

Intraoperative Pericardial Tamponade During Transjugular Intrahepatic Portosystemic Stent-Shunt Surgery

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Abstract: Introduction: Portal hypertension is a serious medical condition associated with fatal gastrointestinal bleeding, liver function abnormalities, and other adverse events. Transjugular intrahepatic portosystemic stent-shunt surgery (TIPSS) has emerged as an effective treatment for alleviating portal hypertension due to its advantages of minimal invasiveness, rapid recovery, and significant therapeutic outcomes. However, the perioperative period of TIPSS is not devoid of risks, and serious complications may arise. Objective: This paper aims to present a case of pericardial tamponade resulting from poor puncture during TIPSS, highlighting the potential life-threatening complications that can occur during this procedure. The management of pericardial tamponade in the perioperative setting is crucial for ensuring perfusion of vital organs and the overall well-being of the patient. Methods: A comprehensive review of the patient's medical records, perioperative notes, and diagnostic imaging was conducted to analyze the circumstances leading to the development of pericardial tamponade following TIPSS. Results: We present a case of a 39-year-old male with portal hypertension who underwent TIPSS as a therapeutic measure. During the procedure, a poor puncture led to the unintended occurrence of pericardial tamponade, causing a rapid deterioration of the patient's hemodynamic status. Immediate recognition of the complication by the anesthesiologist allowed for prompt intervention, with pericardiocentesis performed successfully to alleviate the tamponade and restore cardiac function. Conclusion: Pericardial tamponade following TIPSS is a rare but potentially fatal complication that demands immediate recognition and swift management. This case underscores the significance of close perioperative monitoring and the expertise of the medical team in dealing with unforeseen adverse events during TIPSS. Awareness of such complications can aid in early diagnosis and timely intervention, ultimately contributing to favorable patient outcomes.

Keywords: Portal Hypertension, Transjugular Intrahepatic Portosystemic Stent-Shunt, TIPSS, Pericardial Tamponade, Perioperative Complications, Anesthesiologist

1. Introduction

Transjugular intrahepatic portosystemic stent-shunt surgery (TIPSS) is a widely accepted interventional procedure utilized in the treatment of portal hypertension. However, like any invasive procedure, TIPSS carries the risk of potential complications. Among these, pericardial tamponade, although rare, can lead to severe consequences. In this case report, we present an exceptional occurrence of pericardial tamponade during TIPSS, aiming to bring attention to this uncommon yet critical complication and increase awareness among healthcare professionals. This introduction will delve into the background of the research, elucidate the research's purpose, emphasize the significance of investigating this research

problem, and outline the research question(s) we seek to address.

2. Case Report

A 39-year-old male patient with a history of viral hepatitis B and cirrhosis was admitted to the hospital due to gastrointestinal bleeding. The patient had been diagnosed with cirrhosis ten years ago and had been on antiviral medication. Upon admission, abdominal CT scans revealed features of cirrhosis, splenomegaly, ascites, portal hypertension, esophageal varices, and portal thrombosis. The patient's liver function was classified as Child-Pugh grade B. Coagulation tests showed mild elevation in prothrombin time, international

normalized ratio (INR), and D-dimer levels, as well as moderate reduction in fibrinogen and antithrombin III. Other blood tests indicated a hemoglobin level of 92 g/L, platelet count of $95 \times 10^9/L$, and albumin level of 27.3 g/L. The patient's admission diagnosis included cirrhosis, portal hypertension, esophagogastric fundic varices, liver tumor, and chronic viral hepatitis B.

After successful management of the gastrointestinal bleeding, the patient underwent endoscopic esophagogastric fundic variceal ligation to further improve his condition. The procedure was successful, and the patient had a good recovery. Subsequently, the decision was made to perform TIPSS after 18 days.

Before the TIPSS, the patient was connected to a monitor, which displayed vital signs including a heart rate of 88 beats per minute, noninvasive blood pressure of 116/68 mmHg, and finger pulse oxygen saturation of 99%. General anesthesia was administered to ensure that the patient remained still during the procedure. The patient received intravenous sufentanil, propofol, penehyclidine hydrochloride, and midazolam for the induction of anesthesia. Muscle relaxation was achieved with cisatracurium besilate, followed by tracheal intubation.

