Importance of Surgical Exploration in the Diagnosis of the Penetrating Superior Vena Cava Injury in Case of Soft Clot Formation and Unusual Injury Site: Case Report

Defekti Pıhtıyla Tıkalı ve Olağandışı Giriş Yeri Olan Penetran Superior Vena Kava Yaralanmasının Teşhisinde Cerrahi Eksplorasyonun Önemi

Aşkın Ender TOPAL, MD[a]
Orçun ÜNAL, MD,[b]
Ahmet AKGÜL, MD[b]

[a]Department of Cardiovascular Surgery, Dicle University Faculty of Medicine, Diyarbakır
[b]Department of Cardiovascular Surgery, Bakırköy Dr. Sadi Konuk Training and Research Hospital, İstanbul

Geliş Tarihi/*Received:* 08.10.2009
Kabul Tarihi/*Accepted:* 14.12.2009

Yazışma Adresi/*Correspondence:*
Aşkın Ender TOPAL, MD
Dicle University Faculty of Medicine, Department of Cardiovascular Surgery, Diyarbakır, TÜRKİYE/TURKEY
aendertopal61@hotmail.com

ABSTRACT Penetrating injuries to the intrapericardial superior vena cava pose a significant risk because of the likelihood of either heaviy hemorrhage or pericardial tamponade. A penetrating injury of superior vena cava with unusual injury site (right hypochondrium) is presented whose diagnosis was complicated because of soft clot formation which prevented collection of huge amount of pericardial blood. It was repaired by lateral venorrhaphy with sutures close to the edges to avoid narrowing of the lumen without using vascular clamp and cardiopulmonary bypass. This case showed that ceasing of the hemorrhage does not mean the absence of major vascular injury. Therefore definite diagnosis must be provided by either using endoscopic instruments or surgical exploration.

Key Words: Vena cava, superior; wounds, penetrating; blood coagulation

ÖZET İntraperikardiyal süperior vena kavanın penetran yaralanması, gerek şiddetli kanama gerekse de perikardiyal tamponada yol açma ihtimali nedeniyle ciddi bir risk oluşturur. Sunduğumuz bu olguda, sağ hipokondrium gibi olağandışı bir giriş yeri olan penetran süperior vena kava yaralanması mevcuttu. Gelişen yumuşak pıhtı, vena kavadaki yaralanma ağzını tıkayarak perikard içinde fazla kan birikmesini engellemiş ve bu da tanıyı zorlaştırmıştı. Kardiyopulmoner bypassa geçmeden ve vasküler klemp kullanmadan, yaralanma ağızlarına yakın sütürler koyarak lümende daralmaya sebep olmadan, lateral venorafi ile onarım yapıldı. Bu vaka gösterdi ki, kanamanın durması ana vasküler yapılarda yaralanmanın olmadığı anlamına gelmemektedir. O halde endoskopik yolla veya cerrahi eksplorasyonla kesin teşhis mutlaka ortaya konulmalıdır.

Anahtar Kelimeler: Vena kava, süperior; yaralar, delici; kan pıhtılaşması

Turkiye Klinikleri J Cardiovasc Sci 2011;23(2):150-3

Injury to the great vessels of the thorax occurs generally following penetrating trauma.[1] Vena cava injuries are rare and most of the cases are related to abdominal inferior vena cava.[2] Injuries to the intrapericardial superior vena cava (SVC) pose a significant risk because of the likelihood of either significant hemorrhage or pericardial tamponade, both of which are lethal if not rapidly treated.[3]

This seems to be the first reported case of an intrapericardial SVC injury in a 8-year-old girl who suffered a penetrating trauma to right hypochondrium.

CASE REPORT

A 8-year-old female was brought to the emergency department (ED) in 120 minutes following a fall from height onto a constructive iron. Injury site was right hypochondrium near its junction with lomber region and close to the anterior axillary line (Figure 1). Her initial Glasgow Coma Scale was 7 with a heart rate of 132 beats per minute, and a systolic blood pressure of 70 mm Hg. There was not jugular venous distention. Her hypotension responded appropriately to 500 mL of crystalloid and one unit of packed red blood cells.

She had no breath sounds on the right hemithorax and at the bottom of the left hemithorax. Initial radiographs revealed a right hemothorax for which a tube thoracostomy was performed. Subsequent chest computed tomography was remarkable for bilateral segmental atelectasis and right hemothorax with pericardial blood (Figure 2). Abdominal computed tomography (CT) also demonstrated diffuse free pelvic fluid with 4.5 x 7 cm hepatic laceration.

The patient was brought to the operating room where a median sternotomy was performed in 90 minutes after his initial presentation. The pericardium was fully opened and blood clot was evacuated. A 2 cm tear in the right posterolateral pericardium was identified. There was no ventricular injury noted. The SVC laceration was 7-8 mm in length and involved the anterolateral wall of the intrapericardial SVC, 5 mm away from its junction with right atrium (Figure 3). After removing the blood clot on the laceration, significant hemorrhage began. It was immediately controlled by digital pressure, then the injury was primarily repaired using interrupted pledgeted 5.0 non-absorbable monofilament sutures without cardiopulmonary bypass. The patient remained in sinus rhythm despite the close proximity of the sinoatrial node. After adequate hemostasis, one pericardial tube was placed and pericard was closed. Pediatric surgeons preferred frequent follow-up instead of laparoscopy.

