

Case report of fatal complication of superior vena cava tear from balloon dilatation of iatrogenic superior vena cava narrowing

Nivash Chandrasekaran, Ashwini Thimmarayappa, A. M. Jagadeesh

Department of Cardiac Anesthesiology, Sri Jayadeva Institute of Cardiovascular Sciences and Research, Bengaluru, Karnataka, India

ABSTRACT

The treatment options for superior vena cava (SVC) obstruction depends on the cause and severity of SVC narrowing. It ranges from conservative medical management to more elaborate endovascular and surgical repair of obstruction. There has always been a concern regarding the possibility of rupture of SVC during balloon dilatation, if the obstruction is secondary to the surgical cause. Very few cases are reported in the literature. We report a case of fatal complication of SVC tear in a 2-month-old child who had iatrogenic SVC narrowing.

Received: 02-01-15
Accepted: 24-07-15

Key words: Endovascular stenting; Superior vena cava syndrome; Superior vena cava tear

INTRODUCTION

Superior vena cava (SVC) syndrome is characterized by swelling of face, head, neck, upper extremity, engorgement of mucus membrane, upper airway, and laryngeal oedema caused by partial or total obstruction of SVC. Causal factors have been related to surgical injury, thrombosis, tumours, infection, chronic indwelling catheters, and devices. Reports of SVC obstruction in paediatric age group secondary to cardiovascular surgery are rare. Yet, the number of patients at risk for SVC obstruction is increasing due to increased frequencies in procedures such as Fontan, Glenn, Mustard, Senning, and those involving central venous cannulation for cardiopulmonary bypass, transvenous pacing, and dialysis.^[1-4] Relief of SVC obstruction through various less invasive means like the endovascular approach has been widely practiced.

Procedure related injury to SVC can rapidly cause life threatening haemorrhage and hemodynamic deterioration. Review of literature shows only very few reports of iatrogenic SVC tear. Here, we describe a case

of SVC tear while attempting balloon dilatation in a postoperative patient of the arterial switch.

CASE REPORT

A 2-month-old child with dextro transposition of great arteries was posted for the arterial switch. Intraoperative period was otherwise uneventful except for the difficulty during SVC cannulation which caused a rent in SVC. Extra sutures were required to repair the rent. However, there was no significant change in central venous pressure in the post bypass period. The patient was electively ventilated in

Address for correspondence: Dr. Nivash Chandrasekaran, A-401, Rose Garden Apartments, Bannerghatta Road, Bengaluru - 560 076, Karnataka, India.
E-mail: nivash_c@yahoo.co.in

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Cite this article as: Chandrasekaran N, Thimmarayappa A, Jagadeesh AM. Case report of fatal complication of superior vena cava tear from balloon dilatation of iatrogenic superior vena cava narrowing. *Ann Card Anaesth* 2015;18:589-92.

<p>Access this article online</p> <p>Website: www.annals.in</p>
<p>DOI: 10.4103/0971-9784.166478</p>
<p>Quick Response Code:</p> 

the postoperative period. On the 3rd postoperative day, the patient developed swelling of the face, head, neck, and upper limbs. A two-dimensional transthoracic echo showed bi-ventricular dysfunction with a gradient of 10 mmHg across SVC and dilatation of proximal left innominate vein. A decision to further evaluate the SVC obstruction by contrast venography was made, and the patient was shifted to the cath lab. Contrast venography revealed narrowing at the level of the innominate-SVC junction [Figure 1]. Based on the imaging, balloon dilatation and stenting to relieve SVC obstruction was planned. A 8 mm balloon mounted stent was placed across the narrowing through right internal jugular vein and inflated up to 2 atm. Immediately after the deflation of the balloon there was a sudden deterioration of hemodynamic parameters with precipitous fall in the heart rate and blood pressure. The patient went into cardiogenic shock, requiring epicardial pacing, and cardiopulmonary resuscitation. Subsequent contrast venogram revealed tear of SVC at the site of narrowing and leakage of dye into the right pleural cavity [Figure 2]. Right thoracostomy tube was inserted, and about 200 ml of frank blood was drained. The patient was successfully resuscitated with inotropes and blood transfusion. A 6 mm covered stent was intercalated within the existing stent. The check contrast venogram revealed no further extravasation of the dye through the tear. However, the venous drainage from left innominate was compromised. The patient was shifted to the recovery room with inotropic support, where there was progressive worsening of the upper extremity, facial, and airway

