


MANAGEMENT OF COMPLICATION DURING BRONCHIAL ARTERY ANEURYSM EMBOLIZATION



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ABSTRACT

Abstract

Objective

To report our management technique of glue reflux occurring during embolization of a bronchial artery aneurysm.

Case Report

A 68-year-old Chinese male patient presented with an asymptomatic 1.5cm bronchial artery aneurysm, for which he underwent embolization with n-butyl-2-cyanoacrylate (NBCA) glue. During the procedure, a small volume of glue mixture was noted protruding out of the aneurysm into the aorta, which subsequently detached and travelled into the left external iliac artery and left popliteal artery. The glue cast in the left external iliac artery was snared and deposited into the left internal iliac artery, while the smaller fragment in the left popliteal artery was removed. Completion angiograms showed complete occlusion of the bronchial artery aneurysm, and patent bilateral iliac and left lower limb arteries. The patient remained asymptomatic and ultrasound scan one month later showed patent bilateral common, internal and external iliac arteries. Computed tomography performed 16 months post-embolization showed complete occlusion of the aneurysm.

Conclusion

This technical report describes a known complication of transcatheter embolization, non-target distal embolization, which must be recognised and managed well to avoid sequelae. This technical complication was recognised and managed as shown with no adverse outcome and good long-term treatment of the lesion.

الملخص

الغرض

الإبلاغ عن طريقة إدارة الارتداد الصمغي الذي يحدث أثناء إصمام تمدد الأوعية الدموية في الشريان القصبي.

تقرير حالة

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مريض ذكر صيني يبلغ من العمر 68 عاماً يعاني من تمدد الأوعية الدموية في الشريان القصي بحجم 1.5 سم بدون ظهور أي أعراض, وخضع بسببه لسد التمدد باستخدام مادة n-butyl-2-cyanoacrylate (NBCA) الغرائية. أثناء إجراء القسطرة باستخدام الأشعة التداخلية, لوحظ وجود الغراء في الشريان الأورطي, والذي انفصل لاحقاً وانتقل إلى الشريان الحرقفي الخارجي الأيسر والشريان المأبضي الأيسر. تم إزالة الغراء في الشريان الحرقفي الخارجي الأيسر ووضعه في الشريان الحرقفي الداخلي الأيسر, بينما تمت إزالة الجزء الأصغر في الشريان المأبضي الأيسر. أظهرت صور الأشعة التداخلية انسداداً تاماً لتمدد الأوعية الدموية في الشريان القصي, ووضوح للشرايين الحرقفية الثنائية والشرايين السفلية اليسرى. بقي المريض بدون أعراض وأظهرت فحوصات الأشعة الصوتية بعد مرور شهر ووضوح الشرايين الحرقفية. أظهر التصوير المقطعي المحوسب الذي تم إجراؤه بعد 16 شهراً من الانصمام انسداداً كاملاً لتمدد الأوعية الدموية.

الخلاصة

يصف هذا التقرير الفني أحد المضاعفات المعروفة للانصمام عبر القسطرة, والانصمام غير المستهدف, والتي يجب التعرف عليها وإدارتها بشكل جيد لتجنب العواقب. تم التعرف على هذه المضاعفات وإدارتها كما هو موضح بدون نتائج سلبية أو معالجة طويلة الأمد.

Keywords: aneurysm, bronchial artery, transcatheter embolization, n-butyl-2-cyanoacrylate, NBCA, glue, reflux, distal embolization

1. INTRODUCTION

Bronchial arterial aneurysm (BAA) is defined as focal dilatations involving any segment of the bronchial artery. It is a rare but potentially life-threatening entity that is seen in less than 1% of all cases of selective bronchial arteriography [1]. BAA can be incidentally detected on radiological examination, such as contrast-enhanced Computed Tomography (CT), although its incidence has not been reported. These aneurysms can be intrapulmonary or mediastinal in location, with clinical presentation dependent on their location, size and the presence of concomitant disease. Intrapulmonary aneurysms usually present as hemoptysis, while mediastinal aneurysms present with symptoms related to extrinsic compression or rupture into contiguous anatomic structures, e.g. hemothorax, hemomediastinum, superior vena cava obstruction, dysphagia, Horner syndrome, and hematemesi. Treatment should be recommended as soon as possible due to potential risk of rupture, although the causes of rupture are not well established and the risk of rupture has not been shown to be dependent on lesion size [2]. Management options include open surgery e.g. lobectomy, pneumonectomy, ligation of bronchial artery; or transcatheter embolization.

