Case Report

Embolization of bronchial artery of anomalous origin: Management of two cases presenting with hemoptysis

Sengupta Saikat, Bandyopadhyay Saikat, Kumar Palas, Maitra Gaurab, Wankhede Ravi

Abstract

Life-threatening hemoptysis is one the most challenging condition encountered in critical care. Bronchial artery embolization (BAE) has become an established procedure, in the management of massive and recurrent hemoptysis. Bronchial arteries have variable anatomy. The reported prevalence of bronchial arteries with an anomalous origin ranges from 8.5 -35%. We are describing two patients who presented with hemoptysis and were effectively managed with bronchial artery embolization. Both these patients had anomalous origin of bronchial artery from the internal mammary artery, one from the Right Internal Mammary Artery (RIMA) and one from the Left Internal Mammary Artery (LIMA). The procedures were performed under general anesthesia. In the first case a double lumen endobronchial tube was used while in the second case, the patient was managed without tracheal intubation. The first patient was dyspnoeic; saturation was poor and was unable to maintain her airway probably due to profuse blood in her airways. We used a double lumen tube in her to isolate the diseased lung from the healthier lung. We gave her muscle relaxants and mechanical ventilation so that a stable lung field could be provided during embolization. The second patient was quite stable and comfortable while breathing room air. We decided not to interfere with his airway. A back-up plan and preparation for urgent airway control and lung isolation was done inside the catheterization laboratory. From the management point of view, an unstable patient with life-threatening hemorrhage needs airway control and lung isolation. A stable patient with minimum to moderate bleeding may be managed safely under general anesthesia with the patient spontaneously breathing.

Key words: Anomalous origin bronchial artery, embolization, hemoptysis

Life-threatening hemoptysis is one the most challenging condition encountered in critical care and requires a thorough investigation and timely intervention.[1] Despite advances in medical and intensive care management, massive hemoptysis remains a serious threat and has a mortality rate of >50%.[2] Conservative management of massive hemoptysis carries a mortality rate of 50-100%.[3] The cause of death is asphyxiation and not exsanguination.[4] The reported mortality rates for surgery performed for massive hemoptysis range from 7.1-18.2%.[5] However, the mortality rate increases significantly, up to 40%, when the surgery is undertaken as an emergency procedure.

Bronchial artery embolization (BAE) has become an established procedure, in the management of massive and recurrent hemoptysis; its use was first reported in 1973 by Remy *et al*.[6] The efficacy, safety and utility in controlling massive hemoptysis have been well-

From:
Department of Anaesthesiology, Perioperative Medicine and Pain, Apollo Gleneagles Hospitals, Kolkata. India

Correspondence:
Dr. Sengupta Saikat, 58 Canal Circular Road, Kolkata - 700 054, India.
E-mail: saikatsg@gmail.com

documented in many subsequent reports. Because of poor pulmonary reserve and other co-morbid conditions, most patients with massive hemoptysis are not good candidates for surgery.[3,4]

Bronchial arteries have variable anatomy with respect to origin, branching pattern and course.[7] Bronchial arteries arise from the Descending Thoracic Aorta, most commonly between the levels of T_5 and T_6 vertebrae. Bronchial arteries that originate outside the area between T_{5-6} vertebrae at the level of the major bronchi are considered to be anomalous.[8,9] The reported prevalence of these bronchial arteries with an anomalous origin ranges from 8.5 -35%.[9,10] These aberrant bronchial arteries may originate from the Aortic arch, internal mammary artery, thyrocervical trunk, brachiocephalic artery, pericardio-phrenic artery, inferior phrenic artery or from the abdominal aorta.

We are describing two patients who presented with hemoptysis and were effectively managed with bronchial artery embolization. Both these patients had an anomalous origin of bronchial artery from the internal mammary artery, one from the Right Internal Mammary Artery (RIMA) and one from the Left Internal Mammary Artery (LIMA).

The procedures were performed under general anesthesia.In the first case a double lumen endobronchial tube was used while in the second case, the patient was managed without tracheal intubation. Both patients tolerated the procedure well without any complications.

