

# Gastric fundus splenosis with hemangioma masquerading as a gastrointestinal stromal tumor in a patient with schistosomiasis and cirrhosis who underwent splenectomy

## A case report and literature review

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### Abstract

**Rationale:** Splenosis is the heterotopic auto-transplantation of the splenic tissues. Gastric splenosis in a rare location mimics a gastrointestinal stromal tumor (GIST). Gastric splenosis with hemangioma has not been reported throughout the literature.

**Patient concerns:** We report a case of a 74-year-old schistosomiasis cirrhosis splenectomy woman diagnosed with gastric fundus mass. Preoperative computed tomography and endoscopic ultrasonography revealed findings suggestive of a GIST.

**Diagnoses:** The mass located in the gastric fundus muscularis propria, measuring 3.9 × 2.8 × 2.4 cm with a dark red color, was removed by surgery. In the mass, a 1 × 1-cm red-purple nodule was also found. On microscopic examination, a well-formed splenic tissue divided into two compartments—white pulp and red pulp—separated by an ill-defined interphase known as the marginal zone. However, a nodule in the heterotopic spleen was mainly composed of larger thin-walled muscular vessels. The final diagnosis was gastric splenosis with hemangioma.

**Interventions:** After discussion in a multidisciplinary conference, the patient was considered for a GIST resection under gastroscopy. In the process of peeling, the surface of the mucosal, submucosal, muscle layers and the tumor surface were diffusely oozing. The effect of electrocoagulation and hemostasis was extremely poor. Therefore, endoscopic surgery was arrested. After dealing with the patient's family, a combination of laparoscopic-gastroscope double-mirror surgery was decided in accordance with the principle of minimally invasive surgery to preserve the stomach. Owing to several adhesions and concealed the location of tumor, we stopped the double-mirror combination surgery plan. Considering the great possibility of a malignant GIST, we still decided to continue the traditional surgical resection. The tumor was then removed via surgery.

**Outcomes:** The patient was favorable with healing and discharged on postoperative day 10.

**Lessons:** Gastric splenosis with an associated hemangioma is the first well-documented case. Its pathogenesis may be direct implantation. Appropriate medical history taking and Tc-99m heat-denatured RBC spleen scintigraphy (Tc-99mHSDRS) are valuable for its diagnosis; however, pathology is the gold standard. Surgery is a reasonable treatment for gastric splenosis with hemangioma.

**Abbreviations:** CA = cancer antigen, CD = cluster of differentiation, CT = computed tomography, FNA = fine-needle aspiration, GIST = gastrointestinal stromal tumor, H&E = hematoxylin and eosin, MRI = magnetic resonance imaging, Tc-99mHSDRS = Tc-99m heat-denatured RBC spleen scintigraphy.

