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CASE REPORT

ADVANCED

CLINICAL CASE

A Sticky Situation

An Uncommon Cardiac Complication of Cyanoacrylate Glue Injection

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ABSTRACT

This case report describes an uncommon cardiac complication related to the endoscopic injection of cyanoacrylate glue to treat gastric variceal bleeding. The presentation and management options are reviewed and compared with our step-by-step approach in a patient requiring a liver transplant. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2023;17:101886) © 2023 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 28-year-old man with iron deficiency anemia of unknown cause was referred to the local hospital for elective esophagogastroduodenoscopy (EGD). Before this episode, the patient's general practitioner had investigated him for iron deficiency anemia with intermittent diarrhea and rectal bleeding in the community. The computed tomography (CT) scan revealed a cirrhotic appearance of the liver, with splenomegaly and gastric varices. During EGD, the endoscopist found lesions consistent with gastric varices at the gastric fundus and proceeded to treat them with glue injection consisting of 1.5 mL Histoacryl mixed with lipiodol. This unexpectedly resulted in an exsanguinating hemorrhage, requiring admission to the intensive care unit after resuscitation to achieve hemodynamic stability.

LEARNING OBJECTIVES

- To recognize that TIPS can facilitate Histoacryl glue extension and embolization, complicating further management.
- To anticipate embolic complication of glue injection because the presentation can be acute, subacute, or delayed.
- To consider a multidisciplinary approach with multimodality imaging as early as possible to deliver the safest treatment option to the patient with embolic complications.

MEDICAL HISTORY

The patient had a 2-year history of loose stools with occasional blood. He was not a regular alcohol drinker, with 1 episode of heavy drinking for 6 months a few years before this admission. No further personal or family history to indicate liver diseases was reported.

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ABBREVIATIONS AND ACRONYMS

EGD = esophagogastroduodenoscopy

IR = interventional radiology

IVC = inferior vena cava

RA = right atrium

TIPS = transjugular intrahepatic portosystemic shunt

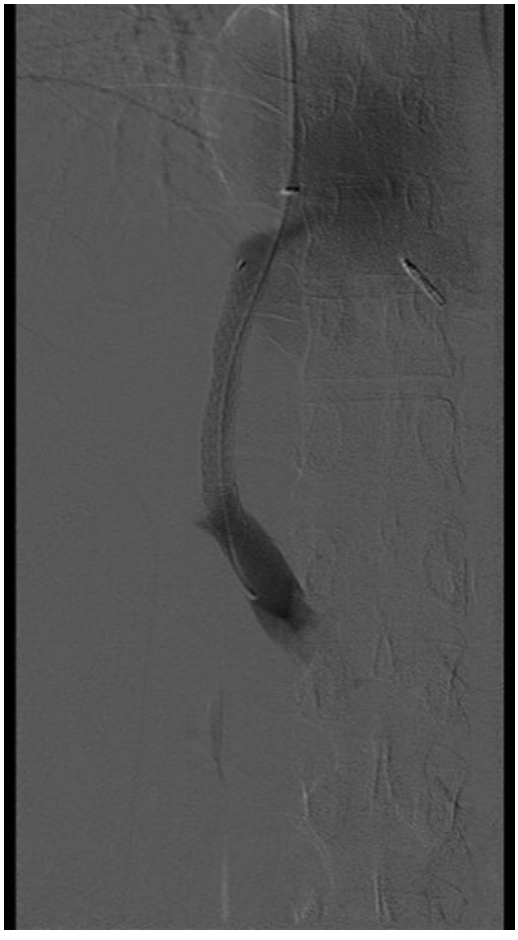
DIFFERENTIAL DIAGNOSES

The differential diagnoses at this point were iatrogenic upper gastrointestinal hemorrhage and variceal bleeding with portal hypertension resulting from cirrhosis of uncertain etiology.

INVESTIGATIONS

On the following day, the patient underwent a repeated EGD under general anesthesia. Owing to the large volume of fresh blood obscuring the view, a Sengstaken-Blakemore tube was inserted as a rescue and bridge therapy to definitive treatment. The team investigated further with a CT angiogram, which did not suggest active bleeding.

