



Case report

Aortic arch aneurysm. Tracheobronchial compression as a vital indication for emergency surgery: A case report

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ABSTRACT

Introduction: Giant thoracic aortic aneurysms and aortic arch dissections are accompanied by high mortality rates, cardiac and neurologic events and pulmonary complications. Tracheobronchial compression with aorta-tracheal fistula is a rare complication of the aorta aneurysms. Aortic arch replacement in such case presents several formidable challenges.

Presentation of case: This is the case report of successful surgical treatment of giant aortic arch aneurysm, complicated by airway compression, aorta-tracheal fistula and recurrent community-acquired pneumonia.

Discussion: Urgent indications for the aortic arch aneurysms surgery include significant size and high risk of rupture. As well as a visceral compression are presented. Bronchoscopy can be used to successfully treatment at all stages from trachea intubation to extubation.

Conclusion: Aggressive surgical approach with careful pre-operative diagnostic are the key to success and the only one chance for patients with aortic arch aneurysm, complicated by airway compression.

1. Introduction

Tracheobronchial compression is a formidable and rare complication of the thoracic aorta aneurysms. Clinical manifestations are varying from asymptomatic conditions to acute respiratory failure [1]. Pulmonary complications, as a result of vascular compression, can lead to tracheomalacia, recurrent pneumonias and aorta-tracheal (bronchial) fistulas.

We describe a case of a 56-year-old man with giant ascending aorta and aortic arch aneurysm, complicated by airway compression, aorta-tracheal fistula and recurrent community-acquired pneumonia.

This work is reported in line with the SCARE 2020 Guidelines [2].

2. Presentation of case

A 56-year-old man was referred because of breathlessness on exertion and at rest, prolonged cough with bloody sputum production and hoarseness. Over the last two years he noted a decline in performance impact, reduced tolerance to physical activity, breathlessness and hoarseness. It was assumed that the patient had chronic bronchitis, but

he did not receive the benefit from antibacterial, mucolytic and local therapy.

The patient was admitted with significant decrease of blood oxygenation, NYHA III-IV condition. The main symptoms were associated with stridor and respiratory distress. Preoperative chest CT (Fig. 1) showed giant ascending aorta, aortic arch and initial part of the thoracic aorta partially-thrombosed ampullary false aneurysm, 80 × 100 × 65 mm in size (more pronounced on the lower wall of aortic arch). Left main bronchus, left pulmonary artery and the trachea (as in compartment syndrome over the bifurcation) were compressed and pushed by aneurysm, less compressed were left pulmonary veins, esophagus, and azygos vein. Moreover, recurrent pneumonia against the trachea drainage tube disorder was diagnosed. The multivessel coronary artery disease (left anterior descending, left circumflex, and posterior descending arteries) by coronarography was presented.

The surgery was performed as emergency through median sternotomy, the cardiopulmonary bypass (CPB) was performed by right subclavian artery and central venous cannulation. Taking into account the supra-bifurcation compression of the trachea, as well as compression of the left main bronchus, tracheal intubation using bronchoscopy was

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performed. Given the complete compression of the left main bronchus, at the initial stage, only the right lung was ventilated.

In order to reduce the time of myocardial ischemia, the distal anastomoses of the coronary artery bypass grafting were performed in parallel CPB during the cooling process (target temperature 26 °C). After mobilising the ascending aorta, the aneurysmal sac was delicately separated from the branches of the pulmonary artery. After clamping, the ascending aorta was transected 1,5 cm above the sinotubular junction and blood antegrade cardioplegia was performed. The brachiocephalic trunk was clamped, visceral arrest and mono-hemispherical perfusion of the brain were started. The aneurysmal sac was opened. Multiple signs of intimal rupture were revealed in the lumen, as well as massive thrombotic masses (up to 400 g). Sac was formed by the posterior wall of the aortic arch and the initial section of the descending aorta, excised. The aneurysm bed in the posterior mediastinum was thoroughly sanitized with antiseptics, and the affected aorta was cut off from its thoracic region within the "healthy" tissues. During the revision an aorta-tracheal fistula up to 2 cm long was found, temporarily damped with an antiseptic napkin.