**Keywords:** gastric fundus, hemangioma, schistosomiasis cirrhosis, splenectomy, splenosis

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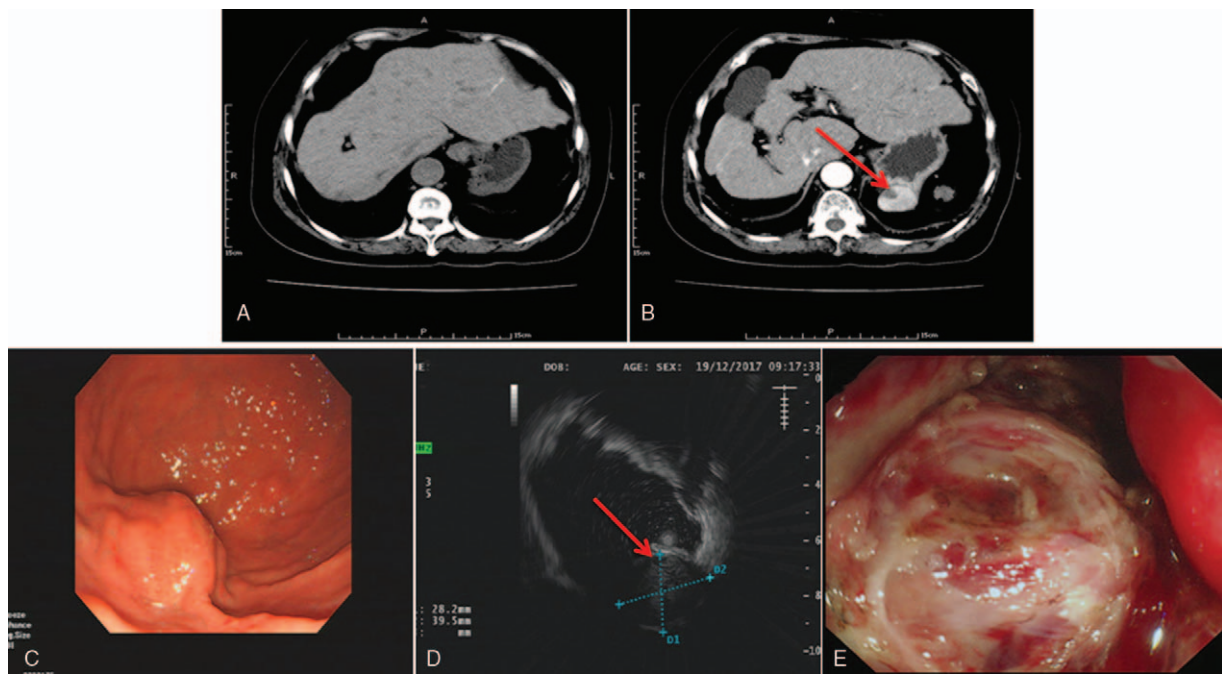
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**Figure 1.** (A) CT scan shows pipe stem cirrhosis. (B) CT scan reveals an approximately 4-cm mass in the gastric fundus wall with a homogeneous contrast enhancement, which is typical in GISTs, and a 1-cm low-density solid lesion with a clear outline within the mass (red arrow). (C) Gastroscopy shows a mass in the gastric fundus. (D) Endoscopic ultrasonography reveals a  $3.95 \times 2.82$ -cm slightly low echoic mass with a homogeneous appearance in the muscularis propria of the stomach fundus wall and a low echoic area with a clear boundary in the mass (red arrow). (E) The mucosa and submucosa were cut open, and the mass was exposed in the muscularis propria of the stomach fundus wall. The surface of the mass was covered by larger blood vessels. CT = computed tomography, GIST = gastrointestinal stromal tumor.

## 1. Introduction

Splenosis is the heterotopic auto-transplantation of the splenic tissues arising from traumatic ruptures or iatrogenic splenectomy.<sup>[1]</sup> Its incidence has been reported to be 67% for traumatic ruptures.<sup>[2]</sup> Splenosis in the gastric area is a rare location for seeding or spreading. However, gastric splenosis with hemangioma has not been reported throughout the literature. Herein, we report a rare case of a schistosomiasis cirrhosis splenectomy in an asymptomatic elderly woman who had a splenosis with hemangioma located in the gastric fundus wall, which was misdiagnosed as a gastrointestinal stromal tumor (GIST) before on preoperative imaging.