FIGURE 1 Fluoroscopy Demonstrating Successful and Uneventful Transjugular Intrahepatic Portosystemic Shunt Procedure



MANAGEMENT

With a provisional diagnosis of portal hypertension and cirrhosis, a rescue transjugular intrahepatic portosystemic shunt (TIPS) was performed to lower portal venous pressure, with removal of the Sengstaken-Blakemore tube after a few days (**Figure 1**). TIPS was indicated to treat uncontrollable variceal bleeding secondary to portal hypertension.

Postoperatively, the patient experienced episodes of melena, requiring a further admission to the intensive care unit. A third EGD revealed oozing gastric varices requiring multiple bandings and glue injections. Because of further attacks of melaena, TIPS patency was investigated with Doppler ultrasonography and CT angiography, which showed TIPS patency to be inconclusive. A provisional diagnosis of cirrhosis of the liver with uncertain etiology, and a high United Kingdom Model for End-Stage Liver Disease score, resulted in the patient's being transferred to the regional liver transplantation unit.

In our center, an interventional radiologist then performed a TIPS venogram to investigate the patency and the need for potential embolization of varices. This surprisingly revealed the migration of glue in both the afferent and efferent systems of TIPS, further extending into the inferior vena cava (IVC) and the right atrium (RA), posing a severe risk factor for pulmonary embolization (**Figure 2**, Video 1). As this glue migration had not been reported in the previous CT scan, a repeat CT scan was performed to assess the risk of further bleeding from varices, the extent of glue migration, and feasibility to retrieve the migrated glue cast (**Figures 3 and 4**). The findings were: 1) good patency of the TIPS; 2) distribution of glue cast without imminent risk of further bleeding; and 3) mobile glue cast in the RA with embolized pieces in branches of the pulmonary arteries. Subsequent transthoracic echocardiography (**Figures 5 to 7**) found mobile echogenic, standlike structures within the RA, originating from the IVC, with normal biventricular size and function.

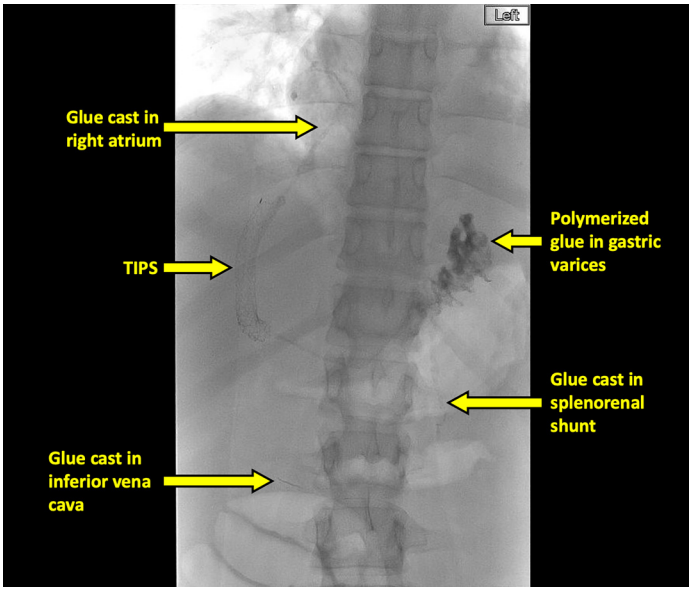
The cardiology team was then consulted for potential retrieval options. Our opinion was that snaring the glue cast was unlikely to be successful, with a further risk of breaking it into pieces flowing down to the pulmonary arteries. A similar view was provided by the interventional radiology (IR) team. Inasmuch as the risk of using a cardiopulmonary bypass machine for the patient was higher because of liver failure at that moment, the cardiothoracic

team also did not support open heart removal. The risk of forming a blood clot on the glue cast was managed by careful anticoagulation with therapeutic low-molecular-weight heparin subcutaneous injection. Then, comprehensive work-ups by the liver team, including magnetic resonance cholangiopancreatography and sigmoidoscopy, reached a final diagnosis for the liver transplantation candidate of cirrhosis of the liver due to primary sclerosing cholangitis with overlapping ulcerative colitis complicated by migration of glue used to treat gastric varices.

The multidisciplinary (interventional cardiology, cardiothoracic surgery, IR, and hepatology) discussion was then arranged to seek consensus on glue retrieval options. The teams agreed that the IR approach would carry the lowest risk, with the standby rescue cardiothoracic team.