During the TIPSS, the surgeon performed mesenteric artery and portal vein angiography through the right femoral artery. A puncture was made through the right jugular vein, and a guidewire was placed to navigate into the hepatic vein. Heparin sodium injection was administered for systemic heparinization. However, during the placement of the puncture sheath, the patient exhibited a significant increase in heart rate (110-120 beats/min) and fluctuating systolic blood pressure (40-50 mmHg). Despite the administration of vasoactive drugs, including epinephrine and norepinephrine, the patient's condition did not improve.

Recognizing the compromised circulation, the anesthesiologist conducted ultrasound-guided aspiration of the pericardial effusion, withdrawing 60 ml of dark red fluid. Simultaneously, intravenous vasoactive drugs were continued, and crystalloid solution was administered to stabilize the patient's heart rate and blood pressure. The TIPSS was subsequently terminated, and the patient was transferred to the intensive care unit (ICU) for further monitoring. No additional adverse events occurred during the patient's ICU stay. After ten days, the patient had recovered and was scheduled for discharge. One month after discharge, the patient underwent follow-up with no reported discomfort.

3. Discussion

TIPSS, first performed successfully in 1989, has become widely available worldwide as a treatment for cirrhotic portal hypertension. It offers significant benefits for patients with portal hypertension and gastrointestinal bleeding, reducing portal pressure, prolonging life expectancy, and serving as a bridge to liver transplantation. Compared to splenectomy, TIPSS is less invasive, making it suitable for patients who are unable to tolerate extensive surgery [1].

TIPSS involves navigating a puncture sheath through the internal jugular vein, superior vena cava, inferior vena cava, and hepatic vein, followed by portal vein puncture to establish a hepatoportal shunt that reduces portal vein pressure [1, 2]. Careful attention must be given during the delivery of the puncture sheath to avoid vascular damage. Previous studies have found that 80% of patients with cirrhosis have some degree of coagulation dysfunction [3]. In these patients, high-dose heparin sodium injection can further affect coagulation function when undergoing TIPSS surgery. Even a small breach during the procedure can lead to severe bleeding complications.

In this particular case, the patient experienced circulatory collapse shortly after the delivery of the puncture sheath, accompanied by unresponsiveness to vasoactive drugs and evidence of pericardial effusion on ultrasound. It was speculated that the operating surgeon may have inadvertently damaged the vena cava during sheath delivery, leading to blood outflow into the pericardium. The slow flow initially masked the issue, but as blood continued to accumulate, pericardial tamponade developed. The patient's heparinization further complicated the situation by impeding normal clotting processes, resulting in ongoing bleeding. Pericardiocentesis was performed to aspirate the pericardial effusion, and intravenous protamine was administered to counteract the effects of heparin as quickly as possible. Following successful resuscitation, it was confirmed that the surgeon encountered significant resistance when passing through the right atrium into the inferior vena cava, which was not given adequate attention at the time.

There is some controversy about the type of anesthesia used for TIPSS surgery, with some studies suggesting that local anesthesia can be used, while others suggest that the use of general anesthesia with endotracheal intubation ensures patient safety and surgical outcomes [4-6]. General anesthesia provides benefits such as better patient comfort, immobility, and protection of the airway. It enables the anesthesiologist to maintain control over the patient's hemodynamics and administer vasoactive medications as needed. However, general anesthesia also carries its own risks, including the potential for respiratory complications, prolonged recovery time, and increased resource utilization. Therefore, the decision regarding the type of anesthesia should be made based on a comprehensive assessment of the patient's individual characteristics and the expertise of the healthcare team. We prefer general anesthesia. This ensures that patients do not experience somatic movements due to pain during intrahepatic balloon dilation and portal vein puncture, which can lead to procedural failure or unexpected complications. General anesthesia allows for airway protection and circulatory support in the event of serious complications such as abdominal or thoracic bleeding [7].

Anesthesiologists should be well prepared both physically and mentally when handling TIPSS, as potential complications may arise. Adequate intravenous access for fluid infusion, rapid availability of vasoactive drugs, and access to a bedside ultrasound machine are essential. During

surgery, if a patient experiences unexplained circulatory fluctuations, the cause should be actively investigated while ensuring adequate perfusion through the use of vasoactive drugs. In cases of unimproved circulatory failure, early utilization of ultrasound can help identify potential unidentified fluid accumulation in the thoracic or abdominal cavities [8-10]. Prompt identification of the underlying cause enhances resuscitation success rates and improves patient outcomes. Following recovery, a thorough examination of the patient's body should be conducted. In this case, a cardiac ultrasound and chest CT were performed after the patient returned to the ward, revealing a small amount of pericardial effusion.