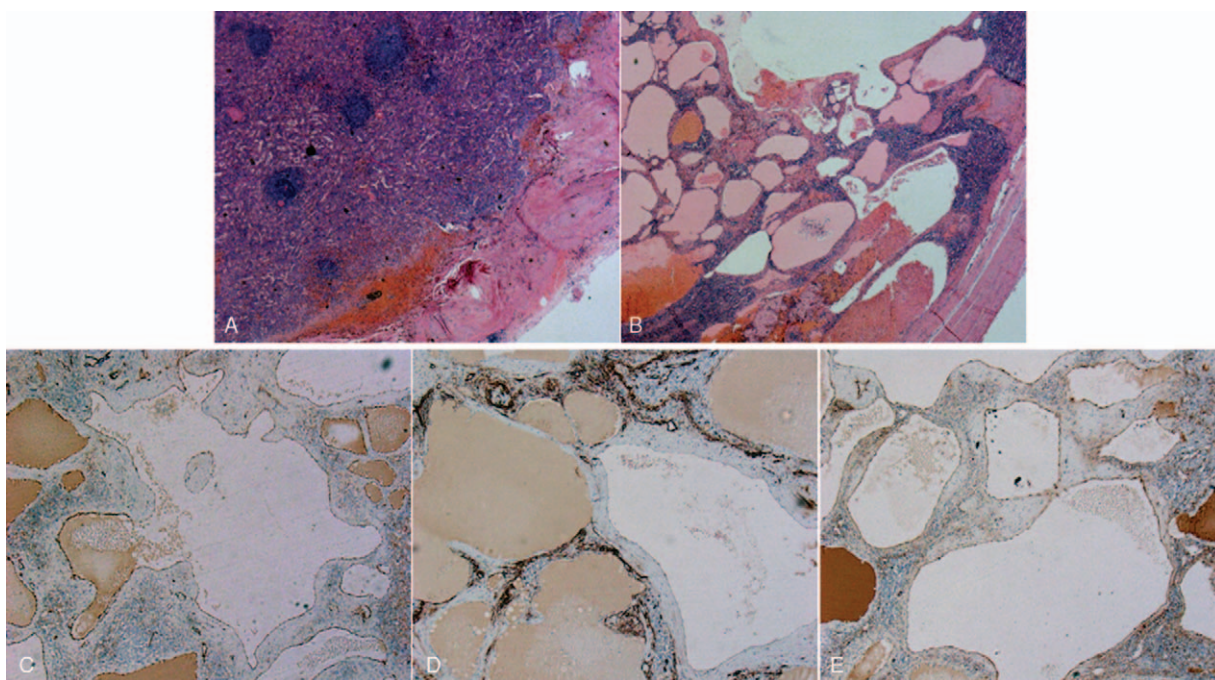
## 2. Case report

A 74-year-old woman was admitted to the Gastroenterology Department of our hospital for an asymptomatic gastric mass. She had a schistosomiasis cirrhosis splenectomy at the age of 29 years.

The patient was initially submitted to a computed tomography (CT) scan for pneumonia in other hospitals, which revealed pipe stem cirrhosis (Fig. 1A), a well-demarcated 4-cm solid mass confined to the gastric wall suggestive of a GIST (Fig. 1B), and a 1-cm low-density lesion with a clear outline in the mass (Fig. 1B; red arrow). Thereafter, she was submitted to an upper gastrointestinal endoscopy in our hospitals, which revealed a smooth and rounded mass in the gastric wall without mucosal infiltration (Fig. 1C) at the level of the greater curvature. Endoscopic ultrasonography revealed a  $3.95 \times 2.82$ -cm slightly low-level echoic homogeneous mass derived from the muscularis propria (Fig. 1D) and a  $1 \times 1$ -cm lower level echoic area with a

clear boundary in the mass (Fig. 1D; red arrow); these findings confirmed the diagnosis of a gastric GIST. The laboratory test findings were normal, except for the following: platelet count of  $369 \times 10^9/L$ , glutamyl transpeptidase level of 53.4 U/L, total bilirubin level of  $22.4 \mu\text{mol/L}$ , serum creatinine level of  $44.0 \mu\text{mol/L}$ , potassium level of  $3.5 \text{mmol/L}$ , and levels of other serum tumor markers (cancer antigen [CA], cytokeratin 19, alpha fetoprotein, carcinoembryonic antigen, CA125, and CA15-3). After discussion in a multidisciplinary conference, the patient was considered for a GIST resection under gastroscopy.

Under the gastroscope, a large submucosal uplift was seen near the posterior wall of the gastric angle. The surface of the mucosa was hyperemic and edematous; the texture was hard; and the activity was poor. After dual-knife labeling, the mucosa and submucosa were opened, and the tumor was initially exposed. The tumor surface was covered with larger blood vessels (Fig. 1E). The IT-NanoKnife was used for detachment around the tumor capsule, and the muscular root penetrated the muscularis propria. In the process of peeling, the surface of the mucosal, submucosal, muscle layers, and the tumor surface were diffusely oozing. The effect of electrocoagulation and hemostasis was extremely poor (taking into account the low coagulation function of liver cirrhosis and the abundant blood supply to the tumor body); further, the procedure took too much time. The tumor roots were poorly exposed owing to persistent oozing. Forcibly removing the full thickness of the stomach wall might lead to difficulties in controlling intra-abdominal bleeding on the serosal side. Therefore, endoscopic surgery was arrested. After dealing with the patient's family, a combination of laparoscopic-gastroscope double-mirror surgery was decided in accordance with the principle of minimally invasive surgery to



