Case Report

Perfusion

Successful repair of iatrogenic inferior vena cava injury during cardiac surgery

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Abstract

Iatrogenic injury to the supra-diaphragmatic inferior vena cava (IVC) is uncommon, but can lead to a potentially complicated situation. Injury to the IVC is encountered usually during re-operative and congenital surgery, but can occur during the course of routine cardiac surgery as well. Depending on the mechanism, injury may involve the anterior or posterior wall of the IVC. A short adherent IVC, redo surgery and female sex are incremental risk factors for injury. Control of bleeding, adequate exposure and prevention of extension of the tear are the important considerations at the time of repair. While a number of management techniques have been reported, we describe a very simple maneuver that allows swift control of bleeding, adequate exposure and minimizes the risk of further extension and a satisfactory repair.

Keywords

cardiac surgery; inferior vena cava injury

Introduction

Injury to the inferior vena cava (IVC) during cardiac surgery is uncommon. However, the presentation of significant injury to the IVC is quite dramatic and can be potentially life-threatening. We report our experience of three cases where there was iatrogenic laceration of the IVC and the subsequent development of a technique that might be useful in dealing with these injuries.

Case History

Of the three patients in our series who had iatrogenic injury to the IVC, two were off-pump coronary artery bypass grafts where the injury occurred at the completion of the procedure, just prior to chest closure. In both cases, the injury occurred with the tip of the suction cannula which was inserted along the diaphragmatic surface of the heart to check the lie of the posterior descending artery (PDA) graft and to drain any remaining collection prior to sternal wiring. The third case was re-operative congenital surgery where the injury was encountered during mobilization of the heart.

In one of the cases, digital compression of the IVC and repair of the tear was possible. Even though the outcome was satisfactory, this was associated with a fair degree of blood loss and a brief period of hypotension. However, in the other two cases, we immediately re-heparinized and inserted a metal-tip, curved, pacifico venous cannula in the rent of the IVC, as if cannulating the IVC as part of bicaval cannulation. (Figure 1) We then clamped the IVC cannula at the top. This maneuver significantly reduced the blood loss and allowed us time to take a 4-0 Prolene purse-string suture (Ethicon, Somerville, NJ) along the tear, which was hemostatic.

Discussion

While iatrogenic injury to the IVC has been reported during procedures such as IVC filter insertion, supra-diaphragmatic injury to the IVC is encountered usually during re-operative and congenital surgery.[1,2] Depending on the maneuver, injury to the IVC occurs

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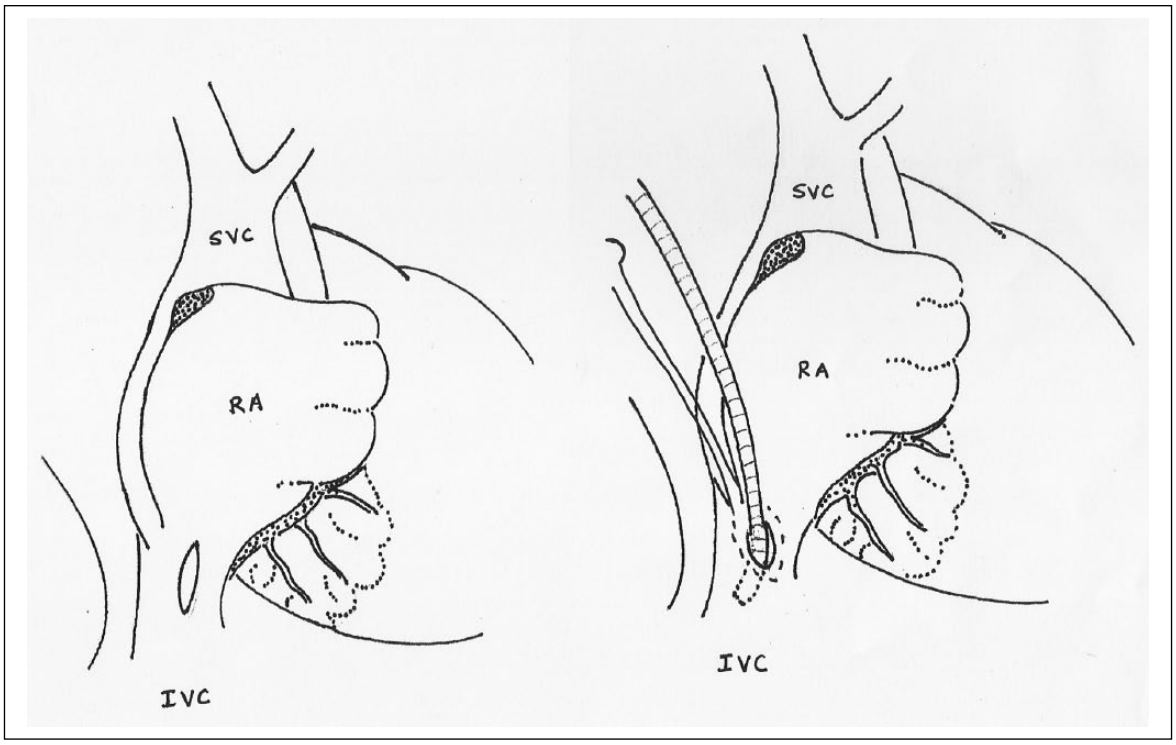

