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CASE REPORT

Inferior Cannula Is in the Hepatic Vein: Case Report

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ABSTRACT

Venous cannulation is one of the most important steps in establishing cardiopulmonary bypass. Misplacement of the cannula is a rare occurrence. Transoesophageal echocardiography can help identify misplacement during conventional cardiac surgery.

Keywords: Cannulation, cardiopulmonary bypass, transoesophageal echocardiography

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Introduction

The process of cardiopulmonary bypass (CPB) involves inserting cannulas into the right atrium or directly into the superior vena cava (SVC), inferior vena cava (IVC), and the ascending aorta. In conventional coronary artery bypass graft surgery, venous cannulation is typically performed under direct vision. The cannula can easily be felt by surgeons when touched, due to its tactile properties.

In minimally invasive surgery, transoesophageal echocardiography (TOE) is used for peripheral cannulation. TOE can also be used in conventional cardiac surgery to identify the tip of the cannula.

The present report discusses the identification of IVC miscannulation with TOE in conventional coronary artery bypass graft (CABG) surgery. Written informed consent was obtained from the patient.

Case Reports

Case 1

A 77-year-old female patient (height: 151 cm; weight: 68 kg) with a Euroscore of 12 was scheduled to undergo coronary artery bypass graft surgery. Prior to the surgical procedure, there were no abnormalities in the preoperative blood tests. Echocardiography revealed a left ventricular ejection fraction of 45%.

The patient was monitored using electrocardiography, pulse oximetry, an invasive blood pressure catheter, a bispectral index, and a cerebral oximeter. Following the induction of intravenous anaesthesia, the patient was also monitored with a central venous catheter and transoesophageal echocardiography. Anaesthesia maintenance was achieved with inhalational and intravenous anaesthesia. After sternotomy, heparinisation at a dose of 300 U/kg was administered following LIMA release. An initial 22 Fr aortic cannulation (DLP curved tip, Medtronic, USA) was performed based on an ACT level of 400 s. Venous cannulation was performed with a 36/46 Fr (LivaNova, UK) venous return cannula. Upon evaluating the cannula's location at 70 degrees in the lower oesophagus and the patient’s right-sided rotated view by TOE, it was ascertained that the cannula was in the right hepatic vein (Fig. 1).

The cannula was withdrawn and reinserted, and TOE revealed that it was in the IVC. Following the implementation of four coronary artery bypass grafts, the patient was

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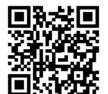

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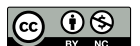

successfully weaned from cardiopulmonary bypass. The cross-clamp time, CPB time, and operation time were 77, 115, and 250 minutes, respectively.

The patient was then transferred to the intensive care unit (ICU). After 10 hours of mechanical ventilation and 19 hours in the ICU, the patient was transferred to the ward. There were no postoperative complications in the ICU. The patient was discharged from the hospital on the 10th postoperative day.

Case 2

A 74-year-old male patient (height: 171 cm; weight: 78 kg) with a Euroscore of 3 was scheduled to undergo coronary artery bypass graft surgery. Echocardiography revealed a left ventricular ejection fraction of 60%.

Standard monitoring, anaesthesia, and surgical procedures were performed on the patient. Initial cannulation was performed using a 22 Fr aortic cannula (DLP curved tip, Medtronic, USA) and a 36/46 Fr venous cannula (LivaNova, UK). Upon evaluating the location of the cannula at 70 degrees in the lower oesophagus and the patient's right-sided view using TOE, it was ascertained that the cannula was in the right hepatic vein (Fig. 2). After withdrawing and reinserting the cannula, TOE revealed that it was now in the inferior vena cava (Fig. 3). Following the implementation of five coronary artery bypass grafts, the patient was successfully weaned from cardiopulmonary bypass. The cross-clamp time, CPB time, and operation time were 60, 133, and 270 minutes, respectively.

The patient was transferred to the ICU. After 5 hours of mechanical ventilation and 21 hours in the ICU, the patient was transferred to the ward. There were no postoperative complications in the ICU. The patient was discharged from the hospital on the 7th day after surgery.

Discussion

In these cases, the focus is on the efficacy of TOE monitoring during cannulation in conventional cardiac surgery. TOE monitoring is recommended for all cardiac surgical procedures. This approach enables the precise location of the cannula to be determined. It is imperative to recognise any instances of mis-cannulation to prevent potential complications.