Case Reports

Case 1

A 65-year-old woman presented with a two-year history of hemoptysis, small in amount initially, but recently increasing in frequency and amount. CT scan of the chest showed bronchiectasis affecting the anterior segment of the right upper lobe. There was also narrowing and localized thickening of the right upper lobe bronchus. Flexible bronchoscopy was also done which showed widened secondary carina. Biopsy from bronchus, as well as broncho alveolar lavage specimen failed to reveal any underlying pathology. The patient was being prepared for right thoracotomy, frozen section of the suspected area and plan to proceed towards definitive surgery. However the patient suddenly developed severe hemoptysis one day. She was unable to maintain her saturation. Her saturation dropped to 80% on room air. Supplemental oxygen with a re-breathing bag brought her SpO_2 to 86%. She was shifted to the intensive care unit and her trachea was intubated and she was put on mechanical ventilation.

Despite endotracheal intubation, in the intensive care unit, her saturation was around 88-90% with a PaO_2 of 52 mm Hg while she was being ventilated on an a FiO_2 of 1.0. During this maneuver, she received muscle relaxants (Atracurium 40 mg) and was sedated with Fentanyl 100 μg and Midazolam 2 mg. It was seen that the tracheal tube started filling up with massive amounts of blood. A decision was then made to insert a double lumen endotracheal tube in order to isolate the right lung. After administration of further Fentanyl 25 μg, Midazolam 1.5 mg and Atracurium 25 mg a 35 F left side double lumen endotracheal tube (Portex, SIMS Portex Inc, Keene, USA) was introduced. The satisfactory position of the double lumen tube was confirmed by clamping the bronchial and tracheal lumens alternately and checking the air entry by auscultation. Isolation of the lungs was done using the air in water cuff-seal leak test. Position of the tube was also seen radiologicaly with the help of an image intensifier. The marker at the end of the tracheal lumen was seen above the carina and the marker at the left lumen was seen on the left side. Functional separation of the two lungs was established by a “catheter -under -water- technique” up to a pressure of 40 cm of H_2O. In this method, the left endobronchial cuff seal is checked by ventilating the left lung alone while no air bubble should emerge the right open suction port connected through a tube to beaker of water. We were challenged by the unavailability of a smaller sized pediatric fiberoptic bronchoscope. Following this the patient was shifted to the cardiac catheterization laboratory. On angiogram no bronchial artery could be seen arising from the descending thoracic aorta. An abnormal origin was sought and it was found to be arising from the RIMA. As many branches from the RIMA were also feeding the bleeding area, it was decided to embolize the RIMA at its ostium, which was done successfully by deploying two coils. Throughout the procedure, anesthesia was maintained with Midazolam, Fentanyl and muscle relaxation with Atracurium. ECG, SpO_2 $ETCO_2$, NIBP and urine output were monitored throughout the procedure. Patient tolerated the procedure

well. After the procedure, suctioning was performed through both the tracheal and bronchial lumens. Patient was shifted to the intensive care unit and the double lumen tube was replaced with a 7.5 mm single lumen cuffed endotracheal tube. The patient was electively ventilated for four hours, then weaned and extubated. The further course was uneventful. At one month follow up there was no recurrence of hemoptysis. However she has been lost to follow-up after that.

Case 2

A 24-year-old man presented to our hospital with complaints of intermittent hemoptysis, left sided chest pain and intermittent high-grade fever for two weeks. He had history of long standing chest problems. He was diagnosed and treated for pulmonary tuberculosis and bronchiectasis couple of years back. Chest X-ray showed patchy opacity on the left side of the chest. CT scan of the thorax showed bronchiectatic changes on the left side. Fibreoptic flexible bronchoscopy was done which revealed that the source of bleeding was a cavity in the left upper lobe and active bleeding was seen from the left main bronchus. Accordingly it was decided to perform a bronchial angiography followed by embolization of the feeder artery causing hemoptysis. Since this patient was in stable hemodynamic condition and was maintaining SpO_2 >98% on room air, we decided to undertake the procedure under Total Intravenous Anaesthesia (TIVA) with a spontaneously breathing patient on oxygen supplementation through a facemask. Monitoring was done with a three lead ECG, SpO_2, NIBP. He was premedicated with 0.2 mg of Glycopyrrolate i.v and sedated with Midazolam 2.5 mg and Fentanyl 100 μg i.v. Anesthesia was maintained with an initial bolus of Ketamine 25 mg and subsequently with two further doses of 10 mg Ketamine and 1 mg Midazolam. On angiography no bronchial artery could be seen arising from the descending thoracic aorta. An abnormal origin of the bronchial artery was sought and it was found to be arising from the Left Internal Mammary Artery (LIMA) and then distributing into the pulmonary tissue in multiple branches. Initially a small coil was placed at the origin of the bronchial artery arising from the LIMA, which however was not adequate to embolize the artery. Subsequently a bigger coil was placed, a part of which remained inside the LIMA showing successful embolization of the Left Bronchial as well as the LIMA at the proximal segment. The patient tolerated the procedure very well. Hemodynamic parameters and SpO_2 were well maintained and the postoperative period was uneventful.

