

Direct venous-to-arterial communication as a novel mechanism for ectopic embolism following esophageal variceal embolization: A case report

YOUCHUN LEI^{1,2*}, YOU KE^{2*}, TIANWEN YANG¹ and ZHENG GUO XU³

¹Department of Gastroenterology, The First Affiliated Hospital of Chongqing Medical and Pharmaceutical College, Chongqing 400000, P.R. China; ²Department of Hepatobiliary Surgery, The Second Affiliated Hospital, Chongqing Medical University, Chongqing 400000, P.R. China; ³Department of Gastroenterology, The Second Affiliated Hospital, The Third Military Medical University, Chongqing 400000, P.R. China

Received July 30, 2025; Accepted January 14, 2026

DOI: 10.3892/etm.2026.13125

Abstract. Ectopic embolism is an infrequent but potentially life-threatening complication following esophageal variceal embolization. Although it has been hypothesized to result from right-to-left shunting via pulmonary arteriovenous malformations or patent foramen ovale, definitive anatomical routes often remain undetected. The present case study reports a 57-year-old male patient with decompensated cirrhosis who developed acute bilateral visual loss and lower limb weakness within 24 h after undergoing transjugular intrahepatic portosystemic shunt placement combined with endovascular embolization of esophageal varices. Brain imaging confirmed multiple acute cerebral infarctions; notably, angiographic review revealed an abnormal direct venous connection between the esophageal variceal plexus and the left heart/ascending aorta, bypassing the pulmonary circuit. No cardiac or pulmonary shunts were identified. This direct communication likely permitted embolic material to enter the systemic circulation, causing cerebral artery occlusion. In conclusion, to the best of our knowledge, the present case provides the first angiographic evidence of a direct vascular route from esophageal varices to

the systemic arterial system. The present finding underscores the importance of comprehensive imaging before embolization and suggests that solid embolic agents such as coils may be preferable in select patients to prevent ectopic embolism.

Introduction

Esophageal varices are a common and life-threatening complication of portal hypertension in patients with liver cirrhosis (1). Endovascular embolization, often in combination with transjugular intrahepatic portosystemic shunt (TIPS), is a standard therapeutic approach to reduce variceal bleeding (2,3). Although generally effective, complications such as ectopic embolism may occur, occasionally resulting in catastrophic outcomes including cerebral, renal or mesenteric infarction (4,5); the underlying anatomical basis for such events has not been fully elucidated. In patients with cirrhosis, treatment for ectopic embolism caused by esophageal varices is relatively rare. Within the literature, to the best of our knowledge, there is only 1 case of cerebral embolism (6) and 3 cases of spinal cord embolism (7-9), but the specific cause of embolism is unclear.

To the best of our knowledge, the present case is the first reported case of angiographically confirmed direct venous-to-arterial communication causing ectopic embolism. Traditionally, right-to-left shunting mechanisms-such as pulmonary arteriovenous malformations or intracardiac defects-have been implicated (7,10); however, in several cases, including the present case, such mechanisms are absent (11-14).

Case report

Case presentation. A 57-year-old man with a long-standing history of hepatitis B virus-related cirrhosis (Child-Pugh class B; model for end-stage liver disease score 15) (15) was admitted to The Second Affiliated Hospital of The Third Military Medical University (Chongqing, China) in June 2023, for recurrent upper gastrointestinal bleeding and progressive ascites, which was unresponsive to diuretics. Previous endoscopic therapy with ligation had been performed twice over the past year, with partial but temporary hemostasis.

Correspondence to: Dr Zhengguo Xu, Department of Gastroenterology, The Second Affiliated Hospital, The Third Military Medical University, 83 Xinqiao Zheng Street, Shapingba, Chongqing 400000, P.R. China
E-mail: xzgd@tmmu.edu.cn

Dr Tianwen Yang, Department of Gastroenterology, The First Affiliated Hospital of Chongqing Medical and Pharmaceutical College, 301 Nancheng Avenue, Nan'an, Chongqing 400000, P.R. China
E-mail: 2055267326@qq.com

*Contributed equally

Key words: esophageal varices, embolization, cerebral infarction, liver cirrhosis, transjugular intrahepatic portosystemic shunt, ectopic embolism, angiography

On admission, the patient was hemodynamically stable. Laboratory investigations revealed anemia (hemoglobin, 82 g/l; reference range, 110-160 g/l), thrombocytopenia (platelets, $55 \times 10^9/l$; reference range, $125-350 \times 10^9/l$), hypoalbuminemia (albumin, 28 g/l; reference range, 35-50 g/l) and elevated total bilirubin ($34 \mu\text{mol/l}$; reference range, 3-22 $\mu\text{mol/l}$). Imaging using contrast-enhanced abdominal CT showed marked splenomegaly, large esophageal varices and ascites. After multi-disciplinary discussion, the patient underwent elective TIPS combined with embolization of esophageal varices.