**Figure 2.** (A) Micrograph shows the same findings as in the normal splenic tissues and the white and red pulps with well-formed splenic corpuscles in the muscularis propria of the stomach fundus wall (H&E,  $\times 40$ ). (B) Micrograph shows a hemangioma in the heterotopic spleen of the stomach fundus wall (H&E,  $\times 40$ ). Endothelial cells of vascular are strongly positive for CD31 (C), CD34 (D), and Factor VIII (E) ( $\times 100$ ). H&E=hematoxylin and eosin, CD=cluster of differentiation.

preserve the stomach. In the process of laparoscopic umbilical puncture point incision, the intestinal mucosa was perforated and was thus subsequently repaired. Owing to the patient's history of 2 abdominal surgeries, several adhesions were seen during laparoscopic surgery, which were then slowly separated. However, the tumor location was high and concealed (gastric angle near the posterior wall); even after following gastroscopy positioning instructions, the tumor still could not be found under laparoscopic direct vision. Therefore, we stopped the double-mirror combination surgery plan. Based on what was seen during the surgery, we communicated with the patient's family again. Considering the great possibility of a malignant GIST, we still decided to continue the traditional surgical resection. The tumor was then removed via surgery; its size was approximately  $3.5 \times 5$  cm, and its blood supply was extremely rich. The abdominal drainage tube and gastrointestinal decompression tube were indwelling. The patient's vital signs were stable; she was then transferred to the intensive care unit and discharged on postoperative day 10.

On macroscopic examination,  $3.9 \times 2.8 \times 2.4$ -cm dark red masses surrounded by a completely thin capsule were observed in the gastric fundus muscularis propria. On the cut surface, the mass appeared red to bluish with scattered white tiny nodules embedded in the muscularis propria. At the edge of the mass, an approximately  $1 \times 1$ -cm nodule appearing as a circumscribed, non-encapsulated, honeycomb-like, and red-purple nodule, which formed with dilated congested vascular space with bleeding, was also observed. On microscopic examination, a well-formed splenic tissue divided into 2 compartments—white pulp and red pulp—was separated by an ill-defined interphase known as the marginal zone (Fig. 2A). However, a nodule in the heterotopic spleen was mainly composed of larger thin-walled muscular vessels, which were variably dilated and occasionally displayed thrombosis. The

widely dilated vessels showed attenuation of their walls, mimicking a cavernous hemangioma (Fig. 2B). Immuno-phenotypically, the endothelial lining cells of the vascular walls were immunoreactive for cluster of differentiation (CD) 31 (Fig. 2C), CD34 (Fig. 2D), and Factor VIII (Fig. 2E).

The final diagnosis was gastric fundus splenosis with an associated hemangioma.

### 3. Discussion

Splenosis was originally described in 1937 by Shaw and Shaf. However, the term "splenosis," first used by Buchbinder and Lipkoff in 1939, refers to the dissemination with heterotopic auto-transplantation and implantation of the splenic tissues, which may follow disruption of the spleen's capsule by trauma or iatrogenic splenectomy.<sup>[3]</sup> Splenosis is commonly found in the abdominal and pelvic cavity, including the greater omentum, serosal surface of the small bowel, parietal peritoneum, mesentery, and diaphragm.<sup>[4]</sup> Additional potential sites of implantation, including intrathoracic, intragastric, and intra-hepatic areas, lungs, kidneys, and brain,<sup>[5–10]</sup> were reported.

The age of patients with gastric splenosis ranged from 17 to 68 years; the mean age was 44 years, and the median age was 42 years. The interval time from splenectomy to its diagnosis was from 4 to 38 years; the mean interval time was 14.56 years, and the median interval time was 12 years. The size ranged from 1.1 to 5 cm; the mean size was 2.31 cm, and the median size was 2.0 cm. The chief cause of splenectomy related to this condition was traumatic rupture (70%); the other cause was iatrogenic reasons (30%). The main primary suspected diagnosis was GISTs (47%); the other diagnoses included upper gastrointestinal bleeding (17%), gastric mass (12%), gastric smooth muscle tumor (6%; may be GISTs), dyspepsia (6%), gastric splenosis (6%), and gastric band