Hemoptysis did not recur post procedure. At three months follow-up, he did not have any further episode of hemoptysis [Figures 1-2].

Discussion

Patients with hemoptysis can present in a critical condition necessitating urgent and appropriate management. Failure to do so can lead to serious complications. Bronchial arteries are the most common source of bleeding and their embolization is a recommended treatment adjunct to control bleeding. This reduces the need for emergency resections.[11]

The first patient was dyspnoeic; saturation was poor and was unable to maintain her airway probably due

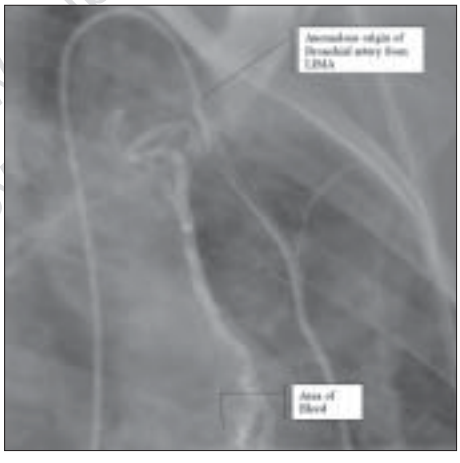

Figure 1: Showing anomalous origin of bronchial artery from LIMA and the area of bleed

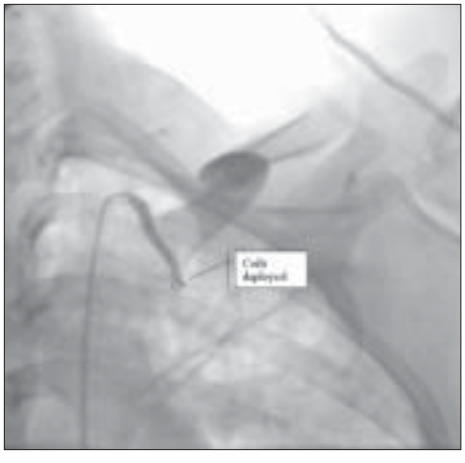

Figure 2: Showing coils in-situ and successful embolization of bronchial artery

to profuse blood in her airways. We used a double lumen tube in her to isolate the diseased lung from the healthier lung. It provided us with the option of selectively ventilating each lung if necessary. She received muscle relaxants mechanical ventilation so that a stable lung field could be provided during embolization.

The second patient was quite stable and comfortable while breathing room air. Therefore, we decided not to interfere with his airway. A back up plan and preparation for urgent airway control and lung isolation was done inside the catheterization laboratory.

We present two cases with aberrant origin of the bronchial artery, who presented with hemoptysis within a span of one week. The management, as has been described varies according to the condition of the patient. In patients with massive bleeds who have respiratory compromise, isolation of lungs is critical to successful outcomes. Early intervention and management of the bleed also reduces morbidity and mortality.

Coil embolization has the advantage of producing permanent result and coils are easily available and cheap. One needs to be aware that distal collateralization is a possibility in the future.

Embolization of bronchial arteries may lead to complications such as subintimal dissection, guide wire perforation and reflux of embolic agents into the aorta.[12] None of our patients had any of the above-mentioned complications.

To conclude, bronchial artery embolization is a recognized procedure for the management of bronchial artery bleed causing hemoptysis. From the anesthetic point of view, an unstable patient with life-threatening hemorrhage needs airway control and lung isolation. A stable patient with minimum to moderate bleeding may be managed safely under general anesthesia with the patient spontaneously breathing. General anesthetics provide a clear stable and quiet field, which facilitates embolization. Successful management of these life-threatening patients requires excellent teamwork. Close co-ordination between the pulmonologist, intensivist, anesthesiologist and intervention radiologist is needed in the management of such cases.

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