Imaging and interventions. The TIPS procedure was performed in June 2023, under local anesthesia via a right internal jugular approach. Puncture of the left portal vein branch was achieved via the middle hepatic vein. Splenic venography revealed large, tortuous esophageal varices. After balloon dilatation of the puncture channel (Cook 7x8 mm), an 8x80 mm GORE VIATORR stent graft was placed.

Embolization of the varices was performed through a 4F Cobra catheter by slow injection of a 1:1 mixture of 2 ml tissue adhesive (GLUBRAN2) and 2 ml iodized oil under fluoroscopic control. Pre- and post-TIPS portal pressure gradients were 32 and 17 mmHg, respectively, indicating successful decompression. At ~24 h post-surgery, the patient developed sudden bilateral vision loss and lower limb weakness (grade III muscle strength bilaterally). Magnetic resonance angiography showed embolic occlusion of branches of the middle cerebral artery. Emergent neuroimaging including non-contrast CT and diffusion-weighted MRI revealed multiple acute infarctions in the bilateral frontal lobe, parietal lobe, occipital lobe, temporal lobe, left thalamus and cerebellar hemisphere (Fig. 1A-E).

To identify the embolic source, further evaluation was conducted. Echocardiography excluded patent foramen ovale or intracardiac thrombus (Fig. 2C). Additionally, no arteriovenous malformations or pulmonary embolism was found on pulmonary CT angiography (Fig. 2B).

Notably, retrospective analysis of fluoroscopic angiography demonstrated direct drainage from the esophageal variceal plexus to the left atrium and ascending aorta, bypassing the pulmonary circulation (Fig. 2A and D and Video S1). This anatomical variant likely accounted for the cerebral embolism.

Due to the recent hemorrhagic history, anticoagulation was withheld, and the patient was managed supportively with neuroprotective agents (0.25 g citicoline once daily for 5 days). Over 2 weeks, bilateral visual acuity markedly improved, and motor function partially recovered. At the most recent follow-up, the patient remained clinically stable with normal mental status and appetite. He reported no recurrence of gastrointestinal bleeding (hematemesis or melena), nausea, vomiting, abdominal pain or ascites.

Discussion

The present case represents a novel mechanism of ectopic embolism in the setting of esophageal variceal embolization. To the best of our knowledge, the present case is the first reported case of angiographically confirmed direct venous-to-arterial communication causing ectopic embolism. Traditionally, right-to-left shunting via patent foramen ovale or pulmonary arteriovenous fistulas has been considered necessary for

