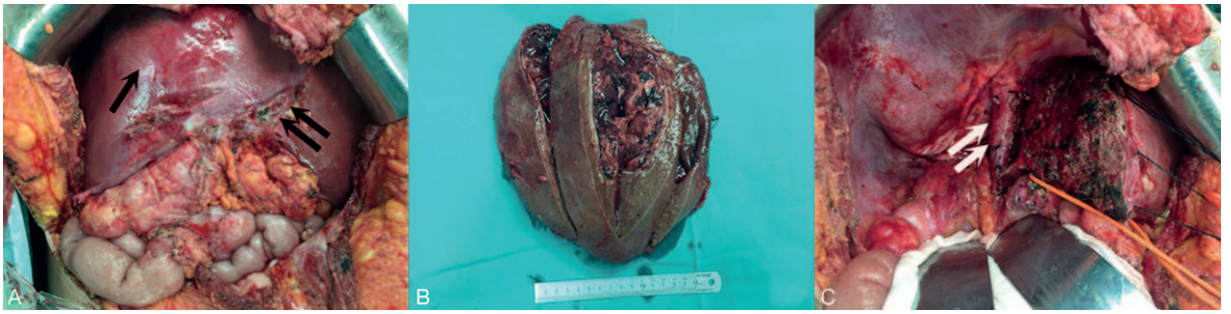

Figure 2. Stage II hepatectomy. (A) Large, multiple liver metastases (black arrow) and evidence of microwave ablation (double black arrow). (B) Specimen of liver metastasis. (C) Surgical wounds of the left lateral lobe and the inferior vena cava (double white arrow) clearly exposed.

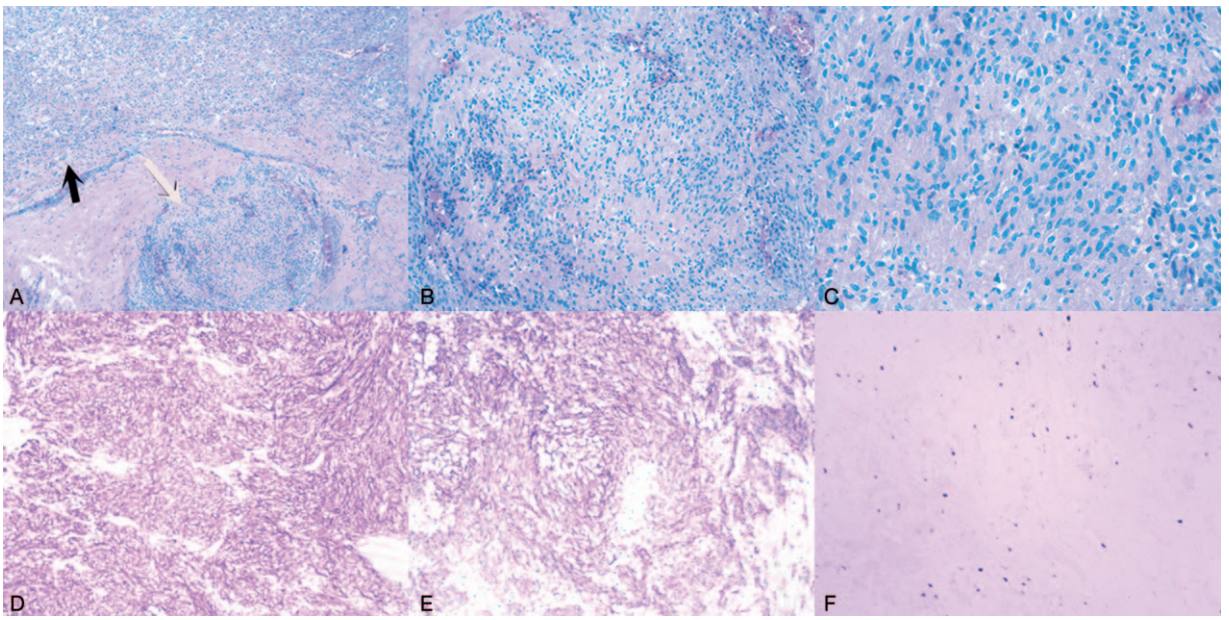

Figure 3. Pathological and immunohistochemical findings of liver metastasis. ((A) The boundary of normal liver tissue (black arrow) and tumor tissue (white arrow) (hematoxylin and eosin staining). Monotonous spindle cells in the tumor (B ×100, C ×200); the cells were positive for CD117 (D) and DOG1 (E ×100). (F) MIB-1 labeling index was approximately 3%.

