CLINICAL STUDY

Outcomes of Pulmonary Artery Embolization and Stent Graft Placement for the Treatment of Hemoptysis Caused by Lung Tumors

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ABSTRACT

Purpose: To evaluate the safety and efficacy of endovascular management of pulmonary artery lesions caused by lung tumors.

Materials and Methods: Nineteen patients (15 men, 4 women; average age: 60.3 years, range, 51–86 years) treated for massive or recurrent hemoptysis with transarterial pulmonary artery embolization between 2010 and 2016 were included in this multicenter, retrospective study. Inclusion criteria were: patients with lung cancer and at least 1 episode of hemoptysis with a pulmonary artery lesion detected by computed tomography (CT) angiography or after failed bronchial artery embolization. No patient undergoing pulmonary embolization for a lung tumor was excluded. Technical success, clinical success, and complications were recorded. The survival curve was estimated using the Kaplan-Meier method

Results: Mean follow-up was 188.1 days (range, 0–1440 days). Primary and assisted technical success rates were 73.7% (14/19) and 84.2% (16/19), respectively. Two patients died during the procedure due to massive hemoptysis and cardiac arrest, and 1 patient was treated with surgery. All patients with technical success achieved clinical success without further bleeding. No complications were noted, and no pulmonary infarction was detected on CT scan during follow-up. Survival rates after embolization at 1 and 3 months were 67% (95% confidence interval [CI]: 40%–90%) and 46% (95% CI: 23%–80%), respectively, with 36.8% (n = 7) of the patients still alive at the end of the study.

Conclusions: Embolization is an effective and safe treatment of lung tumors with pulmonary arterial bleeding.

ABBREVIATIONS

BAE = bronchial artery embolization, CI = confidence interval, SD = standard deviation

Hemoptysis is a life-threatening clinical situation (1), with approximately 20% of lung tumor patients developing hemoptysis, of whom 3% will die due to massive bleeding (2). Hemoptysis mainly originates from the bronchial arteries, or from the pulmonary arteries in less than 10% of patients (3,4). Interventional radiology is an important part of hemoptysis management, and a computed tomography (CT) scan is useful to determine the cause and guide patient management (5).

Presently, bronchial artery embolization (BAE) is the first-line treatment. However, for lung tumor patients, hemoptysis recurrence and mortality are high after BAE, with reported recurrence of 20% (6). Pulmonary artery embolization should be performed when an abnormality, such as erosion or pseudoaneurysm of a pulmonary artery, is diagnosed on CT (7) and after failure or recurrence of BAE. Reports on efficacy and safety of embolization of pulmonary arteries have been limited to small case series on infectious diseases (8,9) and iatrogenic or traumatic pulmonary pseudoaneurysms (10). Pulmonary artery embolization on lung tumors has not been reported.

The purpose of this study was to evaluate the safety and efficacy of endovascular management of pulmonary artery lesions caused by lung tumors.

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EDITORS' RESEARCH HIGHLIGHTS

- Pulmonary artery lesions may be responsible for hemoptysis in patients with lung cancer and should be considered based on CT angiography findings or in those patients with persistent bleeding after bronchial artery embolization.
- Main findings include irregularity of the pulmonary arterial wall (n = 11), pseudoaneurysm (n = 6), truncated vessel (n=1) and pulmonary artery tumoral thrombosis (n = 1).
- Endovascular treatment may be an effective treatment option with different embolic agents and stent-grafts achieving a technical success rate of 84.2% (16/19).
- A high mortality rate of 11% (2/19 patients) was reported due to intraprocedural massive hemoptysis and heart arrest.
- All patients with technical success did not have rebleeding during the entire follow-up time.

MATERIALS AND METHODS

Patients

All lung cancer patients with hemoptysis who received endovascular pulmonary artery embolization or stent graft placement between 2010 and 2016 in 3 university hospitals were retrospectively included. All patients provided signed inform consent.

Each patient was categorized by age, histologic type of cancer, disease stage, type of ongoing treatment, hemoptysis volume, hemodynamic status, and any previous bronchoscopy treatment. Their first BAE (the presence of hypertrophied arteries, a tumoral parenchymography) was included, as well as their 1- and 3-month survival rates after embolization and the survival rates at the end of the study.

All patients were first examined with a 1-mm collimation CT device after administration of contrast material (Xenetix 350; Guerbet, Aulnay, France) (3 mL/sec, 400 mg of iodine per kilogram of body weight). The acquisitions were started 45 seconds after intravenous injection, to obtain maximum opacification of the pulmonary and bronchial arteries at the same time. The presence of pulmonary artery lesions (pseudoaneurysm, truncated vessel, irregularity of arterial wall, pulmonary artery tumoral thrombosis), the presence of necrosis or cavitation, tumor invasion of a proximal lobar pedicle near the hilum, and the size of systemic bronchial arteries (normal diameter less than 1.5 mm) were analyzed.

Inclusion criterion was hemoptysis due to lung cancer with a pulmonary artery lesion detected by CT angiography (12/19 patients) or after failed BAE (7/19 patients). No patient undergoing pulmonary embolization for a lung tumor during this period was excluded.

Between 2010 and 2016, 19 lung cancer patients (15 men, 4 women; mean age: 60.3 years [range, 51–86 years, standard deviation [SD]: 15]) were treated with pulmonary transarterial embolization or stent graft placement for hemoptysis (Table 1).

Table 1. Patient Characteristics

Patient Characteristics	N (range)
Average age in years (range)	60.3 (51–86)
Sex:	
Men	15
Women	4
Hemoptysis:	
Massive	7
Medium	10
Minimal	2
Hemodynamic status:	
Instability	5
Stable	12
Blood transfusion	2
Previous bronchoscopy treatment:	
Yes	9
No	10
Previous radiotherapy	2
Previous chemotherapy	12
Platinum with anti EGFR	5
Folic acid with platinum	3
Platinum with taxol	2
Platinum with etoposide	1
Nivolumab	1
Histology	
Adenocarcinoma	10
Epidermoid	1
Neuroendocrine	5
Sarcoma metastasis	2
Unknown	1
Staging	
IA	0
IIB	2
IIIA	0
IIIB	6
IV	11

EGFR = epidermal growth factor receptor.

Nine patients (47.3%) received bronchoscopy treatment prior to embolization. Fourteen patients had received prior treatment for their lung cancer (Table 1).

For 12 patients (63%), pulmonary artery embolization was the initial treatment because of a pulmonary artery abnormality found on CT. For 7 patients, the origin of the bleeding was less clear. Bronchial embolization was attempted first for each of these 7 patients, but this failed to stop hemoptysis in all cases. Any coagulation disorders were corrected before the procedure.

Endovascular Management

All transarterial procedures were performed on 1 of 2 angiographic units (Philips, Best, Netherlands, and General Electric, Boston, Massachusetts). Procedures were performed under