Transcatheter arterial embolization is now regarded as first line treatment because it allows minimally invasive curative treatment of a surgically difficult to reach lesion [3]. The procedure can often be performed on an outpatient basis under local anaesthesia and conscious sedation. Usual procedure times are 1-2 hours with radiation doses averaging 149.2 Gy•cm² [4]. Technical success occurs in more than 90% of interventions, with

clinical success immediately post-embolization reported in 73 – 99% [5] . The complications that have been described in literature include self-limiting chest pain (which is the most common, with a reported prevalence of up to 89%) [6] , bronchial stenosis, broncho-esophageal fistula as well as non-target embolization [7] . We found few case reports of non-target embolization: esophageal artery occlusion leading to transient dysphagia [8] , and spinal cord ischaemia resulting in transverse myelitis [9] . The recognition and management of this complication is hence vital to prevent long term sequelae for the patient.

Case Report

A 68-year-old Chinese male patient presented to our Interventional Radiology clinic with an incidental finding of a 1.5cm lobulated thoracic mass which was detected during a staging CT scan for newly diagnosed colon carcinoma (Figure 1). The patient was asymptomatic from this lesion but reported a past history of pulmonary tuberculosis. The lesion was located in the mediastinum and showed enhancement on intravenous contrast injection. Possible differentials for lesions in this region include saccular aneurysm of the descending aorta and bronchial arteriovenous malformation. However, the imaging appearances in this case are pathognomonic for BAA. After a multi-disciplinary discussion involving the referring oncologist and thoracic surgeon, decision was made to offer an elective transcatheter embolization procedure prior to initiation of neoadjuvant bevacizumab (Avastin[®], Genentech, California, USA).



Figure 1 Figure 1: Pre-embolization CT showing the bronchial artery aneurysm (white arrow)

The patient was counselled about the risks of the procedure including aneurysm rupture during embolization, recurrence of aneurysm and non-target embolization, and offered alternatives including surgical ligation and close imaging surveillance. The procedure was performed under local anaesthesia and conscious intravenous sedation. Under ultrasound guidance, the right femoral artery was punctured and a 6 French vascular sheath was advanced into the aorta under imaging guidance. Bronchial artery angiogram was performed using a 4 French “shepherd hook” (SHK) (Cordis, Florida, USA) catheter which showed a bilobed aneurysm arising from the origin of the common bronchial artery (Figure 2). The right and left bronchial arteries arose from the distal aspect of the aneurysm. No spinal artery was visible.



Figure 2 Bronchial artery angiogram showing a bilobed aneurysm arising from the origin of the common bronchial artery (black arrows).

Through the 4 French catheter, a 2.7 French Progreat (Terumo Co., Tokyo, Japan) microcatheter was advanced coaxially into the aneurysm and a 20% mixture of n-butyl-2-cyanoacrylate (NBCA) glue and Lipiodol infused slowly. This demonstrated complete filling and occlusion of the aneurysm. The injection was immediately stopped when we noted a small (circa 0.2ml) volume of glue mixture protruding out of the aneurysm into the aorta (Video). The glue component stretched with blood flow and formed a thin glue cast within the aortic lumen.

Immediate suction was applied on the catheter and the glue cast was brought inferiorly up to the aortic bifurcation. However, the glue cast detached at this point and travelled into the left external iliac artery and left popliteal artery (Figure 3). The left femoral artery was then accessed and a 6 French sheath placed directed towards the aorta and 5000 units of intravenous heparin was administered. The glue cast in the left external iliac artery

was snared with a 6 French 15mm diameter Ensnare and deposited into the left internal iliac artery. The glue cast was molded to the outer wall of the vessel using a balloon to maintain patency of the artery. A small separate glue fragment which had migrated to the left popliteal artery was snared out and removed.

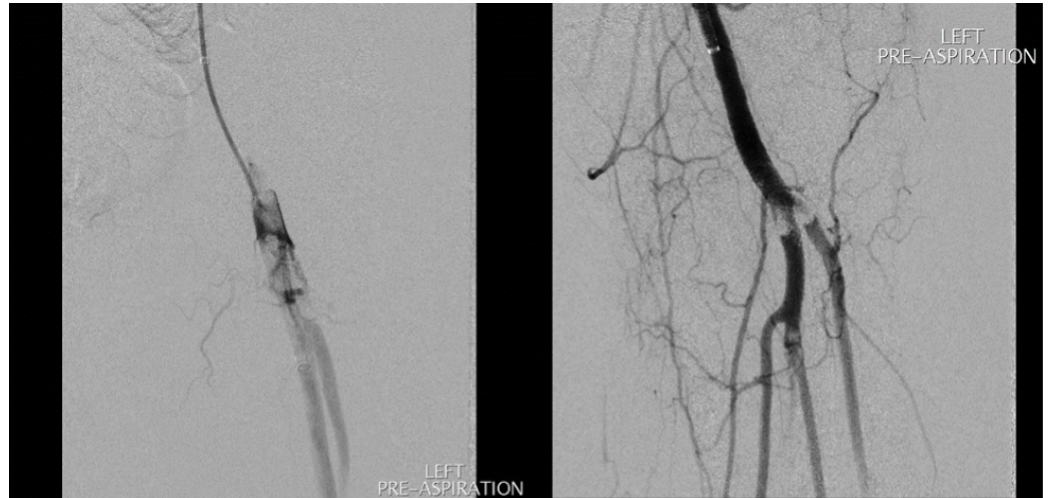


Figure 3 Angiogram of the left external iliac artery (left) and left popliteal artery (right), showing a filling defect (arrowhead) within the artery, corresponding to the site of glue embolization.

