

**Hemoptysis
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Castaner E, Alguersuari A, Gallardo X, et al. When to suspect pulmonary vasculitis: radiologic and clinical clues. <i>Radiographics</i> . 2010; 30(1):33-53.	Review/Other-Dx	N/A	To review the classification and clinical characteristics of pulmonary vasculitis. Radiologic, pathologic, and clinical features of the primary vasculitides that most frequently affect the thorax are described. Authors also discuss the radiologic findings and the underlying causes of diffuse alveolar hemorrhage.	The authors emphasize an integrated radiologic and clinical approach for accurate diagnosis.	4
2. Delage A, Tillie-Leblond I, Cavestri B, Wallaert B, Marquette CH. Cryptogenic hemoptysis in chronic obstructive pulmonary disease: characteristics and outcome. <i>Respiration</i> . 2010; 80(5):387-392.	Observational-Dx	39 patients	To assess the functional characteristics of COPD patients presenting with cryptogenic hemoptysis, the risk factors for cryptogenic hemoptysis and the severity of hemoptysis, as well as long-term outcome.	21 patients (54%) had at least 1 risk factor for prolonged bleeding. Patients with more severe airflow obstruction tended to have more severe bleeding. Bronchoscopy appeared as useful as a CT in locating the bleeding site. Arterial embolization succeeded in controlling bleeding in all patients who underwent angiography. One patient experienced a relapse in bleeding at 2 months. One developed lung cancer after 1 year. 34 patients were followed for an average of 5 years. Only 2 subjects experienced recurrent hemoptysis. None died.	3
3. Menchini L, Remy-Jardin M, Faivre JB, et al. Cryptogenic haemoptysis in smokers: angiography and results of embolisation in 35 patients. <i>Eur Respir J</i> . 2009; 34(5):1031-1039.	Observational-Dx	35 patients	To describe angiographic findings and embolization results in smokers with haemoptysis.	Bronchoscopy depicted focal submucosal vascular abnormalities in 3 patients and only endobronchial inflammation in 32 (91%) patients. Bronchial artery angiography revealed moderate (n=18) or severe (n=10) hypervascularisation in 28 (80%) patients, and normal vascularization in 7 (20%). No statistically significant difference was observed between the angiographic findings and the severity of COPD, tobacco consumption or the amount of bleeding. Cessation of bleeding was obtained by embolization in 29/34 technically successful procedures (85%), requiring surgery in 3/5 patients with recurrence. Follow-up (mean duration 7 years) demonstrated no recurrence of bleeding in 32 (94%) out of 34 patients and excluded late endobronchial malignancy. Smokers with various stages of COPD severity may suffer from haemoptysis that is efficiently treatable by endovascular treatment.	3

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4. Poe RH, Israel RH, Marin MG, et al. Utility of fiberoptic bronchoscopy in patients with hemoptysis and a nonlocalizing chest roentgenogram. <i>Chest</i> . 1988; 93(1):70-75.	Observational-Dx	196 patients	To develop predictors that might help to identify the patient with hemoptysis who needs to have FOB, the authors reviewed their community's experience with this population over a 5-year period.	By univariate and discriminant analyses, the authors found that the 3 factors of age of 50 years or more, male sex, and smoking of 40 pack-years or more best predicted a diagnosis of malignancy. Bleeding in excess of 30 ml daily was associated with an increase in overall diagnostic yield. The presence of two of the three factors associated with malignancy or bleeding in excess of 30 ml daily (or both) identified 100% of the patients with bronchogenic carcinoma and 82% of all of the diagnostic fiberoptic bronchoscopic procedures.	4
5. Revel MP, Fournier LS, Hennebicque AS, et al. Can CT replace bronchoscopy in the detection of the site and cause of bleeding in patients with large or massive hemoptysis? <i>AJR Am J Roentgenol</i> . 2002; 179(5):1217-1224.	Observational-Dx	80 patients	To assess the capacity of chest radiography and CT to determine the cause and site of bleeding in patients with either large or massive hemoptysis compared with bronchoscopy.	Findings on chest radiography were normal in only 13% of patients, of whom 70% had bronchiectasis. The chest radiographs revealed the site of bleeding in 46% of the patients and the cause in 35%, most of whom had tuberculosis or tumors. CT was more efficient than bronchoscopy for identifying the cause of bleeding (77% vs 8%, respectively; P<0.001), whereas the two methods were comparable for identifying the site of bleeding (70% vs 73%, respectively; P=not significant).	3
6. Herth F, Ernst A, Becker HD. Long-term outcome and lung cancer incidence in patients with hemoptysis of unknown origin. <i>Chest</i> . 2001; 120(5):1592-1594.	Review/Other-Dx	722 patients	To provide current data on the long-term outcome and incidence of lung cancer in a large cohort of patients with hemoptysis of unknown origin.	135 patients (19%) had hemoptysis of unknown origin; follow-up data were obtained in 115 patients, of whom 100 were still alive. The mean time of observation was 6.6 years after initial presentation. Lung cancer developed in 7/115 patients (6%) and was unresectable once detected; all of these patients were smokers >40 years old, and malignancy developed within 3 years after first presentation.	4
7. Bruzzi JF, Remy-Jardin M, Delhaye D, Teisseire A, Khalil C, Remy J. Multi-detector row CT of hemoptysis. <i>Radiographics</i> . 2006; 26(1):3-22.	Review/Other-Dx	N/A	To review the pathophysiologic features and causes of hemoptysis, describe the bronchial and nonbronchial systemic arterial anatomy, and discuss the initial evaluation of acute hemoptysis. Authors also discuss and illustrate the role of MDCT in hemoptysis with regard to its exquisite diagnostic capabilities and its potential influence on management decision making.	Massive hemoptysis is a medical emergency that requires prompt assessment. CT is a quick and noninvasive tool that is helpful in the diagnosis and management of hemoptysis, and its use should be considered in any patient who presents with this condition.	4