Hepatic venous mis-cannulation is an uncommon or underreported complication. Anomalous venous anatomy and different types of cannula have been identified as potential risk factors for mis-cannulation.[1] Tempe et al. reported that IVC mis-cannulation was observed in 35% of patients undergoing atrial septal defect closure surgery.[1]

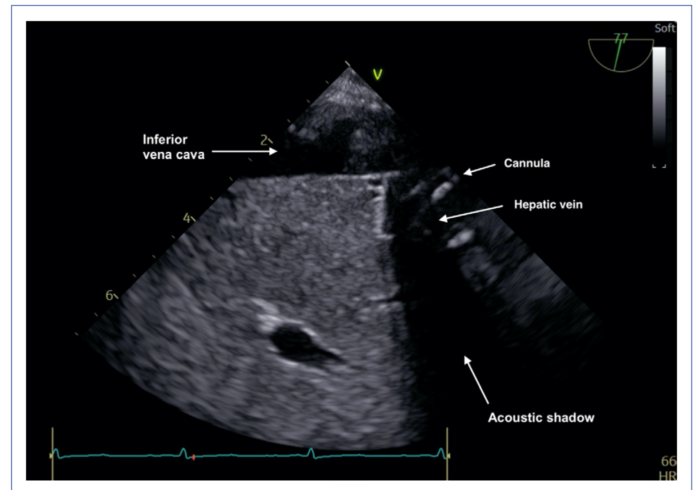

Figure 1. The inferior cannula is in the hepatic vein.

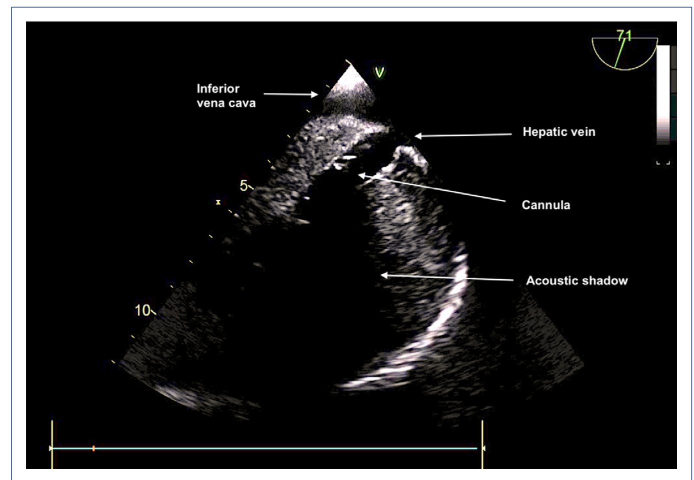

Figure 2. The inferior cannula is in the hepatic vein.

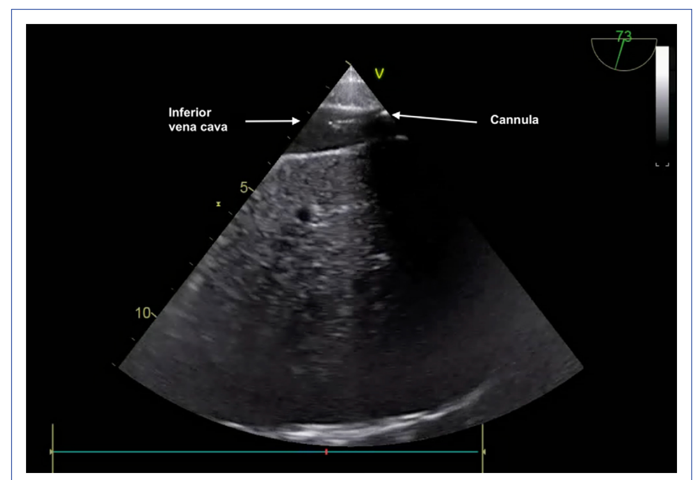

Figure 3. The inferior cannula is in the inferior vena cava.

The cannula was seen to be positioned higher in the right hepatic vein, which is larger than the other hepatic veins and has an oblique angle with the IVC.

The type of cannula is a potential risk factor for mis-cannulation. It has been suggested that straight cannulas are more likely to be malpositioned than angled cannulas.[1] However, Kirkeby-Garstad et al. reported that 9.5% of IVC cannulas were found to be placed outside the IVC, irrespective of cannula type and diameter.[2]

Cannulation of the hepatic vein has been demonstrated to result in impaired drainage from the lower body, which consequently leads to venous congestion and reduced venous return to the CPB circuit.[2] The occurrence of venous congestion can result in hepatic enlargement, elevated hepatic enzyme levels, and subsequent postoperative hepatic failure. Intraoperative or postoperative hepatic dysfunction has been demonstrated to have a detrimental effect on the coagulation process, resulting in bleeding, the need for transfusions, and increased mortality.

The surgical team can prevent mis-cannulation by standardising the cannulation procedure for all cardiac surgeries. TOE should be used routinely during cannulation to help visualise the venous cannula tip and detect abnormal flow patterns.

Conclusion

Hepatic venous mis-cannulation during cardiopulmonary bypass is a rare complication. TOE is the main method for preventing and diagnosing mis-cannulation early in conventional coronary artery bypass surgery.

Disclosures

Ethics Committee Approval: This is a single case report, and therefore ethics committee approval was not required in accordance with institutional policies.

Informed Consent: Written informed consent was obtained from the patient.

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