Traumatic Suprahepatic Inferior Vena Cava Injury: Surgical Management

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Summary: Suprahepatic inferior vena caval (IVC) injuries are rare but carry nearly a 100% mortality rate. The main problem with its surgical management is the technical difficulty in draining the IVC during cardiopulmonary bypass. In this report, an efficient method of IVC drainage for repair of the IVC on cardiopulmonary bypass is described.

Key Words: Inferior vena cava, IVC tear, Endotracheal tube, Suprahepatic IVC, IVC drainage.

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Inferior vena caval (IVC) injuries due to trauma carry high morbidity and mortality rates. Operative management is associated with technical difficulties of repair, high perioperative mortality and morbidity rates, and long-term complications, including IVC stenosis.[1] Hence, some surgeons prefer conservative treatment in hemodynamically stable patients.

Injuries of suprahepatic (intrapericardial) IVC are rare, but the most dreaded. They are associated with cardiac tamponade and hence timely intervention is necessary to arrest hemorrhage. Though stent grafts have been used to repair the IVC,[2] surgical repair is the conventional mode of management of these injuries.

Many times, femorofemoral cardiopulmonary bypass (CPB), deep hypothermia, and circulatory arrest are necessary for successful management of these IVC tears.[3] This case report highlights an alternative method of repair on CPB, using a cuffed endotracheal tube for repair of intrapericardial IVC tears.

CASE REPORT

A 50-year-old man was brought to the emergency room in cardiogenic shock, after a steering wheel injury to the chest 2 hours previously. He was previously seen in a peripheral hospital and was detected to have mediastinal widening on chest radiography. He was receiving 10 μg/kg per minute of dopamine infusion. He was restless and disoriented. An echocardiogram showed pericardial tamponade. There was no evidence of other organ injuries. He was taken for emergency surgery. Under general anesthesia, a median sternotomy was done and tense pericardial tamponade was relieved. About 1.5 L of blood was suctioned out, and a tear in the IVC-right atrial (RA) junction was identified. The tear was occluded with digital pressure. The patient was put on CPB with aortic and superior vena caval cannulas. Cooling was started. In the meantime, a No. 8 cuffed endotracheal tube was inserted into the IVC through a pursestring suture in the low right atrium and the cuff was inflated with 15 mL saline. The cuff was placed just below the diaphragm. This was connected to the venous cannula establishing IVC drainage. The field became reasonably clear and the edges of the tear were clearly visible. It was located on the medial aspect of IVC at the IVC-RA junction, involving almost half the circumference of IVC. The edges could be approximated well, without stenosis of the IVC, using pledgetted 4-0 polypropylene interrupted sutures. The patient was cooled only to 32°C and the heart was not arrested. After control of bleeding, the patient was rewarmed and weaned off bypass with 5 μg/kg per minute of dopamine. He was extubated after 12 hours. He made an uneventful recovery and was discharged home on 7th postoperative day (Figure 1 and Figure 2).

At the 1-month follow-up, he had no features of IVC thrombosis, and echocardiography showed no IVC stenosis.

DISCUSSION

Inferior vena caval injuries have always carried a high mortality rate. Blunt injuries carry higher mortality rates, as do injuries closer to the heart. In a study by Rosengart et al.,[4] suprahepatic IVC injuries carried a 100% mortality rate. The other factors that adversely affect outcome include presentation in shock, associated other organ injuries, high preoperative lactate levels, and lower Glasgow coma score on presentation. Survival is affected by severity and anatomic accessibility of the IVC injury and by the absence of associated major vascular injuries.

Although stent grafts have been used to repair IVC tears, their use in suprahepatic IVC tears is not reported.

Traumatic pericardial collection is a surgical emergency. Hemodynamic deterioration disproportionate to the estimated blood loss should arouse the suspicion of cardiac

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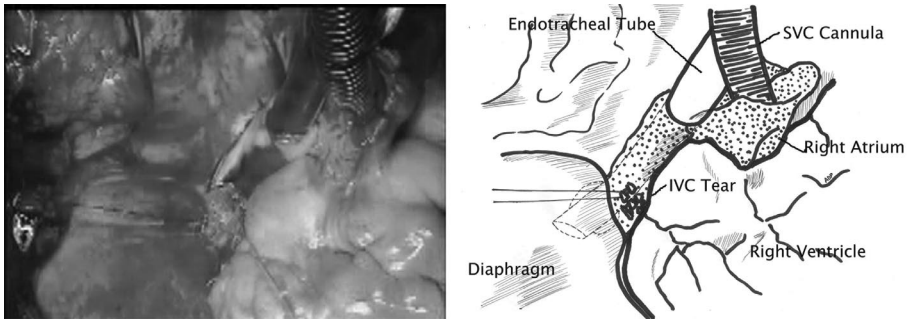

FIGURE 1. Operative photograph shows endotracheal tube draining IVC, over which the IVC is repaired.

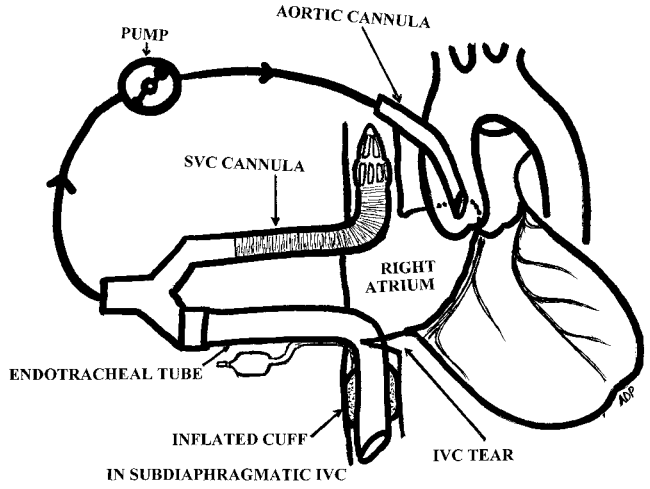

FIGURE 2. Line diagram depicts the CPB circuitry and position of the endotracheal tube in the IVC.

tamponade. Pericardiocentesis may be life-saving but should immediately be followed by surgery to arrest hemorrhage.

Median sternotomy is the preferred approach for traumatic cardiac injuries. In a hemodynamically stable patient, femorofemoral bypass may be instituted if major cardiac injuries are detected before sternotomy. In a patient in shock, sternotomy and pericardiotomy relieve the tamponade and should be done immediately.

Traumatic suprahepatic IVC tears have been conventionally treated with CPB, deep hypothermia, and circulatory arrest. Though life-saving, the patient is exposed to deep hypothermia, complicated by bleeding diathesis (especially worse in a polytrauma patient), and to the deleterious central nervous system effects of circulatory arrest.

Establishing drainage of IVC without having to loop and snare the suprahepatic IVC is crucial in repair of the suprahepatic IVC. A cuffed endotracheal tube achieves both of these with ease. The superior vena cava must be drained by a separate cannula. Tears of the suprahepatic IVC may be repaired conveniently by using this technique. Either a patch repair (pericardium or PTFE patch) or primary repair[5] may be carried out, depending on whether there is tissue loss or not.

Advantages of this technique include avoidance of cooling (or mild hypothermia at the most), avoidance of cardioplegia, and reduction of CPB time, all advantageous in a polytrauma patient.

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