

Treatment of Acute Hemoptysis by Bronchial Artery Embolization with the Liquid Embolic Agent Ethylene Vinyl Alcohol Copolymer

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ABSTRACT

Purpose: To determine the technical and clinical success of bronchial artery embolization (BAE) with the liquid embolic agent ethylene vinyl alcohol (EVOH) copolymer in patients with acute hemoptysis.

Materials and Methods: Thirty-four patients (25 male; mean age, 58 y; range, 13–78 y) who underwent BAE with EVOH were retrospectively reviewed. Reasons for acute hemoptysis included lung cancer (44%), pulmonary metastases (12%), bronchiectasis (21%), arteriovenous malformation (5%), tuberculosis (6%), aspergilloma (3%), acute respiratory distress syndrome (3%), anticoagulant overdose (3%), and scar tissue (3%). Technical and clinical success of BAE were retrospectively assessed.

Results: Embolization was technically successful in 94% of patients. Additional embolization material was needed in 4 patients (12%). The immediate clinical success rate was 94% (32 of 34); in 2 patients (6%), hemoptysis recurred immediately after the intervention or could not be stopped. Periinterventional minor complications included headache (n = 1), fever (n = 1), and acute renal failure (n = 1). During follow-up (mean, 8.8 mo), 5 patients had a recurrence of hemoptysis (15%).

Conclusions: The use of EVOH copolymer for BAE in patients with acute hemoptysis is technically successful and safe and has a good clinical outcome with a low number of recurrences.

ABBREVIATIONS

BAE = bronchial artery embolization, EVOH = ethylene vinyl alcohol, PVA = polyvinyl alcohol

Bronchial artery embolization (BAE) is used as the primary treatment for acute hemoptysis in patients who are not technically treatable by bronchoscopy or are not candidates

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for surgical treatment because of poor clinical status (1). For embolization of bronchial arteries, various embolic materials have been used, such as coils, microspheres, and polyvinyl alcohol (PVA) particles (1,2). In a small patient series, Khalil et al (3,4) showed the technical feasibility and safety of using the liquid embolic agent Onyx (ethylene vinyl alcohol [EVOH] copolymer; Medtronic, Tolochenaz, Switzerland) in the embolization of bronchial and pulmonary arteries in patients with acute hemoptysis. The risk of small shunts and displacement of the embolic agent is lower with the use of Onyx compared with PVA particles. In addition, embolization with Onyx allows a longer time for proper placement of the embolic agent compared with glue embolization. The aim of the present retrospective study was to examine the efficacy and clinical outcome of embolization with the liquid embolic agent EVOH in the treatment of acute bronchial artery bleeding of various causes in a larger series of patients than reported previously (3,4) treated in two medical centers.

MATERIALS AND METHODS

Patients

This retrospective study was approved by the local institutional review board, under which both treatment centers were included. Thirty-nine patients were identified who were admitted for BAE between March 2004 and April 2015.

Five of these patients (13%) were excluded: in one patient, the selective catheterization of the bronchial artery was primary successful, but the catheter could not be advanced beyond a few centimeters because of dissection of the artery. In three patients, the feeding artery was not accessible because of the anatomic course and a small diameter. In the last patient, a tumor-feeding artery could not be detected.

In the remaining 34 patients (25 male, nine female; mean age, 58 y; age range, 13–78 years), BAE was performed with the liquid embolic agent EVOH (Onyx). Reasons for acute bleeding were bronchial carcinoma (n = 15; 44%), pulmonary metastasis of extrathoracic malignancies (n = 4; 12%), bronchiectasis (n = 7; 21%; n = 3 with cystic fibrosis), arteriovenous malformation (n = 2; 6%), tuberculosis (n = 2; 6%), aspergilloma (n = 1; 3%), acute respiratory distress syndrome (n = 1; 3%), anticoagulation overdose (n = 1; 3%), and scar tissue after shooting trauma (n = 1; 3%). The right side of the lung was affected in 22 patients (65%), the left side in eight (24%), and both sides in four (12%). Bronchoscopy was performed before the intervention. Contrast-enhanced computed tomography (CT) was performed to identify the feeding artery in all patients. BAE with EVOH copolymer was performed under local (n = 23; 61% of sessions) or general anesthesia (n = 15; 40% of sessions) by five interventional radiologists with at least 10 years of experience. General anesthesia was used if the patient was in a clinically critical situation and could not control the coughing reflex.