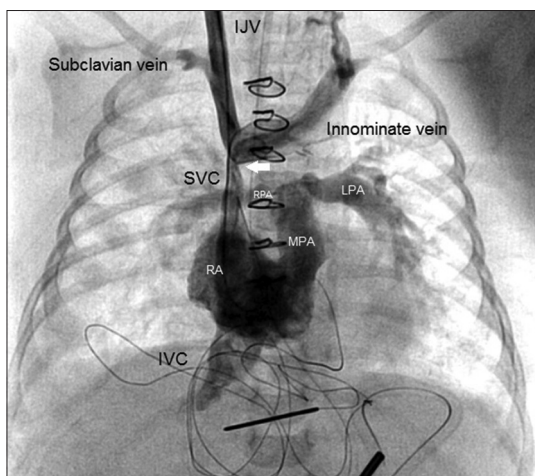


Figure 1: Venogram of post arterial switch repair patient demonstrating narrowing at superior vena cava innominate junction. IJV – Internal jugular vein, SVC – Superior vena cava, IVC – Inferior vena cava, MPA – Main pulmonary artery, RPA – Right pulmonary artery, LPA – Left pulmonary artery, RA – Right atrium. Arrow head shows narrowing at superior vena cava – innominate junction

oedema. Postoperative ventilation was complicated by increased airway pressure due to pulmonary oedema, congestion of airways and increased secretions which lead to impaired oxygenation requiring frequent endotracheal suctioning. The patient succumbed on the 9th postoperative day due to superimposed biventricular failure.

DISCUSSION

Review of literature has shown that there are various treatment modalities for SVC obstruction. It ranges from conservative medical management to more elaborate endovascular and surgical repair. Each of these has merits and demerits depending on the causal factors of the SVC obstruction. Although there is literature regarding endovascular therapy for SVC syndrome, they are limited to case reports and small series. To the authors' knowledge, 16 cases of SVC injury related to endovascular procedures for SVC syndrome have been reported.^[5-18]

Conservative medical management is possible in an appropriately selected patient, provided the patient is hemodynamically stable without hemothorax or pericardial tamponade. Kabutey *et al.*^[19] showed successful management of SVC perforation by conservative management avoiding the morbidity associated with open thoracotomy and covered stent implant compromising flow through collateral vessels. However, conservative management of SVC obstruction with airway involvement requires securing the airway patency and prolonged ventilatory support.

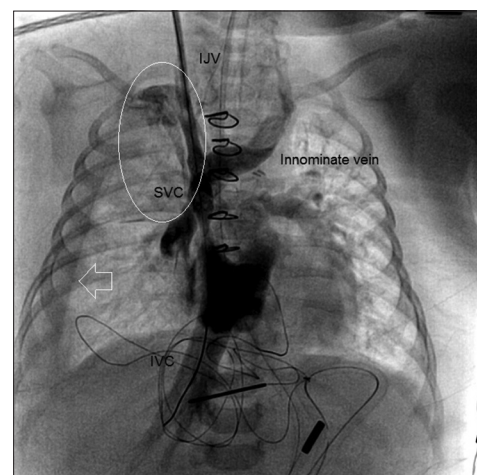


Figure 2: Venogram demonstrating superior vena cava tear with subsequent leakage of dye. IJV – Internal jugular vein, SVC - Superior vena cava, IVC – Inferior vena cava. Encircled part demonstrates leakage of dye through superior vena cava tear. Arrow head shows right hemothorax

Surgical repair of SVC narrowing include patch plasty and bypass of stenosis with either polytetrafluoroethylene conduit or autologous vein graft.^[5] Oshima *et al.*^[20] reported a case of SVC rupture caused during balloon dilatation for treatment of SVC syndrome, which was successfully managed surgically by patch plasty.