Completion angiograms showed complete occlusion of bronchial artery aneurysm, and patent bilateral iliac and left lower limb arteries (Figure 4). The patient remained asymptomatic throughout the procedure and was discharged well after a period of observation in the ward.

One-month post procedure ultrasound examination again showed patent bilateral common, internal and external iliac arteries. Computed tomography performed 3 months and 16 months post-embolization showed complete occlusion of the aneurysm with hyperdense glue material (Figure 5). The patient remains asymptomatic with no lower limb sequelae.

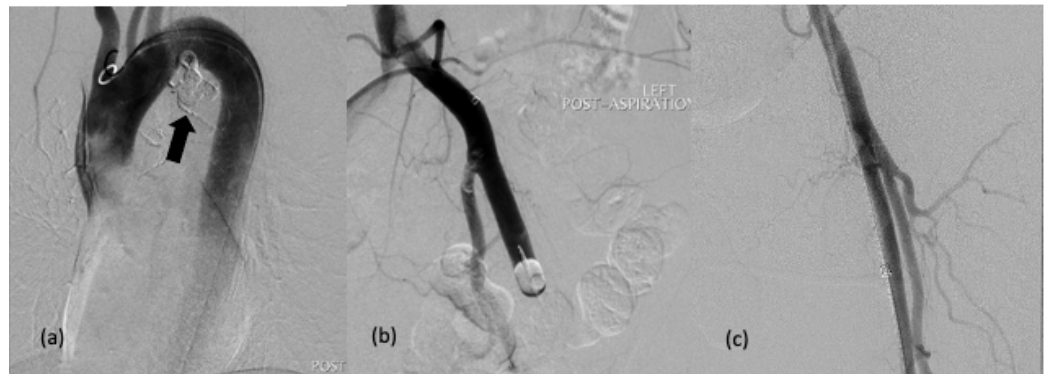


Figure 4 (a) Completion bronchial angiogram showing complete occlusion of bronchial artery aneurysm (black arrow). (b) and (c) Lower limb angiogram showing patent left iliac arteries (left) and left popliteal and lower limb arteries (right).

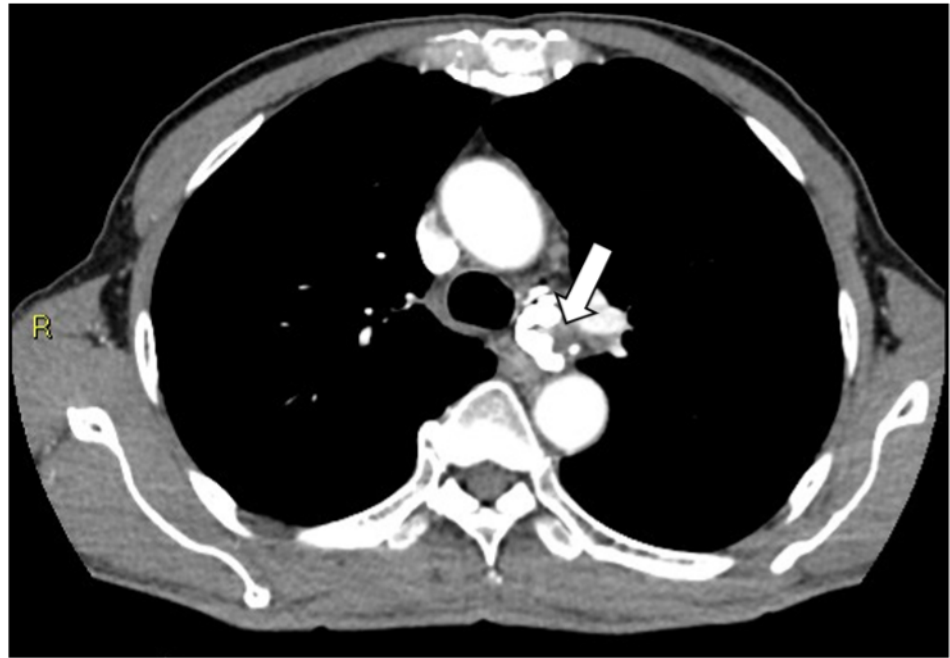


Figure 5 16-month post embolization CT showing complete occlusion of the aneurysm with hyperdense glue material (white arrow).

