Case Report

Pulmonary artery catheter entrapment after mitral valve surgery and the use of transesophageal echocardiography to accurately determine the site of entrapment

ABSTRACT

The prevalence of pulmonary artery catheter (PAC) entrapment in open-heart surgery is scarce with a prevalence rate of 0.065%. Challenges in managing such cases lie particularly in choosing the modalities (chest roentgenogram, fluoroscopy, and transesophageal echocardiography) to accurately identify the anatomic location and cause of entrapment. In this case, we report a 42-year-old man who underwent mitral valve replacement with PAC entrapment discovered on postoperative day 2 and subsequently underwent retrieval after re-sternotomy. This case also highlights the usefulness of transesophageal echocardiography by the cardiac anesthetist in aiding the surgeons to locate the anatomic location where the catheter was entrapped.

Key words: Echocardiography; Swan-Ganz; transesophageal; vascular catheters

Introduction

Swan-Ganz catheter or pulmonary artery catheter (PAC) is frequently used for intra- and post-operative monitoring in open-heart surgery. It is used to measure the pulmonary artery pressure, pulmonary wedge pressure, mixed venous oxygen saturation, and cardiac output.[1,2] The incidence of complication (complete heart block, tachycardia, catheter knotting, pulmonary artery rupture, and PAC entrapment) from its insertion stands at 3%.[3] We report a 42-year-old man with severe rheumatic mitral stenosis who underwent mitral valve replacement with PAC entrapment due to a pledgeted 4/0 suture used for hemostasis at the superior edge of the left arteriotomy suture line. Before sternotomy, transesophageal echocardiography (TEE) was used to identify the anatomic location of the entrapment which allowed the surgeons to accurately confirm its location.

Case Report

A 42-year-old male with underlying chronic obstructive airway disease and chronic rheumatic heart disease was diagnosed with severe mitral stenosis. The patient had symptoms of and shortness of breath despite optimal medical therapy. An echocardiogram revealed a mitral valve area of 0.9 cm^2 and ejection fraction of 69%. The patient underwent an

Access this article online	
Website: www.saudija.org	Quick Response Code
DOI: 10.4103/sja.SJA_674_17	

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Lip HT, Huei TJ, Hamid SR, Vendargon SJ. Pulmonary artery catheter entrapment after mitral valve surgery and the use of transesophageal echocardiography to accurately determine the site of entrapment. Saudi J Anaesth 2018;12:462-4

Henry Tan Chor Lip[1,2,3], Tan Jih Huei[1,2,3], Syed Rasul Bin G. Syed Hamid[3], Simon Jerome Vendargon[3]

[1]Department of General Surgery, Faculty of Medicine, National University of Malaysia Medical Centre, Kuala Lumpur, Malaysia, Kuala Lumpur, [2]Clinical Research Centre, Hospital Sultan Ismail, [3]Department of Cardiothoracic Surgery, Hospital Sultanah Aminah, Johor Bahru, Johor, Malaysia

Address for correspondence: Dr. Henry Tan Chor Lip, Department of Cardiothoracic Surgery, Hospital Sultanah Aminah, Jalan Abu Bakar, Masjid Sultan Abu Bakar, 80000 Johor Bahru, Johor, Malaysia. E-mail: relos1402@gmail.com

elective mitral valve replacement through a left arteriotomy. Before the start of surgery, a PAC was inserted by the cardiac anesthetist to aid in pulmonary artery pressure monitoring. Intraoperatively, the diseased and stenosed mitral valve was replaced with a mechanical stable type size 8 using interrupted pledgeted sutures. After closing the left atrium with 3/0 prolene sutures, there was bleeding at the superior edge of the arteriotomy site adjacent to the superior vena cava (SVC)-pulmonary artery junction. This was controlled using two pledgeted 4/0 prolene stitches. The sternum was closed in standard fashion using steel wires. Postoperatively, the patient was nursed in the cardiac intensive care unit and his recovery was uneventful. On the second postoperative day, attempts to remove the PAC were met with great resistance. A chest roentgenogram [Figure 1a] revealed a straight PAC without any kinks or knots. This led to the suspicion of a possible PAC entrapment secondary to suture piercing. A chest re-open through median sternotomy was decided for fear of risk from fatal bleeding due to further attempts at pulling on the PAC. After intubation, a TEE was performed which revealed that the PAC was adherent to the wall of the right atrium close to the SVC [Figure 1b].