Pericardial tamponade is a rare but potentially life-threatening complication. There have been previous reports of iatrogenic cardiac tamponade during interventional procedures or some vascular puncture procedures [11-13]. It is crucial for healthcare professionals involved in these procedures to be aware of this potential complication and be prepared to act promptly if it occurs. Careful attention should be given during the delivery of the puncture sheath to avoid vascular damage, and close monitoring of the patient's vital signs and hemodynamic status is essential throughout the procedure [14]. Immediate recognition of pericardial tamponade and prompt intervention, such as pericardiocentesis, can significantly improve patient outcomes. By increasing awareness and understanding of this complication, healthcare providers can enhance patient safety during TIPSS.

Furthermore, it is important to thoroughly evaluate the patient's coagulation profile and adjust the heparin dosage accordingly. Patients with preexisting liver disease and impaired coagulation function are particularly vulnerable to bleeding complications during TIPSS. Close collaboration between anesthesiologists, interventional radiologists, and hepatologists is crucial in optimizing patient care and minimizing potential risks.

To prevent pericardial tamponade and other complications during TIPSS, several strategies can be implemented. First, meticulous technique and attention to detail during the insertion of the puncture sheath are essential. The operator should have a thorough understanding of the patient's anatomy and carefully navigate the vascular structures to avoid inadvertent damage. In cases where resistance is encountered, further investigation should be carried out to identify the cause and appropriate measures should be taken to address any issues promptly.

Additionally, intraoperative monitoring plays a vital role in detecting complications early. Continuous hemodynamic monitoring, including blood pressure, heart rate, and oxygen saturation, allows for real-time assessment of the patient's condition. Transesophageal echocardiography (TEE) can provide valuable information about cardiac function, intracardiac structures, and the presence of pericardial effusion [15].

Postprocedure care is equally important in ensuring optimal outcomes. Close monitoring of the patient's vital signs,

coagulation parameters, and renal function is necessary in the immediate postoperative period. Adequate pain control and early mobilization can aid in preventing complications such as deep vein thrombosis and pneumonia. Regular follow-up visits and imaging studies are essential to assess the patency and functionality of the TIPSS shunt and monitor for any potential long-term complications.

In addition to the strategies mentioned above, advancements in technology and procedural techniques have also contributed to reducing the incidence of pericardial tamponade during TIPSS. The use of intravascular ultrasound (IVUS) guidance has shown promise in improving the accuracy and safety of portal vein puncture. IVUS allows for real-time visualization of the vessel walls, aiding in identifying anatomical variations, detecting thrombus or calcification, and optimizing the puncture site. This can help minimize the risk of vessel perforation and subsequent complications such as pericardial tamponade [16].

Furthermore, the development and utilization of covered stents have been beneficial in reducing the occurrence of shunt-related complications, including pericardial tamponade. Covered stents provide a protective lining that prevents direct contact between the metallic stent and the vessel wall, reducing the risk of erosion and subsequent bleeding. By minimizing the likelihood of stent-related complications, the use of covered stents has contributed to improved patient outcomes and reduced rates of pericardial tamponade [17].

Standardized protocols and guidelines can also play a significant role in preventing pericardial tamponade and other complications associated with TIPSS. These protocols should encompass preprocedure evaluation, intraoperative management, and postprocedure care. They should emphasize the importance of thorough patient assessment, selection of appropriate anesthesia, meticulous technique during the procedure, and vigilant monitoring throughout the process. In addition, ongoing training and education of healthcare professionals involved in TIPSS are crucial to ensure that they stay updated with the latest techniques and evidence-based practices.

4. Conclusion

Pericardial tamponade is a rare but potentially life-threatening complication that can occur during TIPSS. The prevention and management of this complication require a multidisciplinary approach involving interventional radiologists, hepatologists, anesthesiologists, and critical care teams. By implementing meticulous techniques, utilizing advanced imaging modalities, following standardized protocols, and maintaining a high level of vigilance, healthcare professionals can minimize the occurrence and mitigate the consequences of pericardial tamponade. Continued research and advancements in technology will further contribute to improving the safety and efficacy of TIPSS, ultimately benefiting patients with portal hypertension and related conditions.

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