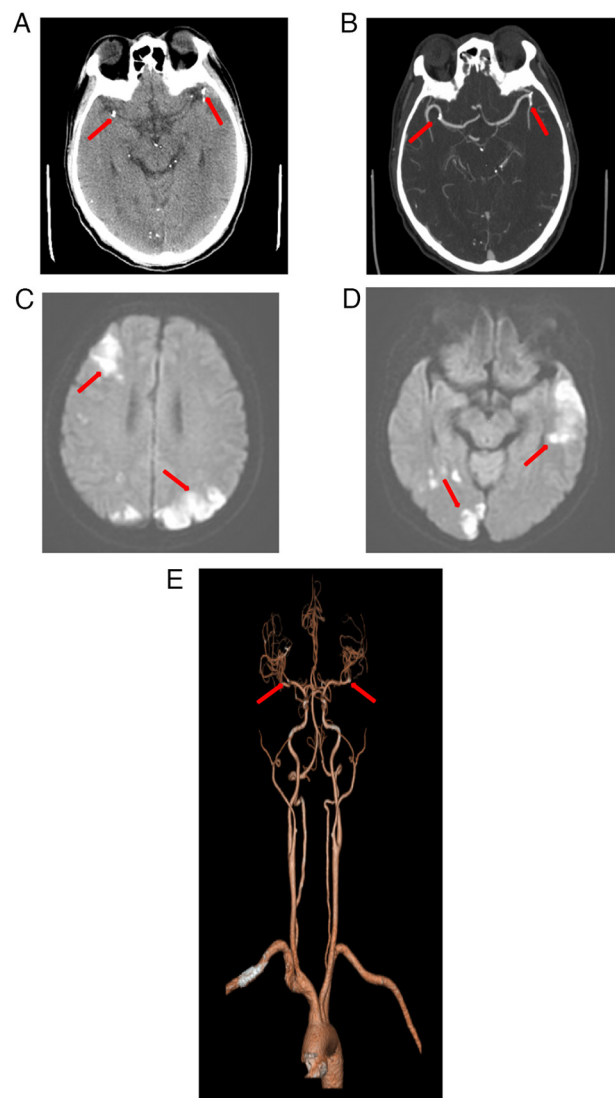


Figure 1. Multimodal imaging evaluation revealing acute cerebral infarction. (A) Axial head CTA demonstrates spotty and nodular high-density filling of the sclerosing agent within the distal M1 segments of the bilateral MCAs. (B) Head CTA maximum intensity projection reveals cast-like high-density filling in the distal M1 segments of the bilateral MCAs. (C) Brain MRI (DWI, $b=800$) shows multiple patchy hyperintense lesions in the right frontal lobe and bilateral parietal lobes. (D) Brain MRI DWI ($b=800$) displays multiple patchy hyperintense lesions in the right temporo-occipital region and the left temporal lobe. (E) Head CTA volume rendering depicts the abrupt cutoff of the distal M1 segments of the bilateral MCAs, accompanied by sparse and reduced distal branching. CTA, CT angiography; MCA, middle cerebral artery; DWI, diffusion-weighted imaging. (A, B and E) Arrows refer to the positions filled with sclerosing agents in the cerebral arteries. (C and D) Arrows refer to the part of the cerebral infarction caused by arterial blockage.

systemic embolization following venous embolization procedures (16-18). However, in the present case, such conventional shunts were definitively ruled out.

Instead, angiography revealed a rare and direct venous drainage route from the esophageal variceal plexus to the systemic circulation via the left heart, presumably through pathological dilation of small bronchial or mediastinal collaterals (19,20). To the best of our knowledge, this anatomic variant has not been previously described in the literature, in the context of post-embolization cerebral infarction (16).