**Table 1****Summary of gastric splenosis case reports.**

Case	Age, y/Sex	Reason of splenectomy	Time interval, years	Number	Location	Size, cm	Primary suspected diagnosis	Confirmed method
Wang et al <sup>[11]</sup>	40/M	Traumatic rupture	6	1	Posterior wall of the upper gastric fundus	2 × 1.5	GIST	Pathology
Reinglas et al <sup>[12]</sup>	52/M	Traumatic rupture	38	1	Perigastric	1.3	Upper gastrointestinal bleeding	Pathology
Nicolas et al <sup>[13]</sup>	30/F	Traumatic rupture	10	1	Greater curvature of the stomach	NM	Gastric band ineffectiveness	Pathology
Elwir et al <sup>[4]</sup>	20/F	Splenopancreatectomy for acute pancreatitis	4	1	Cardia	2.1 × 1.8	Dyspepsia	Cytology and FNA
Carrara et al <sup>[6]</sup>	65/F	Splenopancreatectomy for pancreatic mucinous cystic neoplasm	14	1	Gastric fundus	1.8	GIST	FNA
Yang et al <sup>[2]</sup>	53/M	Traumatic rupture	8	1	Anterior wall of gastric greater curvature	2.5 × 2	GIST	Pathology
Li et al <sup>[1]</sup>	40/F	Traumatic rupture	20	1	Gastric fundus	2 × 1.5	GIST	Pathology
Li et al <sup>[11]</sup>	32/M	Traumatic rupture	4	1	Gastric fundus	2 × 2	GIST	Pathology
Chung et al <sup>[15]</sup>	17/F	Splenectomy for a giant epithelial splenic cyst	8	2	Posterior wall of the gastric fundus	1.1 × 0.9 × 1.1 and 1.9 × 1.6 × 1.7	GIST	Pathology
Yang et al <sup>[14]</sup>	42/M	Traumatic rupture	17	1	Gastric fundus	5	GIST	Pathology
Mineccia et al <sup>[16]</sup>	17/F	Traumatic rupture	5	1	Gastric fundus	2.5 × 2.5 × 0.9	GIST	Pathology
Alvite Canosa et al <sup>[17]</sup>	49/M	Traumatic rupture	21	1	Gastric fundus	3 × 1	Upper gastrointestinal bleeding	Pathology
Arroja et al <sup>[18]</sup>	68/M	Traumatic rupture	30	1	Greater curvature of the proximal gastric body	NM	Gastric splenosis	Tc-99mHDRS
Falk et al <sup>[19]</sup>	64/F	Splenopancreatectomy for pancreatic cystadenoma	7	1	Posterior wall of the stomach	3	Gastric mass	Pathology
Deutsch et al <sup>[20]</sup>	67/M	Traumatic rupture	21	1	Lesser curve of the stomach	NM	Gastric smooth muscle tumor	Pathology
Laszewicz et al <sup>[5]</sup>	40/M	NM	NM	1	Posterior wall of the stomach	1.5 × 1	Upper gastrointestinal bleeding	Pathology
Agha et al <sup>[21]</sup>	52/M	Traumatic rupture	20	1	Gastric fundus	3 × 2	Gastric fundic mass	Tc-99mHDRS

F = female, FNA = fine-needle aspiration, GIST = gastrointestinal stromal tumour, M = male, NM = not mentioned.

ineffectiveness (6%). The leading method of confirmation was pathology (76%), followed by Tc-99m heat-denatured RBC spleen scintigraphy (Tc-99mHDRS) (12%), cytology (6%), and fine-needle aspiration (FNA) (6%) (Table 1).<sup>[1,2,4-6,11-21]</sup>

The pathogenesis of splenosis still remains unclear. Some hypotheses to explain such have been proposed. The seeding/implantation hypothesis in which the isolated splenic pulp may survive after seeding into any position of the abdominal cavity has been demonstrated by animal experiments.<sup>[11]</sup> However, this hypothesis fails to explain cases found on other sites, such as the liver and lungs. A recent research showed that intra-organ splenosis could spread through the vasculature into the liver and the lungs and that the morphologic and immunologic structures formed in these regenerated autografts were influenced by the organ vasculature and extracellular matrix wherein the tissue fragments settle.<sup>[22]</sup> Although the hematogenous spread of gastric splenosis is possible, a direct implantation of splenic cells might be caused by needle transfixion during surgical hemostatic maneuvers at the time of emergency splenectomy.<sup>[21]</sup>

