Results of Bronchial Artery Embolization for the Treatment of Hemoptysis Caused by Neoplasm

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ABSTRACT

Purpose: To describe experience with bronchial artery embolization (BAE) in a cohort of patients with cancer.

Materials and Methods: All consecutive patients with cancer and at least one episode of hemoptysis that required BAE during a 14-year period were included in this observational retrospective review. The endpoints of the study were immediate success, recurrence of hemoptysis, mortality resulting from hemoptysis, and all-cause mortality.

Results: Immediate control of bleeding was achieved in 31 of 40 patients (77.5%). Recurrence requiring BAE occurred in eight patients (20%). Cumulative hemoptysis control rate was 0.90 (95% confidence interval [CI], 0.80–1.0) at 1 month and 0.65 (95% CI, 0.44–0.86) at 6 months. Probability of survival was 0.75 (95% CI, 0.62–0.88) at 1 month, 0.42 (95% CI, 0.27–0.57) at 6 months, 0.36 (95% CI, 0.21–0.51) at 12 months, and 0.08 (95% CI, 0.0–0.18) at 3 years.

Conclusions: BAE is an effective and safe technique in the treatment of hemoptysis in patients with cancer. Nevertheless, mortality resulting from hemoptysis and recurrence rate are high among these patients secondary to progression of the underlying disease.

ABBREVIATIONS

BAE = bronchial artery embolization, CI = confidence interval, PVA = polyvinyl alcohol

Since its first description by Remy et al (1), bronchial artery embolization (BAE) has become an established procedure in the management of massive and recurrent hemoptysis. Its efficacy, safety, and utility have been established (2–12). Although the most common indication for BAE is hemoptysis resulting from benign lung diseases such as bronchiectasis, cystic fibrosis, or tuberculosis, embolization may also be effective in controlling hemoptysis in patients with cancer. Although BAE is routinely performed in patients with hemoptysis secondary to neoplasm, several studies have reported that BAE in patients with lung cancer is associated with a high failure rate (4,10) and increased mortality (13). Nevertheless, the few studies that have focused exclusively on patients with hemoptysis secondary to malignancy have reported better results (14–16). The aim of this study was to report our experience with BAE in a consecutive group of patients with cancer and hemoptysis that required BAE and to evaluate retrospectively the efficacy and safety of the technique.

MATERIALS AND METHODS

Patient Population

This observational retrospective study comprised patients presenting with life-threatening or persisting hemoptysis who underwent BAE at Hospital Universitari Germans Trias i Pujol, a tertiary-care hospital in Badalona, Spain. Life-threatening hemoptysis was defined as bleeding amounting to 200 mL during 24 hours, 100 mL daily during at least 3 days, or minor bleeding with hemodynamic instability. All consecutive patients with at least

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one episode of hemoptysis that required BAE during a 14-year period (January 1999 to December 2012) with a histologically confirmed diagnosis of either primary lung cancer or extrapulmonary cancer with pulmonary metastases were included. The clinical records were reviewed, and the following data were collected for analysis: age, sex, diagnosis, BAE findings, and time period between embolizations in case of recurrence. Written informed consent was obtained from patients before embolization. The research protocol was approved by the regional ethics committee (Ethics Committee for Clinical Research of the Hospital Universitari Germans Trias i Pujol).

BAE

According to our institution protocol, platelet count, international normalized ratio, and activated partial thromboplastin time were reviewed before angiography, and any coagulation disorders were corrected before the procedure. No patient was coagulopathic at the time of angiography. No other therapeutic measures were attempted before BAE. All procedures were performed by one of two interventional radiologists with $>$ 10 years of experience. The choice of catheter, microcatheter, and embolization materials was made at the discretion of the operating physician. BAE was performed using the Seldinger technique via the femoral approach except in one patient in whom BAE was performed via a brachial approach owing to extreme tortuosity of the supraaortic trunks. A descending thoracic aortogram was obtained at the beginning of the procedure, followed by selective catheterization of bronchial arteries using various shaped 4-F (Cobra 2, Radiofocus Glidecath; Terumo, Somerset, New Jersey) and 5-F angiographic catheters (Pigtail, Imager II; Boston Scientific, Natick, Massachusetts; Amplatz Left 2 Performa; Merit Medical, South Jordan, Utah). If no abnormal bronchial arteries were identified, nonbronchial systemic arteries were selectively catheterized, depending on the known site of pulmonary disease (assessed by x-ray, computed tomography (CT) scan, or diagnostic bronchoscopy). Target vessels were superselectively catheterized using a 3-F coaxial microcatheter system (Progreat; Terumo) if stable cannulation could not be achieved or if more distal cannulation of the vessel was required to avoid important side branches, such as the anterior spinal artery. The embolic material used was nonspherical polyvinyl alcohol (PVA) particles (Contour; Boston Scientific) (years 1999–2008) or gelatin cross-linked acryl microspheres (Bead Block; Biocompatibles, Farnham, Surrey, United Kingdom) (years 2009–2012) for proximal vessels and metal coils (VortX 18 Diamond; Boston Scientific) for proximal and larger arteries (especially when pseudoaneurysms in the bronchial arteries or arteriovenous malformations were present, which occurred in two patients). Embolization was performed of all abnormal vessels supplying the area of interest if technically possible. If there was no detectable underlying pulmonary abnormality, embolization was performed of all bronchial arteries on the side of the tumor that could be catheterized. Embolization was performed to complete stasis. Contraindications to embolization were visualization of the anterior spinal branch (if it was not possible to advance the catheter beyond this point) and catheter instability. Pulmonary angiography was not routinely performed.

No embolizations were performed by using coils alone. Of the 40 embolization procedures, 23 (57.5%) were performed by using PVA particles alone. The size of PVA particles ranged from 300–500 μm (n = 12) and 500–700 μm (n = 11). Of the 40 embolization procedures, 16 (40%) were performed by using microspheres alone. The size of the microspheres ranged from 300–500 μm (n = 10) and 500–700 μm (n = 4). In two procedures, a combination of microspheres 300–500 μm and 500–700 μm was used. In one procedure, a combination of microspheres 300–500 μm and PVA particles 300–500 μm was used.

Data Analysis

The endpoints of this study were immediate success of the procedure, recurrence of hemoptysis, mortality secondary to hemoptysis, and all-cause mortality. Immediate success was defined as cessation of hemoptysis during the same admission, whereas failure was indicated by continued or recurrent hemoptysis during the same admission. Recurrence was defined as an episode of life-threatening hemoptysis or persisting hemoptysis requiring BAE in a patient with a previous BAE performed. Indications for BAE in recurring hemoptysis were the same as for the initial bleeding event (bleeding of 200 mL during 24 hours, 100 mL daily during at least 3 days, or minor bleeding with hemodynamic instability). Patient status at the end of the follow-up period was thoroughly investigated, including a review of hospital and outpatient medical records, computerized databases, and telephone contact with the patient or family members or primary care physician when necessary. When a patient died, the date of death was obtained from hospital medical records, if he or she died in the hospital, or from official death certificates.

Statistical Analysis

The statistical package SPSS, version 19.0 (SPSS, Inc, Chicago, Illinois), was used for statistical analysis. All data were tabulated as mean and standard deviation in the case of quantitative variables and as absolute numbers and percentages in the case of qualitative variables. Survival curves for the groups were constructed according to the Kaplan-Meier method. Survival curves were compared using the log-rank test.

RESULTS

During the study period, 40 patients with life-threatening hemoptysis secondary to neoplastic disease were