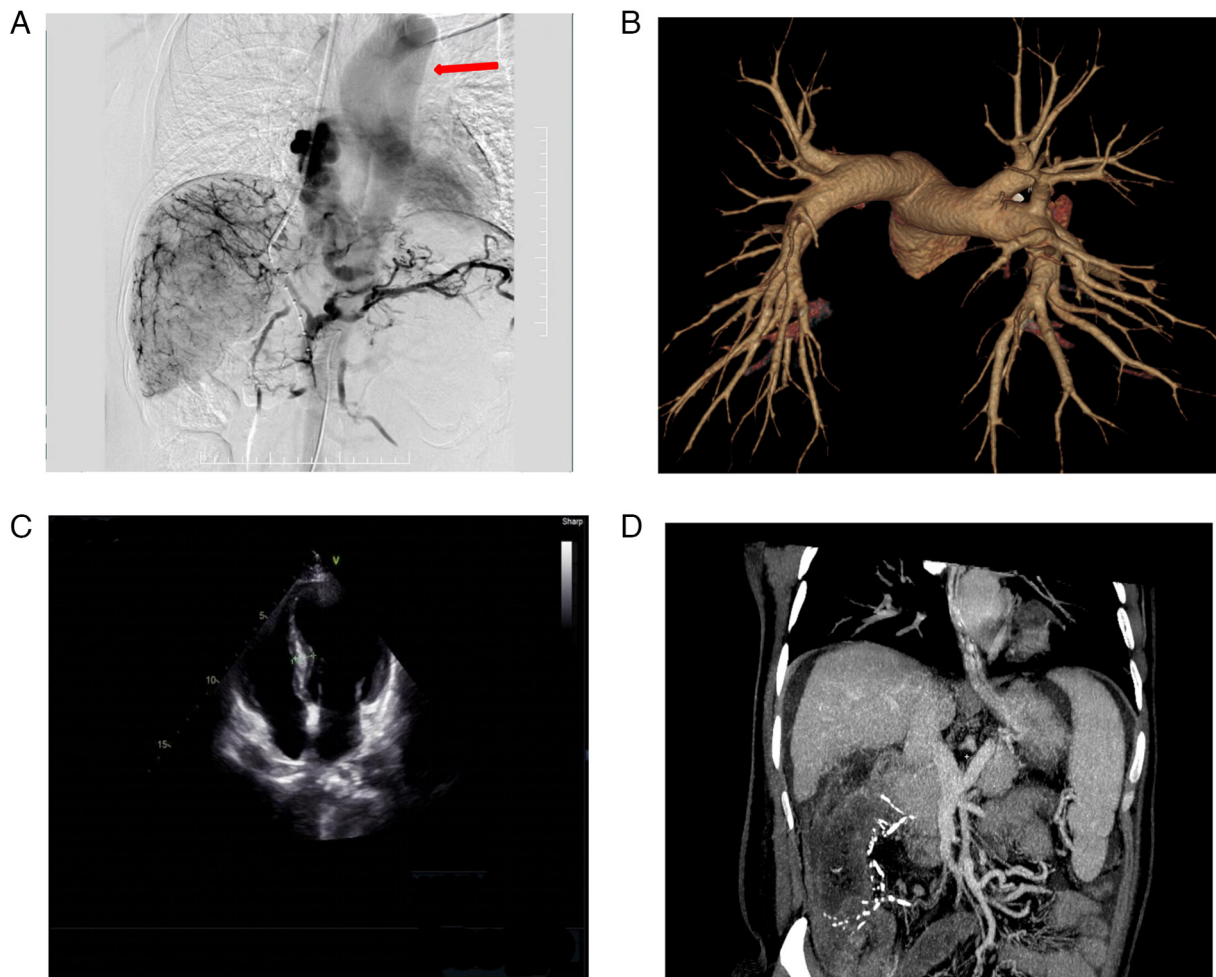


Figure 2. Intraoperative angiography demonstrated direct drainage from the esophageal variceal plexus to the left heart and ascending aorta, exclusion of conventional shunts and underlying abdominal pathology. (A) Sequential fluoroscopic images obtained during the procedure reveal the abnormal vascular pathway in this single patient. Contrast medium injected into the esophageal variceal plexus drains directly into the left heart and subsequently fills the ascending aorta (indicated by arrows), completely bypassing the pulmonary circulation. This rare anatomical variant provided the direct conduit for the embolic material to enter the systemic arterial circulation. (B) Pulmonary CT angiography shows no evidence of pulmonary arteriovenous malformations or pulmonary embolism, ruling out intrapulmonary shunting. (C) Echocardiography reveals normal cardiac chambers with no signs of patent foramen ovale or intracardiac thrombus, excluding intracardiac shunting sources. (D) Contrast-enhanced abdominal CT scan demonstrates marked splenomegaly, extensive esophageal varices and ascites, confirming the background of decompensated cirrhosis and portal hypertension.

A similar case of spinal cord infarction after sclerotherapy was reported by Seidman *et al* (7) in 1984, but no vascular mechanism was identified. Other studies postulated that the patent foramen ovale may allow embolic material into the cerebral circulation during TIPS, but in the absence of identifiable shunts, the mechanism remained speculative (21-25). The present case confirms the hypothesis of an alternative, direct venous-to-arterial conduit.

Due to the difficulty of detecting this vascular pathway with preoperative routine vascular CT, it is recommended to extend the display time and fully understand its flow direction in gastric coronary angiography during TIPS surgery, especially paying attention to whether the heart and aortic circulatory system are visible. From the perspective of surgical safety, if direct esophageal venous to the systemic arterial communication is found during surgery, it is recommended to avoid using liquid embolic agents due to their inherent migration risk (26,27). Solid embolic agents such as coils or embolization are unlikely to penetrate small caliber blood vessels and may be a safer option, particularly when imaging

suspicion or abnormal communication is observed prior to embolization (28,29).

In conclusion, the present case highlights a previously unreported cause of systemic embolization following esophageal variceal embolization; direct venous communication between the esophageal variceal plexus and the left heart/ascending aorta. If the cardiac and aortic circulatory systems are found to be visualized during gastric coronary angiography during TIPS surgery, it is recommended to use large-diameter or solid embolic materials such as coils, which may prevent potentially life-threatening ectopic embolic events.

Acknowledgements

Not applicable.