Successful repair through endovascular approach by balloon angioplasty, either with balloon expandable stents or self-expanding stents were reported. Lanciego *et al.*^[21] in a series of 52 cases, reported resolution of symptoms of SVC syndrome within 72 h after stenting. Leonelli *et al.*^[6] have reported the usefulness of balloon dilatation of SVC syndrome caused by ablation or radiofrequency modification as it can be easily performed and is less invasive compared to a surgical procedure. In spite of its simplicity and less invasiveness, the risk of dreadful complications like SVC tear, right atrial perforation, cardiac tamponade, and massive hemothorax makes successful resuscitation of the patient difficult.

Aphrodite Tzifa *et al.*^[7] in their 22-year experience at Boston Children's Hospital in endovascular treatment for SVC occlusion showed that all patients who developed complications like SVC tear, right atrial perforation, and stent malposition had history of prior cardiac surgery.

In our patient, SVC obstruction developed on the 3rd postoperative day. The decision for the less invasive balloon dilatation and stenting was favored considering, the decreased procedure related morbidity and shorter recovery period compared to the surgical repair^[16] and the risks associated with re-exploration surgery.^[17,18]

There was SVC tear during balloon inflation after stent placement. The suture lines in the SVC might have narrowed it leading to the tear. The less elastic nature of the venous vasculature could have further contributed to the cause. SVC tear lead to massive blood loss into the pleural cavity which resulted in cardiogenic shock. Hemothorax required emergent volume replacement along with inotropic support. Simultaneous management of biventricular failure in this case mandated placement of the central venous cannula at a site away from SVC drainage area for monitoring and therapeutic purpose.

Long-term occlusion of the venous drainage from left innominate vein, due to covered stent as in our case worsens airway oedema and complicates weaning from ventilator support during the postoperative period.

Factors like increased airway pressure, engorgement of mucous membrane, secretions, swelling of airway impair oxygenation. Maintaining the patency of airway in scenarios like dislodgement of endotracheal tube prove to be a nightmare even for an experienced anaesthesiologist. One should not hesitate to secure airway with either a noninvasive approach like fiber optic assisted intubation or invasive methods like percutaneous tracheostomy or cricothyrotomy.

To conclude, airway patency and impaired venous drainage are always a concern in cases of SVC obstruction. Interventional endovascular procedure is widely accepted as the treatment of choice. But management of iatrogenic narrowing when attempted with balloon dilatation carries the risk of SVC tear. With the available limited data, the safety of surgical repair over endovascular is yet to be conclusively established. Till then, the decision to operate or to perform a percutaneous procedure rests on individual preference. The rapidity with which hemodynamic parameters deteriorate in these patients requires the anesthesiologists to be prepared and well equipped to handle such catastrophes.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Lock JE, Bass JL, Castaneda-Zuniga W, Fuhrman BP, Rashkind WJ, Lucas RV Jr. Dilation angioplasty of congenital or operative narrowings of venous channels. *Circulation* 1984;70:457-64.
2. Benson LN, Yeatman L, Laks H. Balloon dilatation for superior vena caval obstruction after the Senning procedure. *Cathet Cardiovasc Diagn* 1985;11:63-8.
3. Frias PA, Johns JA, Drinkwater DC, Doyle TP. Percutaneous stent placement as treatment for an infant with superior vena cava syndrome. *Catheter Cardiovasc Interv* 2001;52:355-8.
4. Kai H, Honma T, Imaizumi T. Superior vena cava syndrome caused by multiple pacing leads. *Heart* 2001;86:80.
5. Schindler N, Vogelzang RL. Superior vena cava syndrome. Experience with endovascular stents and surgical therapy. *Surg Clin North Am* 1999;79:683-94, xi.
6. Leonelli FM, Pisanó E, Requarth JA, Potenza D, Tomassoni G, O'Connor W, *et al.* Frequency of superior vena cava syndrome following radiofrequency modification of the sinus node and its management. *Am J Cardiol* 2000;85:771-4, A9.
7. Tzifa A, Marshall AC, McElhinney DB, Lock JE, Geggel RL. Endovascular treatment for superior vena cava