The suspicion of the entrapment due to suture piercing was confirmed upon entering the chest and examining of the heart. The cardiac surgeons could feel a tug over the plegeted suture (which was previously sutured over the left atrial suture line for hemostasis) when the anesthetist tugged gently on the PAC [Figure 2].

Incidentally, during digital palpation of the superior edge of the left arteriotomy incision with simultaneous gentle traction by the anesthetist to locate the area of entrapment, the PAC became loose and removed in its entirety. No sutures were removed, and no bleeding was observed at the pledgeted suture site. The PAC was successfully removed without having to go on bypass again and to open the left atrium again. On examination of the entrapped PAC showed a complete and unfractured catheter with a 2-mm superficial puncture mark located 25 cm distal to its tip [Figure 3]. This confirmed our suspicion of a PAC entrapment secondary to suture piercing which occurred during hemostasis at the superior edge of the arteriotomy suture line. Apart from atrial fibrillation, the postoperative recovery was uneventful and trachea extubated on the first postoperative day.

Discussion

The incidence of PAC entrapment in patient's undergoing open-heart surgery is rare with a prevalence of 0.065%. There were only ten patients (from a total of 15244 patients undergoing open-heart surgery) that had PAC entrapment as reported by Kaplan *et al*. All cases reported were from valve repair procedures similar to our patient.[1] Resistance during removal of the Swan-Ganz catheter is usually caused by suture entrapment, looping, knotting of the catheter, and entrapment in the papillary muscles of the tricuspid valves.[1,4] Chest roentgenogram, fluoroscopy, and TEE are the commonly used modalities to roughly estimate the anatomical location and cause of entrapment.[2,5] Common anatomic locations' entrapment occurs and is in the right atrium, SVC purse-string suture, left atrial ventricular site, right pulmonary artery, and ventricular papillary muscle.[1,6] To our knowledge, majority of catheter retrievals are often through a chest re-open.[6] The fact that a tear caused by sheer force on the entrapped PAC may lead to catastrophic bleeding usually lowers the threshold for a retrieval under direct vision. Considerations of the morbid complications of re-sternotomy (sepsis, sternal nonunion, surgical site infections, mediastinitis, and prolong hospital stay) definitely outweigh the risk of death from uncontrolled bleeding due to nonsurgical removal of the catheter.[1] TEE is useful in

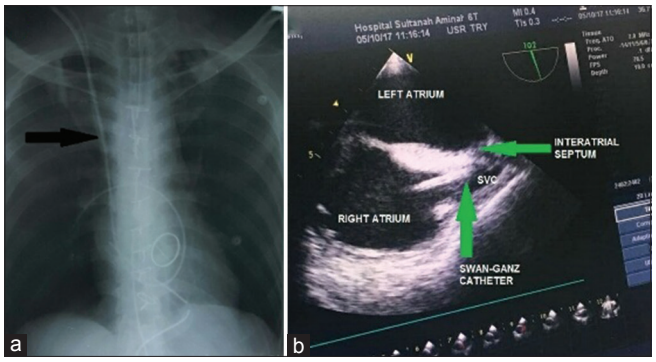

Figure 1: (a) Chest roentgenogram showing intact Swan-Ganz catheter without any knots (black arrow). (b) Transesophageal echocardiography revealing the Swan-Ganz catheter firmly adhering to wall at junction of the right atrium and superior vena cava (green arrow)

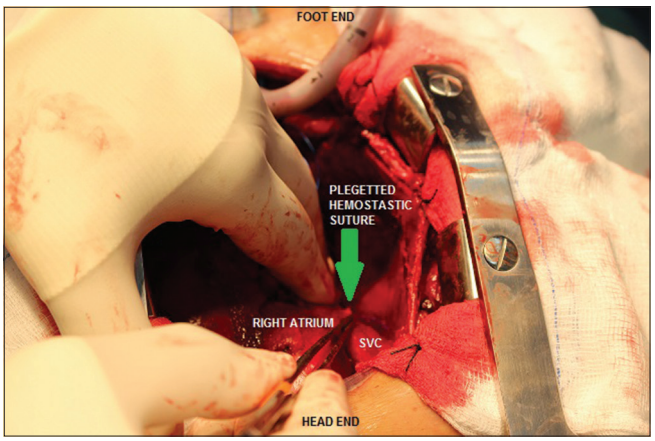

Figure 2: Intraoperatively, Swan-Ganz catheter is palpated at the junction of the right atrium and superior vena cava where hemostatic pledgeted suture was placed (green arrow)