2. DISCUSSION

Bronchial artery aneurysms are uncommon, but massive hemoptysis or rupture of the aneurysm can be life-threatening [1]. While their exact pathogenesis is not well known, it has been linked to chronic lung diseases like bronchiectasis, infections, and vascular abnormalities like Rendu-Osler-Weber syndrome. These aneurysms are usually asymptomatic and can be diagnosed incidentally on CT. After diagnosis, treatment should be advised early due to their potential risk of rupture, not thought to be associated with the diameter of the aneurysm [2].

Treatment options include open surgery e.g. lobectomy, pneumonectomy, ligation of bronchial artery; or transcatheter embolization. Transcatheter arterial embolization has now been regarded as first line treatment as it is minimally invasive with significantly reduced hospital stay and relatively low morbidity compared to open surgery [5].

Relatively few serious adverse complications of bronchial artery embolization have been reported in the literature. Minor adverse outcomes include transient chest pain (which is the most common, with a reported prevalence of up to 89%) [6] and dysphagia. Major complications include bronchial infarction, esophago-bronchial fistula and non-target distal embolization, resulting in transverse myelitis, stroke or ischaemic colitis.

Various embolic agents have been studied for use in bronchial artery aneurysm embolization. Older studies did not favor the use of liquid embolic agents like glue due to its high risk of severe complications, such as tissue necrosis [10]. Instead, polyvinyl alcohol particles (PVA) were then the most frequently used embolic agent. However, newer studies comparing PVA and glue have found that embolization with glue provided higher hemoptysis-free survival rates, without increased complication rates [11].

Glue has few advantages when compared to other embolic agents: it results in fast and complete vascular occlusion, controlled embolization by adjustment of polymerization rates, and relatively short procedure time [12]. Glue polymerizes rapidly on contact with ionic solutions like blood, and forms a cast which molds to the shape of the aneurysm thus providing complete luminal occlusion. This compares favorably with particles or coils which do not completely occlude the aneurysm but instead rely on thrombus formation within the vessel to cause occlusion. Hence, there is a significantly higher risk of vessel recanalization with PVA or coils, resulting in the need for close imaging monitoring to detect aneurysm regrowth or potential for rupture. On the other hand, glue has the potential to reflux backwards as it is injected or adhere to the microcatheter tip and detach when the microcatheter is withdrawn. Therefore, due to its unpredictable nature, it is important to take caution to avoid reflux and subsequent non-target embolization.

There are several measures to reduce the risk of non-target glue embolization during embolization procedures. Firstly, the proportions of glue to iodized oil can be varied to alter the rate of glue polymerization. This allows us to manipulate the degree of vessel penetration with glue, to achieve a more controlled embolization. In a study by Dong Hyun Yoo et al, [13] the concentration of glue was adjusted according to the characteristics of the vessels being embolized, for example, in larger vessels with rapid blood flow and those associated with prominent bronchopulmonary shunt, a lower ratio of glue to iodized oil was used for faster polymerization. The authors reported no ischemic complications, such as lung parenchymal infarction.

Secondly, super-selective embolization of the target bronchial artery, using a coaxial microcatheter technique allows stability deep within the aneurysm thus reducing the risk of glue reflux. A retrospective analysis by Tanaka et al [14] demonstrated superiority of super-selective (embolization of the bronchial artery past the spinal and mediastinal branches) compared to non-super-selective (embolization at the origin of the bronchial artery) embolization. In their series, no patient in the super-selective group developed spinal infarction from embolization of the embolic material into the spinal artery, versus 4% in the non-super-selective group.

Finally, the catheter tip should be maintained in the target artery after embolization until the catheter has been thoroughly flushed and/or a guidewire has been inserted

through it, to minimize shedding of glue fragments attached to the catheter lumen post embolization. In the event glue embolization is detected, the size, shape and location of the glue fragment should be identified. Thereafter, management [15] includes retrieving the glue embolus through a catheter, if it is small enough to be retrieved through a sheath, using a loop snare or thrombo-embolectomy balloon; or if it is too large to be retrieved, to relocate the embolus back to the target site, if it is settled in close proximity to the target lesion, or to park the embolus in a suitable vascular bed. After redirecting the glue fragment to a designated vascular bed, an endograft may be deployed across the embolic cast, trapping it against the vessel wall, to eliminate the risk of further fragmentation and downstream vessel compromise.

3. CONCLUSION

This technical case report describes our management of non-target glue embolization during BAA embolization with good long-term outcomes, as well as measures to reduce the risk of such complications during subsequent embolization procedures.

CONFLICT OF INTEREST

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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N/A

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