Funding

The authors declare that financial support was received for the research, authorship and publication of this article. This

study was funded by the General Project of Chongqing Science and Health Joint Medical Research Project (grant no. 2024MSXM081), the Science and Technology Research Project of Chongqing Education Commission (grant no. KJQN202302828), the 2023 Chongqing Nan'an District Science and Health Union Public Medical Research Project (grant no. 2023-05), the Open Research Project of the Chongqing Key Laboratory for Occupational Disease Prevention and Poisoning Treatment in 2021 (grant no. 2021ZYBKF07), the Chongqing Pharmaceutical Vocational Education Group General Project (grant no. CQZJ202352), the General Project of the Incubation Fund within The First Affiliated Hospital of Chongqing Medical and pharmaceutical College (grant no. 2022-2023MS02) and the 2023 Chongqing Nan'an District Public Health Key Specialty (Disease Prevention and Control) Construction Project.

Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

YL and ZX contributed to designing the study and performed the surgery. YK obtained the medical images. TY advised on patient treatment and analyzed patient data. ZX and YK confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The Ethics Committee of the Second Affiliated Hospital of the Third Military Medical University (Chongqing, China) exempted the present study from ethical approval. The participant provided written informed consent to participate in this study.

Patient consent for publication

Written informed consent was obtained from the patient for the publication of clinical details and any accompanying images.

Competing interests

The authors declare that they have no competing interests.

References

- Zhang CM and Wang X: Suspected cerebrovascular air embolism during endoscopic esophageal varices ligation under sedation with fatal outcome: A case report. *World J Clin Cases* 10: 371-380, 2022.
- Abuelazm MT, Cheema HA, Jafar U, Awad AK, Atef M, Abdalshafy H, Alashwah M, Shahid A, Awan RU, Afifi AM, *et al*: Transjugular intrahepatic portosystemic shunt with or without variceal embolization to prevent variceal rebleeding: An updated meta-analysis. *Expert Rev Gastroenterol Hepatol* 17: 741-751, 2023.
- Betancourt-Torres M, Perez-Torres A, Figueroa-Diaz L and Labat Alvarez EJ: Iatrogenic cerebral air embolism during esophago-gastroduodenoscopy. *Am J Case Rep* 21: e925046, 2020.
- Chevallier O, Comby PO, Guillen K, Pellegrinelli J, Mouillot T, Falvo N, Bardou M, Midulla M, Aho-Glélé S and Loffroy R: Efficacy, safety and outcomes of transcatheter arterial embolization with N-butyl cyanoacrylate glue for non-variceal gastrointestinal bleeding: A systematic review and meta-analysis. *Diagn Interv Imaging* 102: 479-487, 2021.
- Davis JPE, Lim JK, Francis FF and Ahn J: AGA clinical practice update on management of portal vein thrombosis in patients with cirrhosis: Expert review. *Gastroenterology* 168: 396-404. e1, 2025.
- Wang G, Zhang C and Shi Y: Cerebral embolism due to portopulmonary venous anastomosis during endoscopic therapy for gastric varices. *Am J Gastroenterol* 114: 1833, 2019.
- Seidman E, Weber AM, Morin CL, Ethier R, Lamarche JB, Guerguerian AJ, Geoffroy G and Roy CC: Spinal cord paralysis following sclerotherapy for esophageal varices. *Hepatology* 4: 950-954, 1984.
- Mueller D and Gilden DH: Brown-Sequard syndrome after esophageal sclerotherapy and crack cocaine abuse. *Neurology* 58: 1129-1130, 2002.
- Heller SL, Meyer JR and Russell EJ: Spinal cord venous infarction following endoscopic sclerotherapy for esophageal varices. *Neurology* 47: 1081-1085, 1996.
- Xu SH, Wu F, Guo LH, Zhang WB and Xu HX: Liver fibrosis index-based nomograms for identifying esophageal varices in patients with chronic hepatitis B related cirrhosis. *World J Gastroenterol* 26: 7204-7221, 2020.
- de Sousa CP, Carvalho C, Sousa C and Amaral R: Treatment of gastric varices with cyanoacrylate complicated by systemic embolization. Treatment of gastric varices with cyanoacrylate complicated by systemic embolization. *Rev Gastroenterol Peru* 44: 67-70, 2024.
- Gong T, Tsao J, Ding M, Jin L, Duan F, Yu Y and Li X: Transcatheter arterial embolization for cancer-related non-variceal upper gastrointestinal bleeding: A multicenter retrospective study of 107 patients. *Diagn Interv Imaging* 104: 60-66, 2023.
- Lee EW, Eghtesad B, Garcia-Tsao G, Haskal ZJ, Hernandez-Gea V, Jalaieian H, Kalva SP, Mohanty A, Thabut D and Abraldes JG: AASLD practice guidance on the use of TIPS, variceal embolization, and retrograde transvenous obliteration in the management of variceal hemorrhage. *Hepatology* 79: 224-250, 2024.
- Jiang N, Wang WS, Zhu XL and Shen J: Liver failure after percutaneous transhepatic variceal embolization: A case report. *Asian J Surg* 46: 2857-2858, 2023.
- D'Amico G, Garcia-Tsao G and Pagliaro L: Natural history and prognostic indicators of survival in cirrhosis: A systematic review of 118 studies. *J Hepatol* 44: 217-231, 2006.
- Kim JS, Kim BW, Kim DH, Park CH, Lee H, Joo MK, Jung DH, Chung JW, Choi HS, Baik GH, *et al*: Guidelines for non-variceal upper gastrointestinal bleeding. *Korean J Gastroenterol* 75: 322-332, 2020 (In Korean).
- Kolb JM and Samarasekera JB: EUS-guided splenic artery embolization for variceal hemorrhage: Balancing creativity and innovation in Endo-hepatology with caution. *Gastrointest Endosc* 95: 184-186, 2022.
- Lai HY, Wu KT, Liu Y, Zeng ZF and Zhang B: Angiography and transcatheter arterial embolization for non-variceal gastrointestinal bleeding. *Scand J Gastroenterol* 55: 931-940, 2020.
- Liu B and Li G: Progress in endoscopic and interventional treatment of esophagogastric variceal bleeding. *Dis Markers* 2022: 2940578, 2022.
- Ohs Z, Jones M, Sharma N and Loveridge K: Percutaneous transhepatic embolization of ectopic varices in a patient with portal hypertension presenting with hemorrhagic shock. *Cureus* 13: e18209, 2021.
- Onishi Y, Shimizu H, Tsunoda S, Obama K and Nakamoto Y: Direct percutaneous access to a mesenteric vein for antegrade embolization of esophageal varices: A case report. *Radiol Case Rep* 16: 2491-2495, 2021.
- Pal A, Blanz J, Gómez KJR, Preul MC and Vernon BL: Liquid embolic agents for endovascular embolization: A review. *Gels* 9: 378, 2023.
- Patidar Y, Chatterjee N, Mukund A and Sarin SK: Evaluation of clinical outcome and predictors of mortality in patients undergoing antegrade transvenous variceal embolization in adjunct to salvage transjugular intrahepatic portosystemic shunt for active uncontrolled gastric variceal bleeding. *Br J Radiol* 97: 1791-1798, 2024.