Splenosis in the gastric area is an exceptional location for seeding or spreading. To date, no more than 20 cases have been reported. To the best of our knowledge, gastric splenosis with hemangioma has not been reported throughout the literature. It is mainly composed of red and white pulps; however, it does not comprise all kinds of cells in the normal spleen. The implant's or

spread spleen's undifferentiated reticular cells are induced to differentiate into the endothelial antrum, capillary vessel, and lymphocytes, which finally create the splenic tissues.<sup>[11]</sup> Splenic hemangioma is the most common benign neoplasm of the spleen. Splenic hemangiomas are typically solitary lesions and appear as circumscribed, non-encapsulated, honeycomb-like, red-purple masses that frequently blend imperceptibly into the surrounding splenic parenchyma. Microscopically, the majority of splenic hemangiomas are cavernous in nature. A pure capillary architecture is less common, with many lesions containing varying proportions of both cavernous and capillary components. Immuno-phenotypically, splenic hemangiomas show reactivity of the endothelial lining cells of the vascular markers CD31, Von Willebrand factor, Ulex europaeus lectin I, and CD34.<sup>[23]</sup> Other types of splenic hemangioma include venous hemangioma, benign (infantile) hemangioendothelioma, and diffuse sinusoidal hemangiomatosis.

Gastric splenosis is usually asymptomatic and is only incidentally found in most circumstances. Only in a few cases, patients have upper gastrointestinal bleeding. It is a challenge to diagnose such. Based on the literature statistics, we found that most gastric splenosis cases had been misinterpreted as GISTs. The reason is that conventional ultrasound, CT, and magnetic resonance imaging (MRI) lack typical features to distinguish it from GISTs. Tc-99mHDRS is deemed to be the optimal method

for diagnosis of splenosis because it has a higher uptake by the splenic tissues than Tc-99m sulfur colloid scan.<sup>[24]</sup> Furthermore, superparamagnetic iron oxide-enhanced MRI is a useful diagnostic tool to distinguish gastric splenosis.<sup>[25]</sup> However, a careful medical history inquiry may provide valuable clues for the differential diagnosis between gastric splenosis and GISTs. On pathology, it is easy to distinguish between the two. Gastric splenosis is mainly composed of red and white pulps. The cells of the red pulp sinusoids are bi-phenotypic immunoreactive for vascular (CD31 and Von Willebrand factor) and histiocytic markers (CD68 and lysozyme).<sup>[23]</sup> The immunoreactivity for CD8 provides additional evidence for the presence of normal subsets of splenic red pulp lining cells.<sup>[23]</sup> Most splenic hemangiomas are of cavernous or capillary in nature or of varying proportions of both and have immunoreactivity for vascular markers (CD31, Von Willebrand factor, and CD34). GISTs are mainly composed of spindle cells or epithelioid cells or both in different proportions. The immunoreactivity for CD34 and CD117 discovered on gastrointestinal stromal tumor-1 is helpful for the definitive diagnosis of GISTs. Splenosis is a benign disease and may have some immunologic and splenic-filtering functions, which may be favorable for the organism.<sup>[25]</sup> Therefore, it is important to establish a correct diagnosis before preoperative imaging to avoid unnecessary surgery, and a thorough follow-up is beneficial in most circumstances. If the patient has clinical symptoms, and a surgery is inevitable, endoscopic or laparoscopy resection or traditional surgery can be selected on the basis of the size or location of the gastric splenosis. If the diagnosis is still unclear, further FNA and cytology examination are recommended.

#### 4. Conclusion

In conclusion, gastric fundus splenosis with hemangioma is a unique case with a rare location for seeding or spreading; it is asymptomatic and an incidental finding. It has been misinterpreted as a GIST, and Tc-99mHDS may be the optimal method for its diagnosis before preoperative imaging. Pathology confirmation is the gold standard. Based on the findings in this case, surgery is a reasonable treatment for gastric fundus splenosis with hemangioma.

#### Author contributions

BG performed the pathology and histological examination. XHL, LW, MZ, ZWD, GJL, and LPM assessed the medical records and obtained information on the patient's clinical history. JH and WYJ helped in the final drafting of the manuscript. All authors have read and approved the final manuscript.

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