All images and clinical data were retrospectively reviewed in our electronic medical record system. In the present study, 24 patients (71%) underwent follow-up for a mean of 8.8 months (range, 5–1,150 d). Ten patients (29%) did not attend follow-up and had no further hospitalization.

Embolization Technique

BAE was performed through a 5-F femoral access in all cases. A diagnostic angiogram of the aortic arch and descending aorta was obtained to identify the origins of the bronchial arteries, intercostal arteries, and internal thoracic arteries via a 5-F pigtail catheter (eg, Cordis, Fremont, California) with 20–30 mL of contrast agent injected at a rate of 10 mL/s. Based on the results of bronchoscopy, contrast-enhanced CT, and diagnostic angiography, the most likely bleeding artery was selectively catheterized with a cobra-shaped catheter (eg, 5-F Cobra; Cook, Bloomington, Indiana) or a catheter with a reverse curve (SOS Omni Flush; AngioDynamics, Latham, New York). Subsequently, a dimethyl sulfoxide-compatible microcatheter (eg, Echeleon 10, Apollo 10, or Rebar 18; Medtronic) was superselectively inserted and placed proximal to the bleeding vessel. The microcatheter was then preflushed with dimethyl sulfoxide to fill its empty space (0.29–0.49 mL). Embolization with EVOH was then performed under fluoroscopy with very slow injection to avoid nontarget embolization (Figs 1, 2). In patients with arteriovenous malformations and in cases with large, tortuous communicating bronchial arteries caused by chronic inflammatory bronchiectasis (Fig 3), the “plug-and-push” technique was used to occlude the whole pathologic network of bleeding arteries. For this technique, microcatheters with a detachable tip were used (eg, 5-cm detachable-tip Apollo; Medtronic). EVOH was injected slowly under fluoroscopy until

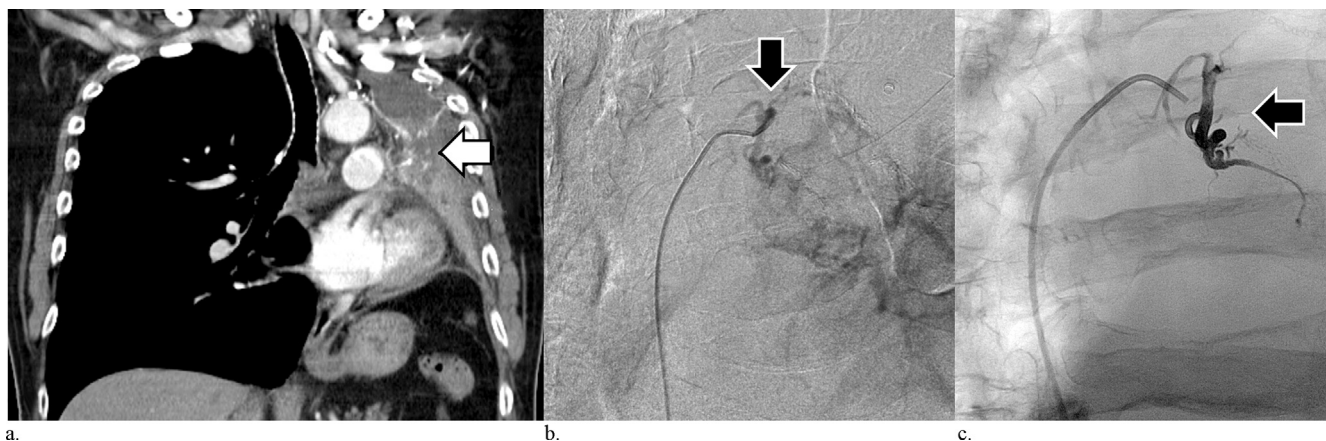


Figure 1. (a) Coronal reconstructed contrast-enhanced CT scan of a 61-year-old patient with a bronchial carcinoma shows an inhomogeneous enhancing mass of the left lung with atelectasis and mediastinal shift to the left. Multiple tumor-feeding vessels are seen originating from the left bronchial artery (arrow). (b) Selective angiogram of the left bronchial artery with a 5-F cobra catheter illustrates a diffuse distribution of the contrast media as a result of tumor blush (arrow). (c) After embolization with 1.0 mL Onyx-18, the bronchial artery is completely occluded (arrow).

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