OPEN ACCESS

GAVIN PUBLISHERS

Annals of Case Reports

Kalscheuer G, et al. Ann Case Report 1: 222.

DOI: 10.29011/2574-7754/100222

Case Report

Successful Pulmonary and Aortic Embolectomies Under Tepid Circulatory Arrest: A Case Report

Grégory Kalscheuer*, Peter Schraverus, Asmae Belhaj, Benoît Rondelet

Department of Cardio-Vascular, Thoracic Surgery and Lung Transplantation, CHU UCL Namur, Université Catholique de Louvain, Yvoir, Belgium

***Corresponding author:** Gregory Kalscheuer, Department of Cardio-Vascular, Thoracic Surgery & Transplantation, CHU UcL Namur, Université Catholique de Louvain, Avenue Dr G. Therasse, 1, 5530 - Yvoir, Belgium. Tel: + 32-81423151, Fax: + 32-81423157. E-mail: gregory.kalscheuer@uclouvain.be

Citation: Kalscheuer G, Schraverus P, Belhaj A, Rondelet B (2019) Successful Pulmonary and Aortic Embolectomies Under Tepid Circulatory Arrest: A Case Report. Ann Case Report 1: 222. DOI: 10.29011/2574-7754/100222

Received Date: 12 June, 2019; **Accepted Date:** 26 June, 2019; **Published Date:** 01 July, 2019

Abstract

Background: A patent foramen ovale is present in approximately 25% of the general population. When associated with deep venous thrombosis, it can lead to cryptogenic strokes and paradoxical emboli in other organs.

Case Presentation: We report the case of a 54-year-old male with a 3-day history of severe dyspnea, chest and left arm pain, and transient paresthesia. He had been treated for a distal leg fracture 6 weeks before. The patient presented with massive thrombi in the pulmonary arteries and threatening, floating thrombi in the aortic arch and the descending part of the aorta, apart from total occlusion of the left subclavian artery. We performed surgical embolectomies of the pulmonary and aortic arteries under hypothermia and circulatory arrest while maintaining antegrade cerebral perfusion. After 12 months of follow-up, the patient was totally free of thrombotic disease and neurological deficits.

Conclusion: Surgery may be a safe treatment option for large emboli in the pulmonary artery and the aortic arch.

List of Abbreviations

CT: Computed tomography; PFO: Patent foramen ovale; CPB: Cardio-pulmonary bypass; VTE: Venous thromboembolism; DVT: Deep vein thrombosis; TEE: Transesophageal echocardiography

Keywords: Aortic embolectomy; Paradoxical embolism; Pulmonary embolectomy; Tepid circulatory arrest; Trendelenburg surgery

Introduction

Pulmonary embolism is a major complication of Deep Vein Thrombosis (DVT). In severe cases, it causes an increase in pulmonary arterial pressure and right ventricular post-charge that results in right-sided heart failure. The enlargement of the right-sided cavities facilitates the opening of right-to-left shunts, thereby allowing the passage of thrombi into the systemic circulation, i.e., paradoxical embolism.

Case Presentation

A 54-year-old man was admitted to our emergency department with a 3-day history of severe dyspnea, chest and left arm pain, and transient paresthesia. The patient had no history of cardiac or pulmonary events but was treated for a comminuted fracture of the distal leg by osteosynthesis 6 weeks ago. Until 4 days before the onset of symptoms, the patient had been prescribed preventive anticoagulant therapy (Enoxaparin 40 mg). The patient was never tested for activated protein C resistance or other hemostatic abnormalities and did not have a history of DVT. All other blood parameters were normal.

A chest X-ray showed bilateral lower lung infiltrations (Figure 1). A thoracic Computed Tomography (CT) scan with contrast, performed to exclude a pulmonary embolism, showed thrombi in both pulmonary arteries with large, floating thrombi in the aortic arch and the descending part of the aorta and total occlusion of the left subclavian artery (Figure 2).

Figure 1: Pre-operative chest X-ray showing bi basal infiltration.

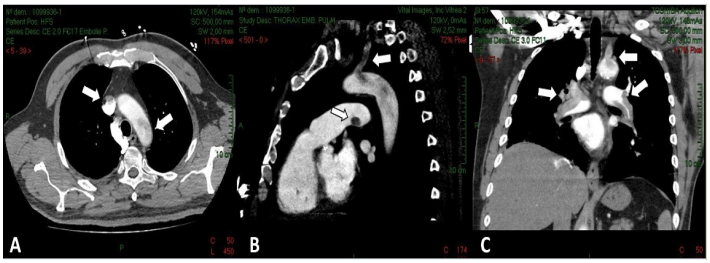

Figure 2: Thoracic CT scan showing a concomitant embolism of the aortic and pulmonary arteries. Panel A, axial view; panel B, sagittal view; panel C, coronal view.