She sustained pulmonary problems due to atelectasis during post-operative course. Atelectasis was treated via pharmacological agents, postural drainage and intermittent continuous positive airway pressure. There was no free pelvic fluid in the control CT performed on the ninth day. She ulti-

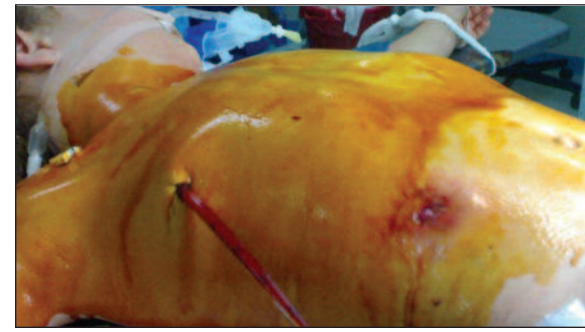

FIGURE 1: Injury site due to the constructive iron in the right hypochondrium near its junction with lomber region and close to the anterior axillary line.

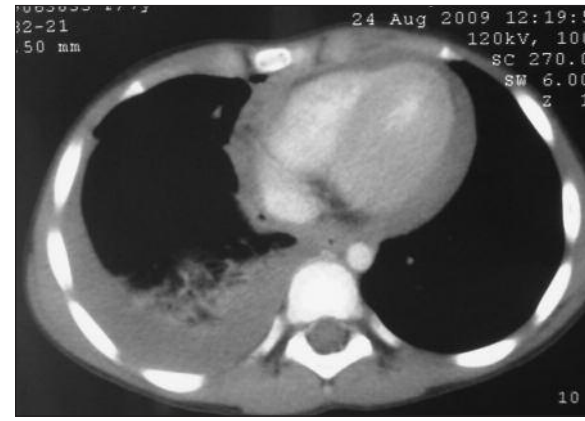

FIGURE 2: Chest computed tomography demonstrating pericardial blood.

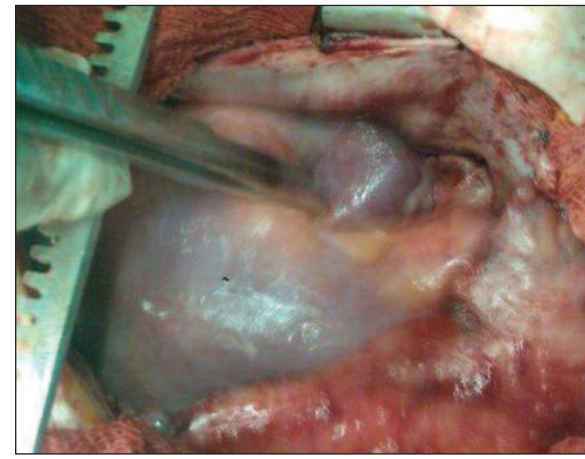

FIGURE 3: SVC laceration of 7-8 mm in length, 5 mm away from its junction with right atrium.

mately experienced full recovery and was discharged to home on post-operative day number 10.

DISCUSSION

Superior vena cava injury is an extremely rare case probably due to its shortness, although the inferior vena cava (IVC) is the most commonly injured intra-abdominal vascular structure from both penetrating and blunt trauma.[4] In a series regarding vena cava injuries, only four of 64 wounds involved SVC.[2] Furthermore intrapericardial SVC injury is usually fatal because of either significant hemorrhage or pericardial tamponade.[3] Associated injuries including heart and/or other major vascular structures are also major contributors to mortality and for morbidity.

The approach to manage patients with a SVC injury is similar to that of other major vascular injury namely rapid transport to an appropriate hospital and surgical control of bleeding without delay.[3] A median sternotomy is the incision of choice and gives access to other mediastinal structures that may have been injured. An isolated SVC injury can be repaired without cardiopulmonary bypass. The vast majority of traumatic SVC injuries can be managed by direct compression or local clamping with primary venorrhaphy. As for the anterior injuries, a side-biting Satinsky clamp can control the injury site and permit continued venous return as well, however, clamp-induced injuries to the thin walled cava may create an additional problem.[5] Also most vena cava injuries can be repaired by lateral venorrhaphy, provided that the diameter of vena cava is not narrowed to less than 50%.[6,7] Direct repair is the simplest and therefore most preferred method with a low thrombosis and embolic complication rate even if the lumen is moderately narrowed.[4,8,9] However, in selected cases autogenous (saphenous vein, peritoneo-fascial patch) or synthetic grafts may be considered.[10] Convenient to the previous reports, hemorrhage was controlled by digital pressure without using clamp and SVC was repaired by lateral venorrhaphy with sutures close to the edges to avoid narrowing of the lumen.

