

## MANAGEMENT OF PENETRATING SUPERIOR CAVAL VEIN INJURY

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### SUMMARY

Penetrating injuries to the superior caval vein (SCV) are rare but are very serious. They can be associated with hemodynamic instability and often produce a substantial technical challenge to the surgeons. We report a case of 32-year old man who was admitted to our hospital having sustained multiple stab wounds over the right chest wall and extremities. Many victims of penetrating thoracic trauma with SCV injury are in profound shock, whereas our patient on arrival in the emergency department had a stable condition, so the diagnosis was delayed. We consider that associated mediastinal pleural adhesions confined the bleeding into the mediastinum which prevented prompt massive bleeding. Therefore he tolerated a preoperative delay of six hours. Caval injury should be kept in mind in the differential diagnosis of hemothorax.

**KEY WORDS:** Superior Caval Vein Injury.

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### INTRODUCTION

Penetrating injuries to the superior caval vein (SCV) are rare but very serious. They can be associated with hemodynamic instability and hemothorax.<sup>1</sup> Most victims die of exsanguinations, because control and repair of profuse bleeding from the thin-walled vena cava poses an arduous technical challenge to the cardiothoracic surgeon.<sup>2</sup>

Our patient with SCV injury developed a delayed right hemothorax after six hours of admission. He was successfully operated and recovery was uneventful. To the best of our knowledge, this is the first report of such a case.

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### CASE REPORT

This 32-year old man was brought to the emergency department of our hospital having sustained multiple stab wounds over the anterior aspect of the right chest wall and extremities. On admission his blood pressure was 90/60 mmHg, with a pulse of 80 beats per minute and respiratory rate of 18 per minute. He was hemodynamically stable. His breath sounds were equal bilaterally, without rhonchi or rales. The heart sounds were regular, and, there were no murmurs, rubs, or gallops. Chest radiograph taken on admission did not show any marked abnormality (Fig-1). The emergency routine laboratory investigations were normal.

Six hours after the admission, the patient became acutely hypotensive with associated tachycardia and tachypnea. A repeated chest radiograph revealed massive hemothorax (Fig-2). A right tube thoracostomy was performed. Approximately 1800 ml of blood was evacuated. The tube was occluded with a clamp and he was immediately taken to the operating



Fig-1: Chest radiograph showing clear lung fields and no evidence of hemothorax.

room and intubated. A right anterolateral thoracotomy was performed through the fifth intercostal space and a large amount of clot was evacuated. We discovered that right lung was adhesive to the mediastinum and diaphragm. The lung was separated from these adhesions by blunt and sharp dissection. After pulling back the lung, we found a large compressive hematoma infiltrating the mediastinum. When this hematoma was removed, a massive caval bleeding was discovered. Digital control was established. The pericardium was opened due to a pericardial laceration. However, myocardium was intact. Two longitudinal tears were identified at the anterior and posterior walls of the SCV (approximately 1.5 cm in lengths). The tip of central jugular venous line was found to be situated in the mediastinum through caval rupture. It was removed by anesthetist.

After giving 5.000 units of heparin intravenously, two vascular clamps were placed on the SCV to prevent bleeding. The anterior and posterior wounds were repaired with running 5.0 polypropylene sutures. At the end of the vascular repair, there was a slight stenosis of the SCV. In addition two deep pulmonary lacerations (3cm & 2cm in length) were found. They were repaired with 3.0 Vicryl sutures. The incision of the thoracotomy was closed in the standard manner. The patient was transferred to the cardiac intensive care unit and extubated six hours after operation. He had slight facial swelling and it resolved in a few days.



Figure-2: Chest radiograph showing right-sided massive hemothorax.

He was treated empirically with intravenous sephazoline sodium for five days due to contaminated nature of the injury. On the eleventh postoperative day, he was transferred to the department of orthopedics and tendinous injuries were repaired. He continues to do well 18 months after surgery.

## DISCUSSION

SCV injuries are usually not easily repaired: massive bleeding from the thin walled vena cava is not easily controlled and the application of vascular clamps to be a bleeding site can often aggravate the injury.<sup>2,3</sup> However, clamping of injured SCV is imperative & fundamental to gain prompt control of bleeding sites, but caval vein injuries often produce a substantial technical challenge to the cardiothoracic surgeons. Therefore, care should be exercised to avoid clamp-induced injuries to the thin walled cava.<sup>4</sup>

Operative exploration is usually required urgently. The approach is usually dictated by the clinical presentation. A massive hemothorax mandates a right thoracotomy,<sup>5</sup> as was done in this case. Ligation of the SCV is not the best management option, because it usually results

in severe cerebral and upper limb edema.<sup>5</sup> Additionally, acute diminution in cardiac output due to diminished venous return to the right atrium may not be tolerated in severely injured victims.<sup>3</sup> However successful ligation of the juxta-atrial portion of the SCV has been reported.<sup>6</sup> Superior intercostals veins, azygos & hemiazygos veins may have constituted alternative pathways to the heart.<sup>3</sup> If few or no collateral veins provide significant drainage of the upper body, prolonged intraoperative clamping of the SCV can result in potentially fatal cerebral edema or postoperative neurologic deficits.<sup>7</sup>

The majority of caval injuries can be repaired without the need of cardiopulmonary bypass (CPB), as was done in our case. However, median sternotomy and CPB may be required for injuries close to the heart where distal control is not tolerated and can be helpful in decompressing the venous system and allowing improved exposure.<sup>5</sup>

Many victims of penetrating trauma with SCV injury are in profound shock, whereas our patient on arrival in the emergency department had a stable condition. We consider that associated mediastinal pleural adhesions confined the bleeding into the mediastinum and prevented prompt massive bleeding. Therefore he tolerated a preoperative delay of six hours.

Although control of caval injury may be difficult, careful surgical technique and application of basic trauma and cardiovascular principles can salvage this injury.<sup>4</sup> If possible caval injuries should be repaired with lateral venorrhaphy. Narrowing of the cava during lateral venorrhaphy has been of some concern to some surgeons, but this was not a problem in one patient whose caval diameter was decreased to 20% of normal and remained patent.<sup>2</sup> Additionally, various materials (gortex, pericardium, saphenous vein) may be used as a patch graft to prevent luminal narrowing.

Gortex graft may be superior to other synthetic grafts for caval vein replacement by reason of good pseudointimal formation and minimal tissue reaction around the grafts.<sup>8</sup> However, there are some risks associated with using a PTFE graft for SCV reconstruction, including the need for postoperative anticoagulation, risk of

infection and thrombosis.<sup>9</sup> Therefore, we have avoided synthetic grafts for caval or other venous reconstruction, if possible. Another alternative that is appealing is the use of stent graft. However, placing a longer length stent graft to the injured SCV could potentially lead to thrombosis of the upper extremity veins.<sup>1</sup>

## CONCLUSION

Penetrating injury of the superior caval vein is a thoracic vascular emergency that should be treated immediately to prevent death. However, the possible undiagnosed pulmonary infection causing pleural adhesions may have saved our patient by playing an important role to prevent massive bleeding of the SVC wounds, by means of a global compression. Similarly occurrence of extensive thoracic wall adhesions and initial hemopneumothorax may also be prevented. Eventually, these adhesions were released due to continued bleeding, as seen in this case. Therefore, caval injury should be kept in mind in the differential diagnosis of hemothorax and surgical intervention should be performed promptly. Also, our familiarity with traumatic cardiothoracic procedures may have also been a factor in the success of this procedure.

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