During fluoroscopy by the IR team, the mobile glue cast in the RA was no longer visible (Video 2). The subsequent echocardiogram confirmed the presence of an echogenic glue cast (Videos 3 to 8). We concluded that lipiodol (radiopaque) was already dissolved; however, radiolucent Histoacryl glue remained in the RA. Therefore, the IR option was no longer feasible. Then, another multidisciplinary meeting proposed direct atrial extraction by the cardiothoracic team at the time of liver transplantation surgery before the liver could be removed, with cardiopulmonary bypass machine support.

FIGURE 2 **Fluoroscopy Before Transjugular Intrahepatic Portosystemic Shunt Venogram Showing Polymerized Glue in Gastric Varices and Extension of Glue Cast in Right Atrium, Inferior Vena Cava, and Splenorenal Shunt**

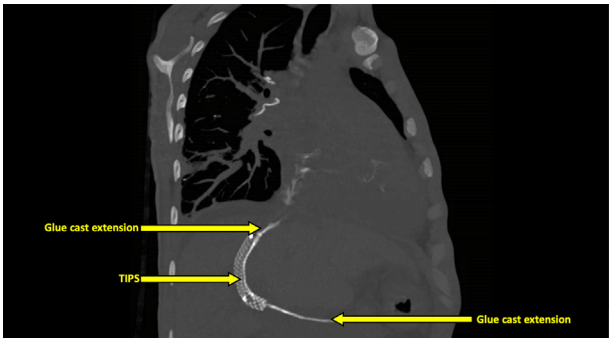


DISCUSSION

Histoacryl glue (a monomer, n-butyl-2-cyanoacrylate) polymerizes into a solid form once exposed to ionic materials such as water or blood. It is usually mixed with lipiodol (0.5 mL glue and 1 mL lipiodol at the authors' center; however, the proportion varies across units both nationally and internationally). Mixing with radiopaque lipiodol not only enables postprocedural radiological assessment but also slows the polymerization process, allowing the endoscopists more time for injection. It is licensed to treat emergency gastric variceal bleeding as first-line therapy. The potential complications include rebleeding, erosion, ulceration, extrusion of glue cast, portal and splenic vein thrombosis, sepsis, and embolization.

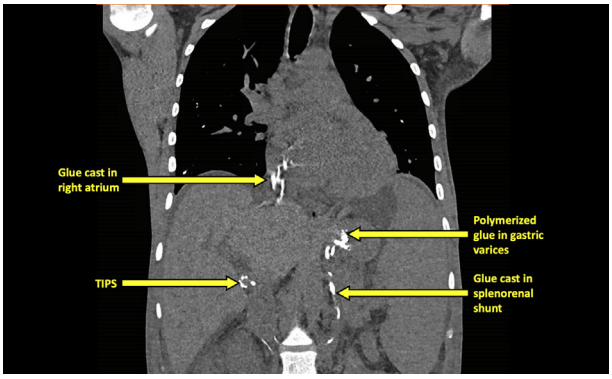
A recent retrospective study reported that the risk of distant embolization after glue injection was 0.5% (1 pulmonary and 1 cerebral).[1] The presentation can vary from within hours to days after injection.[2] A catastrophic outcome with mortality from embolization was also reported.[1] In terms of management, a recent case report followed up the patient with conservative management with anticoagulation and

FIGURE 3 **Computed Tomographic Scan Showing Glue in the Systemic Venous Circulation**



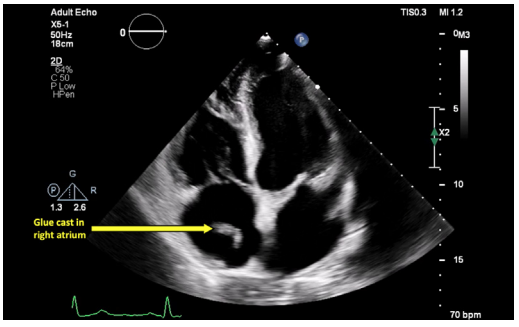
TIPS = transjugular intrahepatic portosystemic shunt.

FIGURE 4 Computed Tomographic Scan Showing Glue in the Systemic Venous Circulation



TIPS = transjugular intrahepatic portosystemic shunt.