Transthoracic echocardiography showed that the right heart was dilated, with a left ventricle ejection fraction of 70% and an estimated pulmonary artery systolic pressure of 48 mm Hg plus central venous pressure. Neither a diagnosed valve dysfunction nor a Patent Foramen Ovale (PFO) was observed on transthoracic echocardiography. The clinical condition of the patient worsened very rapidly and an emergent pulmonary and aortic embolectomy was planned. Transesophageal Echocardiography (TEE) performed in the operating room after the administration of general anesthesia revealed a small PFO. A Cardio-Pulmonary Bypass (CPB) was initiated through a median sternotomy; the arterial cannula was introduced into the brachiocephalic artery 2 cm from its origin after ensuring that it was free of any thrombi, and a two-stage atrio-caval cannula was placed through the right atrium. The patient was cooled to a temperature of 32˚C. After cross-clamping, antegrade cardioplegia was given through the sino-tubulary junction. During the cooling process, a bilateral pulmonary embolectomy was performed through an incision in the transverse pulmonary trunk.

When a temperature of 32˚C was reached, circulatory arrest was initiated after a second clamp was placed proximally to cross clamp the brachiocephalic artery. The flow in the arterial cannula was reduced to 10 mL/kg/min to maintain selective antegrade cerebral perfusion through the right carotid artery. A transverse aortotomy revealed a fresh thrombus that was obstructing the aortic arch and the subclavian artery. A 7-French embolectomy-catheter was deployed through the aortotomy to reach the origin of the subclavian and left common carotid arteries (Figure 3), and the PFO was closed through a right atriotomy during circulatory arrest.

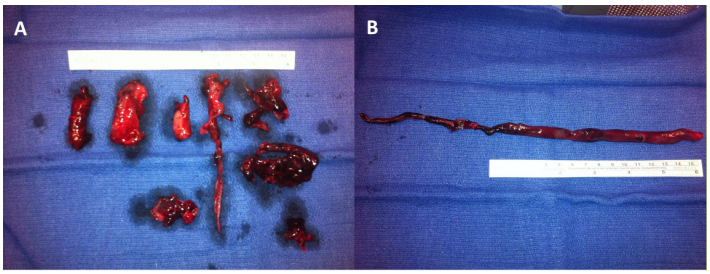

Figure 3: Thrombi specimens after removal from the pulmonary arteries (panel A) and aortic-subclavian arteries (panel B).

Twelve minutes after initiating circulatory arrest, the aorta was closed and the circulatory arrest discontinued. The patient was rewarmed and easily weaned from the CPB after 25 minutes of cross-clamping time. The procedure was performed under pericardial carbon dioxide flooding. The patient recovered well except for residual grade I dyspnea. A post-operative lower leg ultrasound examination revealed a DVT that was treated by warfarin. Post-procedure cardiac echography did not show any residual thrombi in the cardiac chambers and a chest CT scan showed that the aorta and the pulmonary arteries were thrombus-free. Complementary investigations of hemostatic or coagulation dysfunction (antithrombin deficiency, C-protein and S-protein, factor VIII, and resistance to C-reactive protein) did not reveal any abnormalities, and treatment with a vitamin K antagonist (Acenocoumarin) was initiated. One year after the procedure, the patient remained free of thrombotic disease and neurological deficits.

Discussion

We report a rare case of a pulmonary embolism with an intra-aortic thrombus occluding the left subclavian artery in a young patient. A PFO discovered peri-operatively was found to be responsible for the paradoxical aortic thrombus that occurred after DVT developed, despite enoxaparin prophylaxis. Patients undergoing orthopedic or trauma surgery are at high risk for Venous Thromboembolism (VTE) [1]. Therefore, anticoagulation therapy is recommended for the prevention of VTE after orthopedic surgery, but this regimen does not completely prevent DVT or VTE [2]. A PFO is present in about 25% of the general population [3] and increases the mortality rate related to pulmonary embolism from 13% to 44% and the incidence of stroke from 2% to 13% [4]. In this case, an acute increase in right-sided cardiac pressure due to the pulmonary embolism led to a right-to-left shunt responsible for the paradoxical embolism [5]. Because our patient was in a critical condition, we decided to perform emergent surgery. In the

operating room, after general anesthesia had been administered, TEE, which is a very reliable method to detect septal defects [6], revealed the presence of a PFO. After ensuring that the brachiocephalic trunk was free of any thrombotic material, a CPB was initiated by cannulating it distally. This approach was used to maintain antegrade flow in the arch and to avoid dislodging the thrombus located in the left subclavian artery. The entire procedure was performed under carbon dioxide flooding to minimize the risk of air embolism [7].