- occlusion or obstruction in a pediatric and young adult population: A 22-year experience. *J Am Coll Cardiol* 2007;49:1003-9.
8. Boardman P, Ettles DF. Cardiac tamponade: A rare complication of attempted stenting in malignant superior vena caval obstruction. *Clin Radiol* 2000;55:645-7.
 9. Brown KT, Getrajdman GI. Balloon dilation of the superior vena cava (SVC) resulting in SVC rupture and pericardial tamponade: A case report and brief review. *Cardiovasc Intervent Radiol* 2005;28:372-6.
 10. Burket MW. Challenging cases: Superior vena cava rupture. *Endovasc Today* 2003;2:11-3.
 11. Brant J, Peebles C, Kalra P, Odurny A. Hemopericardium after superior vena cava stenting for malignant SVC obstruction: The importance of contrast-enhanced CT in the assessment of postprocedural collapse. *Cardiovasc Intervent Radiol* 2001;24:353-55.
 12. Smayra T, Otal P, Chabbert V, Chemla P, Romero M, Joffre F, *et al.* Long-term results of endovascular stent placement in the superior caval venous system. *Cardiovasc Intervent Radiol* 2001;24:388-94.
 13. Martin M, Baumgartner I, Kolb M, Triller J, Dinkel HP. Fatal pericardial tamponade after Wallstent implantation for malignant superior vena cava syndrome. *J Endovasc Ther* 2002;9:680-4.
 14. Samuels LE, Nyzio JB, Entwistle JW. Superior vena cava rupture during balloon angioplasty and stent placement to relieve superior vena cava syndrome: A case report. *Heart Surg Forum* 2007;10:E78-80.
 15. Ploegmakers MJ, Rutten MJ. Fatal pericardial tamponade after superior vena cava stenting. *Cardiovasc Intervent Radiol* 2009;32:585-9.
 16. Rizvi AZ, Kalra M, Bjarnason H, Bower TC, Schleck C, Gloviczki P. Benign superior vena cava syndrome: Stenting is now the first line of treatment. *J Vasc Surg* 2008;47:372-80.
 17. Vijarnsorn C, Laohaprasitiporn D, Durongpisitkul K, Chantong P, Soongswang J, Cheungsomprasong P, *et al.* Surveillance of pediatric cardiac surgical outcome using risk stratifications at a tertiary care center in Thailand. *Cardiol Res Pract* 2011;2011:254321.
 18. Wisselink W, Money SR, Becker MO, Rice KL, Ramee SR, White CJ, *et al.* Comparison of operative reconstruction and percutaneous balloon dilatation for central venous obstruction. *Am J Surg* 1993;166:200-4.
 19. Kabutey NK, Rastogi N, Kim D. Conservative management of iatrogenic superior vena cava (SVC) perforation after attempted dialysis catheter placement: Case report and literature review. *Clin Imaging* 2013;37:1138-41.
 20. Oshima K, Takahashi T, Ishikawa S, Nagashima T, Hirai K, Morishita Y. Superior vena cava rupture caused during balloon dilation for treatment of SVC syndrome due to repetitive catheter ablation – A case report. *Angiology* 2006;57:247-9.
 21. Lanciego C, Chacón JL, Julián A, Andrade J, López L, Martínez B, *et al.* Stenting as first option for endovascular treatment of malignant superior vena cava syndrome. *AJR Am J Roentgenol* 2001;177:585-93.