Interesting point of this case to keep in mind was unusual injury site for SVC involvement. Diagnosis of SVC injury is crucial. In 59% of cases, chest roentgenogram shows widening of the mediastinum.[11] Although nonspecific, it can alert the surgeon to the possibility of significant cardiovascular injury. FAST examination (focused assessment with sonography in trauma) is a useful and rapid diagnostic modality, especially for the unstable patients to whom CT or angiography are not applicable. In this case at first, ultrasonographic examination was performed to diagnose the intra-abdominal and/or intra-thoracic organ injuries. Because injury site was lateral portion of right hypochondrium, in other words distant to the mediastinum, and there was no widening of the cardiac shadow on the chest roentgenogram. CT, undertaken after stabilization of patient's hemodynamic status, demonstrated intrapericardial fluid. Thus a question of intrapericardial structure injury evolved. Intrapercardial fluid was not so much and it might be due to transfer of pleural fluid to pericardial cavity through the pericardial tear. However absence of serious intra-abdominal organ injury and ceasing of drainage from thoracic tube did not clarify the worse hemodynamic status of the patient at admission to hospital. A small laceration accompanied by hypotension might allow soft clot formation at the injured site of the intrapericardial vascular structure or heart, which stopped hemorrhage.[11,12] This probability prompted us to take the patient to the operating room.

At first, severe hemorrhage from the injured SVC caused hypotension which plays an essential role in the soft clot formation. As large amount of intrapericardial blood passed to peural cavity through the wide tear in the pericardium and pleura, pericardial fluid was not so much. However, if SVC injury was not repaired immediately, even a light chest trauma or excessive rise in blood pressure might cause soft clot dislodgement and also loss of patient due to abundant hemorrhage.

According to an approach, if pericardial fluid does not accumulate after pericardiocentesis, there is no need for any further intervention. However, sometimes as in this case, ceasing of the hemorrhage does not show lightness of the injury. It is

obvious that pericardiocentesis must be performed only to decompress pericardial tamponade. Also pericardial tube drainage is not a trustworthy modality because of the same reasons. This case points out the necessity of proper investigation of all intrapericardial structures. For this purpose, endoscopic instruments may be favorable, because present diagnostic tools such as echocardiography, CT and angiography are incapable of diagnosing the extravasation from the injured structure if clotted. In the case of technical deficiency of endoscopy, to perform operation is the most correct attitude for the patient's life since delayed or missed diagnosis and treatment are far more harmful than a negative surgical exploration.

As a conclusion, penetrating injury of intrapericardial structures may be possible with a distant entry, ceasing of the hemorrhage does not exclude serious injury, thus definite diagnosis must be provided by either using endoscopic instruments or surgical exploration even in the case of a small amount of pericardial blood.

REFERENCES

1. Brinkman WT, Szeto WY, Bavaria JE. Overview of great vessel trauma. Thorac Surg Clin 2007;17(1):95-108.
2. Quast DC, Shirkey AL, Fitzgerald JB, Beall AC Jr, Debakey ME. surgical correction of injuries of the vena cava: an analysis of sixty-one cases. J Trauma 1965;5:3-10.
3. Bakaeen FG, Wall MJ Jr, Mattox KL. Successful repair of an avulsion of the superior vena cava from the right atrium inflicted by blunt trauma. J Trauma 2005;59(6):1486-8.
4. Carr JA, Kralovich KA, Patton JH, Horst HM. Primary venorrhaphy for traumatic inferior vena cava injuries. Am Surgeon 2001;67 (3): 207-14.
5. Aydin U, Yazici P, Zeytunlu M, Kilic M. Management of hemorrhage of retro hepatic inferior vena cava injury during piggy-back technique for liver transplantation. Indian J Surg 2008;70(1):19-24.
6. State DL, Bongard FS. Abdominal venous injuries. In: Bongard FS, Wilson SE, Perry MO, eds. Vascular Injuries in Surgical Practice. 1st ed. Norwalk, Conn: Appleton & Lange; 1991. p.185.
7. Özbek C, Yetkin U, Göktoğan T, Yaşa H, İlhan G, Bayrak S, et al. Experience with infrarenal vena cava injuries. Intern J Thorac Cardiovasc Surg 2007;11(1):3.
8. Burch JM, Feliciano DV, Mattox KL, Edelman M. Injuries of the inferior vena cava. Am J Surg 1988;156(6):548-52.
9. Porter JM, Ivatury RR, Islam SZ, Vinzons A, Stahl WM. Inferior vena cava injuries: noninvasive follow-up of venorrhaphy. J Trauma 1997;42(5):913-7.
10. Emmiler M, Kocogulları CU, Yilmaz S, Cekirdekci A. Repair of the inferior vena cava with autogenous peritoneo-fascial patch graft following abdominal trauma: a case report. Vasc Endovasc Surg 2008;42(3): 272-5.
11. Chaer RA, Doherty JC, Merlotti G, Salzman SL, Fishman D. A case of blunt injury to the superior vena cava and right atrial appendage: mechanisms of injury and review of the literature. Injury Extra 2005;36(8):341-5.
12. Huerta S, Dolich MO, Cohen AJ. Blunt trauma to the intrapericardial inferior vena cava: a case report and review of the literature. Injury Extra 2005;36(8):337-40.