Under conditions of tepid hypothermic circulatory arrest with selective antegrade perfusion of the right carotid, the aortic and subclavian embolectomies were completed and the PFO was closed to prevent future emboli or stroke [8]. These operative conditions were decided upon prior to the procedure to limit the duration of circulatory arrest, post-operative bleeding, and CPB time [9]. In cases of total aortic arch obstruction, cannulation of the apex of the heart is considered a safe option [10], but, if possible, cardiac manipulations should be limited to avoid embolization or thrombus fragmentation. Similarly, atrio-caval cannulation and closing of the PFO during circulatory arrest avoid the need for slinging the caval veins when closing the PFO during a CPB. The mortality of massive pulmonary embolisms reaches 52.4% at 90 days [11]. The main complication of thrombolysis is intracranial hemorrhage which accounts for 3% [12]. Surgical embolectomy is indicated for pulmonary embolism with arterial hypotension and cardiogenic shock [13]. Several studies show a higher mortality and recurrence rate in the medically treated group [14,15], but also a low mortality rate for pulmonary embolectomies [16].

Conclusion

Cases of thrombi in the ascending aorta are rare, and surgical management appears to be the most frequently used option, with low mortality rates [17].

Declarations

Acknowledgments

None.

Funding

GK, AB, and BR were supported by “Fondation Mont-Godinne” (Belgium).

The funding agency had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript. This does not alter our adherence to all the Journal of Cardiothoracic Journal policies on sharing data and materials.

Availability of Data and Materials

The data supporting the conclusions of this article are included within the article.

Authors’ Contributions

GK wrote the report, PS performed the surgery, and AB and BR revised the manuscript. All authors read and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Ethics Approval and Consent to Participate

Not required.

References

1. Geerts WH, Bergqvist D, Pineo GF, Heit JA, Samama CM, et al. (2008) Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th edition). Chest 133:381S-453S.
2. Schellong SM, Encke A, Weber AA, Bramlage P, Paar WD, et al. (2013) Benefits and risks of preventing thromboembolism with enoxaparin in patients with general surgery in real world--the CLEVER study. Clin Appl Thromb Hemost 19: 282-288.
3. Hagen PT, Scholz DG, Edwards WD (1984) Incidence and size of patent foramen ovale during the first 10 decades of life: an autopsy study of 965 normal hearts. Mayo Clin Proc 59: 17-20.
4. Cramer SC, Rordorf G, Maki JH, Kramer LA, Grotta JC, et al. (2004) Increased pelvic vein thrombi in cryptogenic stroke: results of the Paradoxical Emboli from Large Veins in Ischemic Stroke (PELVIS) study. Stroke 35: 46-50.
5. Kollar A, Reames MK, Coyle JP (1998) Patent foramen ovale and pulmonary embolism. An underestimated co-morbidity following cardiac surgery. J Cardiovasc Surg (Torino) 39: 355-358.
6. Favre JP, Dacosta A, Gournier JP, Lafond P, Comtet C, et al. (1994) Paradoxical embolism of the aortic arch diagnosed by transesophageal echocardiography. Surgical treatment. Arch Mal Coeur Vaiss 87:819-822.
7. Martens S, Neumann K, Sodemann C, Deschka H, Wimmer-Greinecker G, et al. (2008) Carbon dioxide field flooding reduces neurologic impairment after open heart surgery. Ann Thorac Surg 85: 543-547.
8. Schuchlenz HW, Weihs W, Berghold A, Lechner A, Schmidt R (2005) Secondary prevention after cryptogenic cerebrovascular events in patients with patent foramen ovale. Int J Cardiol 101: 77-82.
9. Watanabe G, Ohtake H, Tomita S, Yamaguchi S, Kimura K, et al. (2011) Tepid hypothermic (32˚C) circulatory arrest for total aortic arch replacement: a paradigm shift from profound hypothermic surgery. Interact Cardiovasc Thorac Surg 12: 952-955.

10. Walles T, Fischer S, Strüber M, Haverich A (2002) Paradoxic aortic arch embolization with occlusion of the supraaortic arteries. Eur J Cardiothorac Surg 22 : 448-449.

11. Kucher N, Rossi E, De Rosa M, Goldhaber SZ (2006) Massive pulmonary embolism. Circ 113: 577-582.

12. Goldhaber SZ, Visani L, De Rosa M (1999) Acute pulmonary embolism: clinical outcomes in the International Cooperative Pulmonary Embolism Registry (ICOPER). Lancet 353: 1386-1389.

13. Guidelines on diagnosis and management of acute pulmonary embolism. (2000) Task Force on Pulmonary Embolism, European Society of Cardiology. Eur Heart J 21:1301-1336.

14. Gulba DC, Schmid C, Borst HG, Lichtlen P, Dietz R, et al. (1994) Medical compared with surgical treatment for massive pulmonary embolism. Lancet 343: 576-577.

15. Meneveau N, Seronde MF, Blonde MC, Legalery P, Didier-Petit K, et al. (2006) Management of unsuccessful thrombolysis in acute massive pulmonary embolism. Chest 129: 1043-1050

16. Digonnet A, Moya-Plana A, Aubert S, lecher E, Bonnet N, et al. (2007) Acute pulmonary embolism: a current surgical approach. Interact Cardio Vasc Thorac Surg 6: 27-29.

17. Pang PY, Nathan VB (2016) Successful thrombectomy for an idiopathic floating ascending aortic thrombus. Ann Thorac Surg 102: 245-247.