The next step was the total replacement of the aortic arch using a synthetic multi-branch prosthesis, the visceral arrest was completed. Supracoronary replacement of ascending aorta was used for proximal anastomosis with prosthesis and coronary arteries bypass grafts for distal.

After exposure of the trachea and its separation from the surrounding tissues, under the control of bronchoscopy, suture repair of the posterolateral wall defect with 5 separate sutures was performed. Tightness control using bronchoscopy was also carried out. After decompression of the airways, the endotracheal tube was repositioned - the left lung was successfully included. Intraoperative view after reconstruction (Fig. 2).

The patient was extubated 48 h after surgery, the duration of observation in the intensive care unit was 48 h. It should be noted that

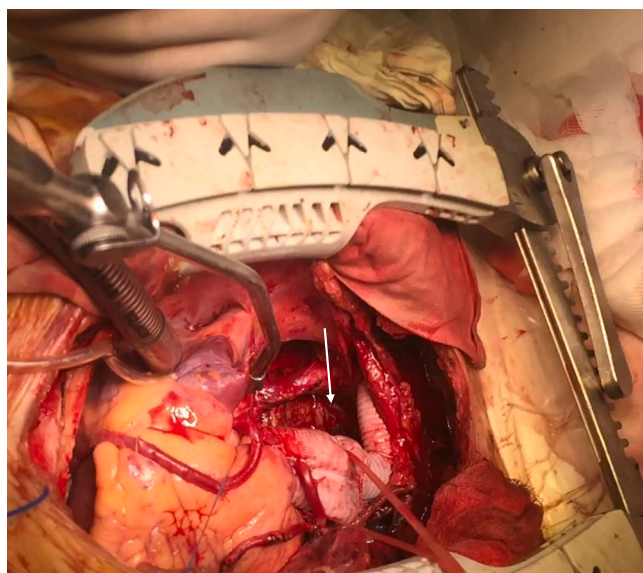


Fig. 2. The final view after operation. Thoracic aortic aneurysm replaced with synthetic prosthesis and coronary artery bypass grafting was performed. The arrow indicates the area of the aorta-tracheal fistula.

the patient's extubation was performed after preliminary bronchoscopy control for tightness of the trachea and patency of the left main bronchus. The patient was discharged on the 14th day after the operation, with satisfactory echocardiography, laboratory tests and no data for respiratory, heart and coronary failure. Dynamic CT did not reveal infiltrative changes in the lungs and mediastinum.