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8. McGuinness G, Beacher JR, Harkin TJ, Garay SM, Rom WN, Naidich DP. Hemoptysis: prospective high-resolution CT/bronchoscopic correlation. <i>Chest</i> . 1994; 105(4):1155-1162.	Observational-Dx	57 patients	To prospectively evaluate the contribution of a modified HRCT compared with both routine chest radiography and FOB in the evaluation of patients presenting with hemoptysis in a large inner-city, acute-care hospital.	High-resolution CT proved of particular value in diagnosing bronchiectasis and aspergillomas, while FOB was diagnostic of bronchitis and mucosal lesions such as Kaposi's sarcoma. FOB localized bleeding in only 51% of cases. The high sensitivity of CT in identifying both the intraluminal and extraluminal extent of central lung cancers in conjunction with its value in diagnosing bronchiectasis suggest that CT should be obtained prior to bronchoscopy in all patients presenting with hemoptysis.	2
9. Hsiao EI, Kirsch CM, Kagawa FT, Wehner JH, Jensen WA, Baxter RB. Utility of fiberoptic bronchoscopy before bronchial artery embolization for massive hemoptysis. <i>AJR Am J Roentgenol</i> . 2001; 177(4):861-867.	Review/Other-Dx	28 patients	To investigate the utility of performing FOB before bronchial artery embolization in patients with massive hemoptysis.	The clinically determined diagnoses of the patients' symptoms were tuberculous bronchiectasis (n=14; 50.0%); bronchogenic carcinoma (n=4; 14.3%); active tuberculosis (n=2; 7.1%); nontuberculous bronchiectasis (n=2; 7.1%); active coccidioidomycosis, pancreaticobronchial fistula, arteriovenous malformation, and tetralogy of fallot (n=1 each; 3.6% each); and unknown cause (n=2; 7.1%). The bleeding site determined through bronchoscopy was consistent with that determined through radiographs in 23 patients (82.1%); all had either unilateral disease (n=15), bilateral disease with unilateral cavities (n=5), or a preponderance of disease on one side (n=3). Bronchoscopy was an essential tool in determining the bleeding site in only 3 patients (10.7%), all of whom had bronchiectasis without localizing features visible on chest radiographs. In the remaining 2 patients (7.1%), bronchoscopic findings were indeterminate, but radiographs were helpful.	4