Figure 1. Figure showing a tear in the inferior vena cava. A curved IVC cannula is inserted in the tear and a purse-string suture taken around the tear.

either along the anterior or the posterior wall. Insertion of a snare around the IVC or passing a Cooley clamp to create the space behind the IVC usually leads to injury to the posterior wall of the IVC.[1] Injury to the anterior wall, as seen in our case, is usually due to a short adherent IVC which is further stretched by lifting the inferior border of the heart, either during mobilization of heart or during inspection of the PDA graft. This maneuver further stresses the IVC and converts it into a non-pliable structure, the anterior wall of which then gives way when subjected to minimal trauma from a blunt object, like a suction device. A small left atrium, rheumatic heart disease, re-operative surgery, female sex and prolonged ischemic time have all been described as incremental risk factors for this complication.[1]

The management strategy of intra-operative injuries is different to the management of IVC injuries in the trauma setting. In the trauma setting, total vascular isolation and occlusion[3] and circulatory arrest,[4] along with operative techniques like atriocaval shunt and diaphragmatic and pericardial flap repair may be required and is associated with a high mortality.[1]

In the iatrogenic intra-operative IVC injury setting the aim is to achieve a swift repair, prevent extension of the tear at all cost and have no additional morbidity or mortality to the original procedure. While the primary repair of a small tear under digital control or using either a side-biting clamp or two separate clamps is possible, the main issues are excessive blood loss, inadvertent extension of the tear into the juxta-diaphragmatic or retro hepatic IVC and excessive narrowing of the IVC. A minimum preservation of 25% of the IVC lumen is a must in the supra-diaphragmatic IVC.[5]

To achieve a controlled repair, we need a relatively bloodless field and the means to establish cardiopulmonary bypass (CPB), if required. While CPB can be established by superior vena cava (SVC) cannulation or even cardiotomy suction bypass, both these objectives can be readily met by the insertion of a curved IVC cannula through the tear, which is held in position manually and clamped. This simple technique prevents excessive blood loss, allows good vision of the operative field and minimizes the risk of further extension of the tear by attempting to repair the tear in less than perfect conditions and provides a route for establishing CPB, if needed. In certain situations, with the IVC cannula in place, it may not even be necessary to establish cardiopulmonary bypass to achieve a satisfactory repair.

While novel techniques using an intravascular tube graft to repair the lacerated IVC has been described,[1] it requires greater expertise. Management of iatrogenic non-extensive IVC injuries using our technique is a simple, effective and highly reproducible technique.

Declaration of Conflicting Interest

The authors declare that there is no conflict of interest.

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References

1. Güney MR, Aksoy N, Sezerman O. Repair of lacerated inferior vena cava with the intravascular tube graft in redo cardiac surgery. *J Thorac Cardiovasc Surg* 2001; 121: 187–188.
2. Demirtas M, Aykut S, DaĞgsali S. Repair of the supradiaphragmatic inferior vena cava lacerated during redo open-heart surgery. *Cardiovasc Surg* 1995; 3: 345–347.
3. Khaneja SC, Pizzi WF, Barie PS, Ahmed N. Management of penetrating juxtahepatic inferior vena cava injuries under total vascular occlusion. *J Am Coll Surg* 1997; 184: 469–474.
4. Kaoutzanis C, Evangelakis E, Kokkinos C, Kaoutzanis G. Successful repair of injured hepatic veins and inferior vena cava following blunt traumatic injury, by using cardiopulmonary bypass and hypothermic circulatory arrest. *Interact Cardiovasc Thorac Surg* 2011; 12: 84–86.
5. Buckman RF, Pathak AS, Badellino MM, Bradley KM. Injuries of the inferior vena cava. *Surg Clin North Am* 2001; 81: 1431–1447.

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