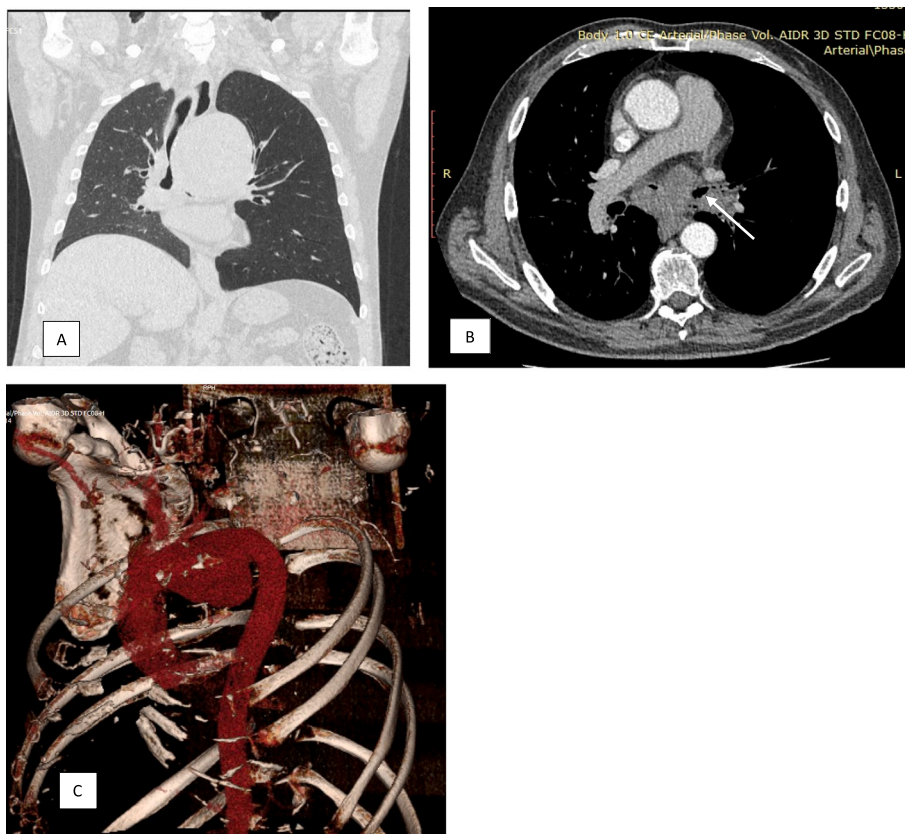


Fig. 1. CT-scan: Aneurysm compresses the trachea and left main bronchus. A) Coronal view; B) axial view (the white arrow indicates the left main bronchus); C) 3D reconstruction.

Histological examination revealed atherosclerosis with thinning and inflammation of the aortic wall tissue.

The patient's somatic condition corresponded to NYHA I after 12 months follow-up. The CT showed no special features in aortic arch reconstruction area (Fig. 3). Patency of the trachea and main bronchus has been restored.

3. Discussion

Aortic arch pathologies often pose significant challenges to surgical or endovascular treatment. Conditions affecting the aortic arch relevant to the vascular surgeon include degenerative aneurysms and the acute aortic dissection [3].

The incidence of degenerative aortic arch aneurysms is increasing with advances of imaging. Main risk factors include increasing age, female sex, presence of chronic obstructive pulmonary disease, hypertension and positive family history [4].

Tracheobronchial compression syndrome with the aortic arch aneurysms is one of the urgent conditions that needs emergency surgery [1]. There is no accurate data presenting the frequency of this complication, although some researchers suggest 5–10% [5].

Airway compression syndrome is also an independent predictor of emergency surgery in patients with double aortic arch, arteria lusoria, pulmonary artery sling, and Kommerell diverticulum [6]. Most of the authors consider urgent aortic arch surgery the only option for patients with tracheobronchial compression syndrome.

Purpose of separate examination of indications for aortic arch surgical treatment as immediate is related to existing relative contraindications for a surgery in conditions of CPB and visceral arrest in our patient. A giant false aneurysm leads to tracheobronchial compression, which cause bronchial drainage disruption. Drug therapy for pneumonia was impossible. We believed that the severe course of pneumonia can complicate the intraoperative and postoperative period.

However, in our case the emergency intervention seems justified, as the patient had both vascular (thrombosis, rupture and size more than 9 cm) and extravasal (tracheobronchial compression syndrome, high degree of respiratory failure). This aneurysm could have been treated by placing a stent graft, but this would not have reduced pressure on the airways. The indication for aortic arch replacement was absolute.

Tracheal intubation, providing of optimal and safe artificial lung ventilation is a significant problem in patients with large aortic arch aneurysms which are accompanied by airway compression. It may be explained by the expressed anatomical distortion due to vascular compression [7]. Trachea intubation in such cases can be performed with endotracheal tube with a double lumen on the left or right side if there is significant compression of the entrance to the left main bronchus

[8]. A number of authors mention the danger of using a left-side double-lumen tube in patients with the compression of the left bronchus trunk bottom, as using of adaptive lung ventilation in this method increases the risk of aneurysm rupture. In addition, contraindications for the use of double lumen tubes include anatomical aspects, such as damage of the cardinal or bronchial veins, coarctation and vessel compression by aortic aneurysm [7]. Most publications point to the vital importance and effectiveness of intraoperative bronchoscopic monitoring while airway decompression [9]. In such cases, the flexible bronchoscope allows to inspect all available areas of the respiratory tract, evaluate the properties of endoluminal tissue of walls and carry out effective direct purification of the remaining excretions after decompression [1].