24. Sioutas GS, Vivanco-Suarez J, Shekhtman O, Matache IM, Salem MM, Burkhardt JK, Srinivasan VM and Jankowitz BT: Liquid embolic agents for middle meningeal artery embolization in chronic subdural hematoma: Institutional experience with systematic review and meta-analysis. *Interv Neuroradiol* 15: 15910199231183132, 2023.
25. Swaminathan N and Chaudhary S: Oesophageal variceal-pulmonary venous fistula A rare cause of a right-to-left shunt. *Eur J Case Rep Intern Med* 7: 001482, 2020.
26. Vollherbst DF, Chapot R, Bendszus M and Möhlenbruch MA: Glue, onyx, squid or PHIL? Liquid embolic agents for the embolization of cerebral arteriovenous malformations and dural arteriovenous fistulas. *Clin Neuroradiol* 32: 25-38, 2022.
27. Wang DX, Wu XJ, Yu JZ, Zhan JY, Xing FF, Liu W, Chen JM, Liu P, Liu CH and Mu YP: Visualizing global progress and challenges in esophagogastric variceal bleeding. *World J Gastrointest Surg* 17: 102020, 2025.
28. Wang Z, Zeng Z, Chen L, Shi C, Jin J, Zhang F, Zhang Q, Mei X and Kong D: Endoscopic ultrasonography-guided injection of cyanoacrylate in the treatment of gastroesophageal varices type 1: A single-center randomized study. *Surg Endosc* 37: 8277-8284, 2023.
29. Wong F: Management of refractory ascites. *Clin Mol Hepatol* 29: 16-32, 2023.



Copyright © 2026 Lei et al. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) License.