approximately 1 cm, which was enough for GIST (Fig. 2C). Pathologically, the boundary of the normal liver tissue and the tumor (Fig. 3A) and the monotonous spindle cells (Fig. 3B and C) was shown clearly. The tumor was positive for CD117 immunohistochemical staining (Fig. 3D) and for DOG1 (Fig. 3 E). The mitotic index was 10/50 high-power field (HPF), and 5/50 HPF for the primary tumor, and the MIB-1 labeling index was 3% (Fig. 3F). The patient was discharged on postoperative day 10 and continued on adjuvant imatinib treatment. At the last follow-up, 17 months postsurgery, the patient had no signs of local or systemic disease.

3. Discussion

Although surgery is effective for patients with resectable GIST, recurrence is common and occurs in up to 50% of patients, with the liver being the most frequent site of relapse.[5] The introduction of tyrosine kinase inhibitors such as imatinib and sunitinib has dramatically changed the outcome for patients with metastatic GIST; however, imatinib is not curative. Fourteen percent of GISTs have a primary resistance to imatinib and progress within 6 months of the start of therapy.[6] Among patients who have an initial partial response or achieve stable disease with imatinib therapy, the median time to progression is 2 to 2.5 years.[7] Xia et al[8] showed a significantly higher overall survival rate among patients who had surgery (6 months preoperative imatinib plus surgery plus adjuvant imatinib) than those who had imatinib alone, suggesting a potential further benefit from surgery. Therefore, radical resection should be an option for patients with liver metastases on long-term drug therapy.

However, liver metastases related to GIST are usually multiple, large, and localized in both lobes.[9] A large tumor burden in the hepatic parenchyma may prohibit resection given the risk of insufficient FLR and subsequent postoperative liver failure. Preoperative PVE is recommended in cases of unilobular involvement of the liver if <30% to 40% of the normal the liver is expected to remain and be functional after resection. However, compensatory hyperplasia of the FLR induced by PVE requires at least 4–8 weeks, which may mean that radical resection cannot be performed due to tumor progression or lack of response. Schnitzbauer first reported a combined liver transection and 2-stage hepatectomy with portal vein ligation (associating liver partition and portal vein ligation [ALPPS]) in 2012. Although ALPPS increased the FLR from 74% to 99% in 7 days after the first operation, severe postoperative complications and mortality rates were as high as 25% to 40% and 10% to 20%, respectively. In addition, ALPPS does not meet the "no touch" principle of cancer treatment, which may result in a 1-year recurrence rate up to 40%.[10]

Based on the mechanism of FLR proliferation induced by ALPPS, we have pioneered the PALPP technology, in which the portal vein ligation of ALPPS has taken the place of PVE, and liver transection was replaced with PMA to isolate the portal communicating branches between the remnant liver and the portion with tumors.[11] We have succeeded in treating >20 cases of huge hepatocellular carcinoma with cirrhosis and locally advanced hilar cholangiocarcinoma using the PALPP technique so far. In this report, the PALPP technique was used for GIST liver metastases with insufficient FLR for the first time and achieved a satisfactory result. Compared with ALPPS, the PALPP system has the following advantages: it can avoid the surgical trauma caused by the first-step abdominal surgery of ALPPS; it is possible not only to avoid the potential risk of tumor compression and dissemination associated with ALPPS, but can also reduce the severity of adhesion formation in the second step of the operation; and although PMA did not separate the liver completely, studies have shown that FLR proliferation rate is not significantly different between partial liver parenchyma transection and complete transection.[12,13] Meanwhile, PMA produced inflammation factors such as a cyclic interleukin-6,

tumor necrosis factor-α, and STAT3 that may significantly stimulate liver hyperplasia.[14]

4. Conclusion

PALPP provides a method of treatment for patients with GIST liver metastases, which may prove beneficial for prolonging a durable remission.

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