In case of our patient, we preferred to use a single lumen tube, and trachea intubation was controlled by bronchoscopy. Constant monitoring within the lumen allowed us to control decompression results, and to turn on the left lung after releasing the main trunk of the left bronchus. Distinction of our case is aorta-tracheal fistula found after aneurysm dissection and complete release of the trachea. Turning to the literature, we found that most modern works describe the successful decompression of the respiratory tract after aneurysmectomy and absence of the need for prosthetics or endovascular repair of trachea and bronchus [10]. However, the literature describes the case of tracheomalacia detected intraoperatively after resection of the syphilitic aneurysm of the aortic arch, which was successfully corrected by implantation of a 14 mm Y-shaped silicone stent explanted after 6 months with complete stabilization of tracheal and main bronchi walls [11]. Treatment of irreversible compression lesions of trachea involves straight or step-by-step reconstruction. However, in cases with cardiosurgical patients, these methods may not be applicable due to development of life-threatening respiratory failure. Most authors confirm the effectiveness and safety of implantation of the above-described temporary endotracheal stent as an alternative to reconstructive airway interventions [12]. After aneurysmectomy and airway decompression, control bronchoscopy revealed no signs of tracheomalacia, which allowed us to eliminate fistula performing only effective suture plastic of trachea. Therefore, regardless of the presence or lack of trachea or bronchial wall integrity, we recommend to use bronchoscopy at all stages of treatment, from intubation in the operating room to extubation in the intensive care unit.

4. Conclusion

Aggressive surgical approach with careful pre-operative diagnostic are the key to success and the only one chance for patients with aortic arch aneurysm, complicated by airway compression.

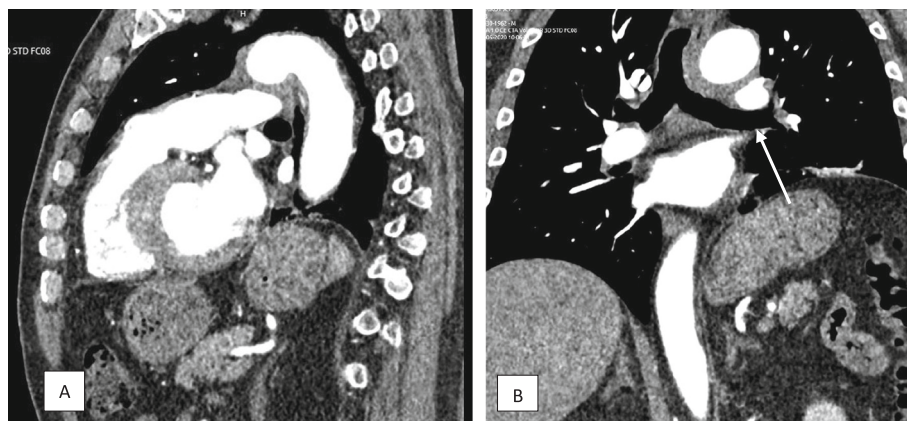


Fig. 3. Chest CT scan 3 months after surgery: A) the aortic prosthesis is functioning well; B) the patency of the left main bronchus is restored (the left main bronchus is indicated by a white arrow).

List of abbreviations

CPB	cardio pulmonary bypass
CT	computed tomography
NYHA	New York Heart Association

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Ethical approval

The study is exempt from ethical approval.

Consent

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

Author contribution

Roman Komarov and Nikolay Kurasov performed surgery, analyzed the literature and interpreted the patient's data regarding it. Alisher Ismailbaev, Boris Tlisov, Alexander Danachev, performed surgery and edited publication. Ivan Ivashov and Maxim Saliba participated to the manuscript editing to its final version, supervised the report and revised it critically. All authors read and approved the final manuscript to be published.

Registration of research studies

Not applicable.

Guarantor

Ivan Ivashov and Alisher Ismailbaev are the guarantors of submission and accepts full responsibility.

Declaration of competing interest

None of the authors have any conflict of interest to declare.

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