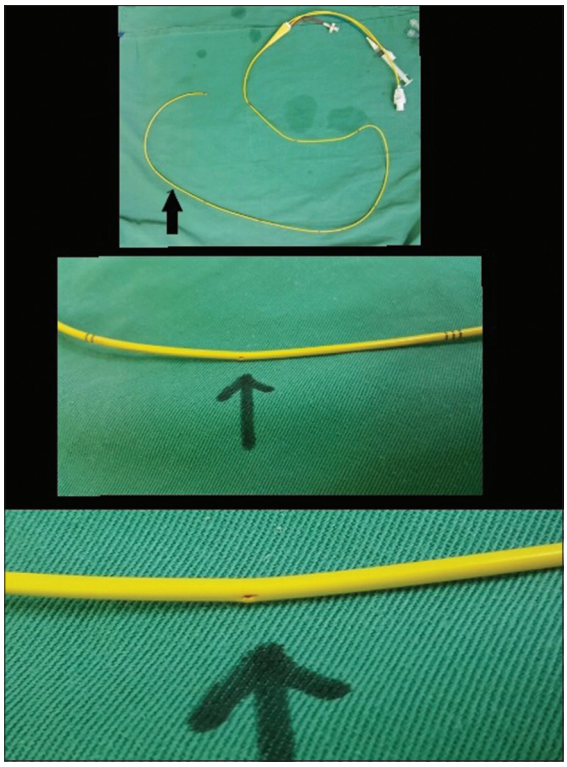

Figure 3: Intact Swan-Ganz catheter removed with 2 mm puncture caused by the pledgeted hemostatic suture (black arrow)

aiding the surgeons to identify the site of entrapment.[7] As demonstrated in this case, TEE was able to locate the site of entrapment by observing the immobility of the catheter on gentle pulling in comparison to mobile parts of the catheter proximal to the site of entrapment. This allowed the surgeons to accurately identify the site of entrapment on the first attempt of digital palpation of the superior edge of the arteriotomy suture line. The entrapped catheter was successfully freed using the combined efforts of gentle traction on the catheter by the anesthetist and digital palpation at suture site by the surgeons intra-operatively. In summary, retrieval of an entrapped PAC through direct surgical vision is necessary to prevent catastrophic bleeding. The use of TEE by the cardiac anesthetist is useful to allow accurate identification of the site of entrapment, and the authors advocate its use if the modality is available.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kaplan M, Demirtas M, Cimen S, Kut MS, Ozay B, Kanca A, *et al.* Swan-Ganz catheter entrapment in open heart surgery. J Card Surg 2000;15:313-5.
2. Huang L, Elsharydah A, Nawabi A, Cork RC. Entrapment of pulmonary artery catheter in a suture at the inferior vena cava cannulation site. J Clin Anesth 2004;16:557-9.
3. Sise MJ, Hollingsworth P, Brimm JE, Peters RM, Virgilio RW, Shackford SR, *et al.* Complications of the flow-directed pulmonary artery catheter: A prospective analysis in 219 patients. Crit Care Med 1981;9:315-8.
4. Deneu S, Coddens J, Deloof T. Catheter entrapment by atrial suture during minimally invasive port-access cardiac surgery. Can J Anaesth 1999;46:983-6.
5. Alsatli R. Pulmonary artery catheter entrapment in cardiac surgery. Saudi J Anaesth 2010;4:114-6.
6. Kansara B, Singh A, Karlekar A, Mishara YK. Swan-Ganz entrapment during cardiac surgery – A case report. Indian J Thorac Cardiovasc Surg 2013;29:20-1.
7. Dubois PE, Collard E, Xenitos P, Louagie YA. Early recognition of pulmonary artery catheter entrapement with TEE. J Cardiothorac Vasc Anesth 2003;17:142-3.