

Inadequate Venous Drainage-transesophageal Echocardiography as Rescue

Abstract

Malposition of venous cannula can cause inadequate venous drainage during cardiopulmonary bypass. It would be good clinical practice to use TEE to check the position of inferior venous cannula to avoid this problem at the earliest.

Keywords: *venous cannula, transesophageal echocardiography cardiopulmonary bypass*

A 55-year-old man was scheduled for mitral valve replacement surgery due to severe rheumatic mitral stenosis. Anesthesia was induced without any incident. After midline sternotomy, aortic and bicaval (superior vena cava [SVC] and inferior vena cava [IVC]) cannulation was performed to institute cardiopulmonary bypass. However, the inadequate venous return was observed during bypass. Venous air lock was checked and ruled out. Vacuum-assisted venous drainage was applied, but venous return could not be augmented. Transesophageal echocardiography (TEE) revealed inferior venous cannula placement in the right hepatic vein [Figure 1]. Venous return was adequate after the repositioning of the cannula.

Inadequate venous return to the cardiopulmonary bypass circuit may be caused by air in the venous return line, low blood volume, obstruction of the cannula, or inappropriate cannula placement.^[1] The right hepatic vein, middle hepatic vein, and left hepatic veins drains into IVC shortly before it enters the right atrium. The right hepatic vein is large vein which enters the IVC at an obtuse angle. Such anatomy sometimes favors inadvertent right hepatic vein cannulation. Cannulation of the hepatic vein is significantly associated with the short distance between the inlet of the right hepatic vein and the eustachian valve.^[2] However, the positioning of cannula in a hepatic vein does not depend on the cannula diameter.^[2] The Large

eustachian valve can also obstruct venous cannula inflow intermittently during direct insertion through a median sternotomy or during femoral cannulation.^[1] IVC with right hepatic vein is best visualized with transgastric echocardiographic view with probe turned to right side and angle of about 60°. Turning the probe to counterclockwise from above position with an angle of 50°–90° can show middle hepatic vein. Further, counterclockwise rotation of the probe with an angle of 80°–130° will display left hepatic vein. TEE is useful for guiding venous cannulation during cardiopulmonary bypass.

TEE can also guide proper positioning of guidewires and cannulae for peripheral cardiopulmonary bypass during minimally invasive cardiac surgery and robotic heart surgery. TEE transgastric view showing IVC and midesophageal bicaval view can help in proper placement of transfemoral venous guidewire and positioning of venous cannula from the IVC into the SVC. TEE-guided negotiation of femoral venous cannulation and guidewire passage can be helpful to avoid venous injury in the perihepatic region.

We suggest echocardiographic assessment followed by correction of the malposition should be performed before the application of vacuum-assisted venous drainage and attempted augmented drainage. Negative pressure application on the venous line in the presence of malpositioned cannulae may cause potential tissue damage from impaction/impingement. It would be a good clinical practice to use TEE to

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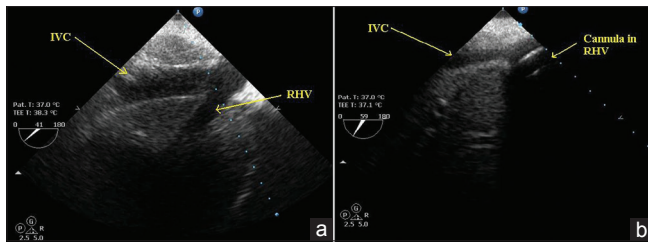


Figure 1: (a) Transesophageal echocardiographic image showing inferior vena cava and right hepatic vein before cannulation. (b) Malpositioning of the cannula in the right hepatic vein

check the position of inferior venous cannula to avoid this problem at the earliest.

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Conflicts of interest

There are no conflicts of interest.

References

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