FIGURE 5 Echocardiography Demonstrating Echogenic Glue Cast in Right Atrium

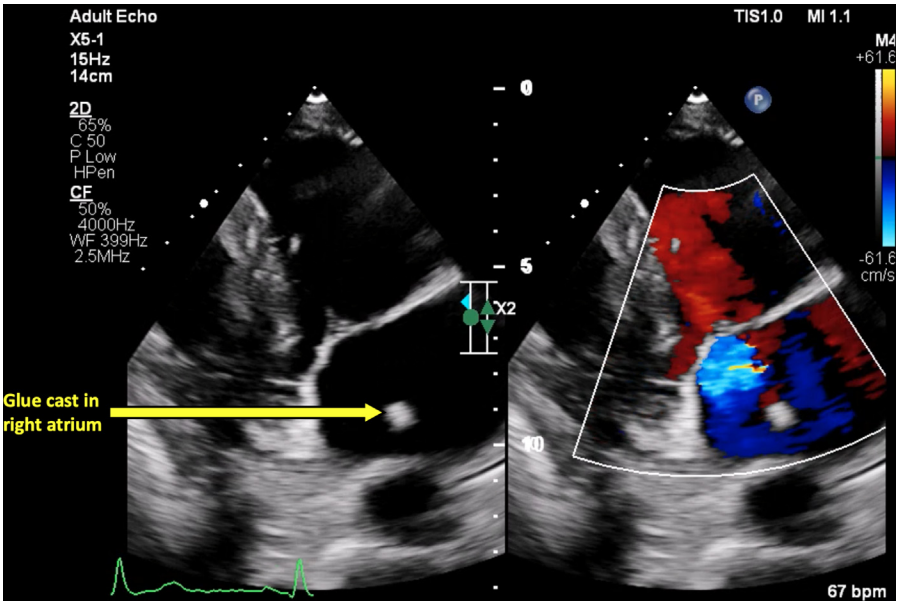


showed no change in the size of the glue in the right ventricle.[3] Few recent case reports of retrieval by a minimally invasive approach or open heart surgery were identified in the literature.

TIPS is a well-established procedure involving inserting a stent to connect the portal veins to adjacent hepatic veins under imaging guidance to relieve portal hypertension, thereby reducing the risk of variceal hemorrhage. However, this therapeutic procedure unexpectedly served as a conduit that allowed glue extension and embolization in our patient. Additionally, liver failure requiring transplantation further limits the management options.

To the authors' knowledge, this case report is the first to describe the extension of glue cast through TIPS to the IVC down to the RA.

FIGURE 6 Echocardiography: Right Ventricular Inflow View Color Flow Mapping



FOLLOW-UP

The patient is on the waiting list for liver transplantation under the care of the hepatology team. The glue cast is planned to be removed by direct extraction by the cardiothoracic unit at the time of liver transplantation surgery.

CONCLUSIONS

Migration of the cyanoacrylate glue used to treat gastric variceal bleeding to the cardiovascular system is uncommon but can be severe. The presentation can be acute, subacute, or delayed. The treatment options can be conservative, minimally invasive, or invasive, depending on the clinical situation. The choice of management should be considered as early as possible in a multidisciplinary approach with minimal risk to the patient.

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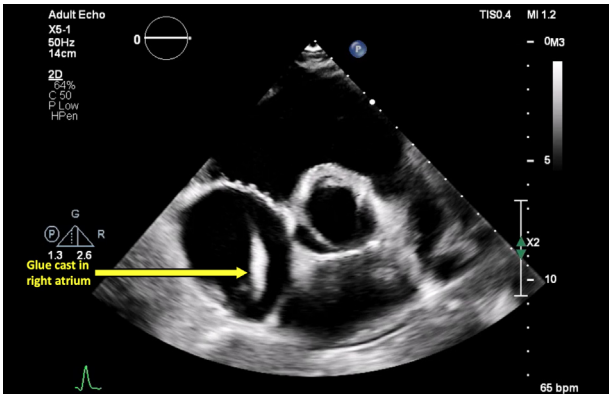
The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

FIGURE 7 Echocardiography: Parasternal View



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KEY WORDS glue embolization, glue injection, liver shunt, right atrium

APPENDIX For supplemental videos, please see the online version of this paper.