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10. Haponik EF, Britt EJ, Smith PL, Bleecker ER. Computed chest tomography in the evaluation of hemoptysis. Impact on diagnosis and treatment. <i>Chest</i> . 1987; 91(1):80-85.	Observational-Dx	32 patients	To assess the roles of chest CT in evaluation of patients who present with hemoptysis. Results of CT and chest radiographs were compared in patients who presented with hemoptysis.	CT demonstrated roentgenographic abnormalities more often than chest radiographs (P<0.01), providing new diagnostic information in 15 patients (46.9%), and clarifying chest radiographic abnormalities in 5 (15.6%) others. In addition, CT correctly localized sources of bleeding in 23 (88.5%) of the 26 patients in whom a site was identified at bronchoscopy, while chest radiograph localization was correct in 17 (65.4%) (P<0.05).	3
11. Lederle FA, Nichol KL, Parenti CM. Bronchoscopy to evaluate hemoptysis in older men with nonsuspicious chest roentgenograms. <i>Chest</i> . 1989; 95(5):1043-1047.	Observational-Dx	106 men	To determine the rate of cancer detection as well as the yield of treatable disease (resectable cancers or other treatable conditions) identified by bronchoscopy.	Hemoptysis with a nonsuspicious chest radiograph carries an appreciable risk of cancer in older men with substantial smoking histories, these cancers are often resectable, a chest radiograph in which the central lung fields are obscured in any way should not be considered negative in patients with hemoptysis, and a negative bronchoscopic examination does not exclude the possibility of cancer in these patients.	3
12. Millar AB, Boothroyd AE, Edwards D, Hetzel MR. The role of computed tomography (CT) in the investigation of unexplained haemoptysis. <i>Respir Med</i> . 1992; 86(1):39-44.	Review/Other-Dx	40 patients	To determine whether CT has a role in the investigation of patients with unexplained haemoptysis.	Abnormalities were seen in 20 (50%) of the CT scans. 7 of the patients had evidence of bronchiectasis (18%), 1 of whom also had a mass. In 4 (10%) cases a mass alone was detected (2 tuberculous, 2 malignant). In a further 4 (10%) scans alveolar consolidation was present and in 3 cases abnormal vessels were detected (7.5%). One patient had cystic changes shown in their scan and multiple nodules were shown in the final patient. The contralateral lungs of 93 patients undergoing CT for preoperative assessment of bronchogenic carcinoma were used as controls. In 6 (6%) of these patients abnormalities were detected by CT. Pleural nodules were observed in 2 patients, fat in the transverse fissure in another, atelectasis in 2 patients and an apical bulla in the other abnormal scan. The relative risk for patients with unexplained haemoptysis having abnormal CT scans compared to the control group of patients was 7.75.	4

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13. Naidich DP, Funt S, Ettenger NA, Arranda C. Hemoptysis: CT-bronchoscopic correlations in 58 cases. <i>Radiology</i> . 1990; 177(2):357-362.	Observational-Dx	58 patients	To evaluate the CT findings in a series of patients presenting with hemoptysis who subsequently underwent FOB. The specific intent was to assess the potential role of CT as a screening modality.	Abnormalities involving the airways were depicted by CT in 28 cases (48%). In 18 of these (31% of the total group of 58), focal abnormalities involving the central airways were identified (17 were subsequently proved to be malignant) and in 10 (17% of the total), CT showed bronchiectasis. Focal airway abnormality was shown by FOB in 18 cases (31%); all of these were depicted with CT. Malignancy was diagnosed in 24 patients, including 3 in whom results of FOB were normal but malignant cells were identified at transbronchial biopsy. CT abnormalities were identified in all cases of malignancy. In 10/21 cases (48%) of non-small-cell lung cancer, CT allowed definitive staging by documenting either direct mediastinal invasion and/or metastatic disease, while FOB allowed definitive staging in only 3 cases. CT studies provided no false-negative results.	4
14. O'Neil KM, Lazarus AA. Hemoptysis. Indications for bronchoscopy. <i>Arch Intern Med</i> . 1991; 151(1):171-174.	Review/Other-Dx	119 patients	To review the records of 119 bronchoscopies performed for hemoptysis in patients with a normal (n=75) or nonlocalizing (n=44) chest radiographs.	Bronchogenic carcinoma was identified in 2.5% of the bronchoscopies. Additional neoplasms were found in another 2.5%. The presence of nonlocalizing abnormalities was not associated with an increase in either the rate of bronchogenic carcinoma or in the diagnostic yield (specific anatomic diagnosis or bleeding site identified) at bronchoscopy when compared with patients with normal chest radiographs. The factors of male sex, age >40 years, and a >40 pack-year smoking history appear useful in identifying patients in whom the yield of bronchoscopy is likely to be high.	4

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15. Set PA, Flower CD, Smith IE, Chan AP, Twentyman OP, Shneerson JM. Hemoptysis: comparative study of the role of CT and fiberoptic bronchoscopy. <i>Radiology</i> . 1993; 189(3):677-680.	Observational-Dx	91 patients	To compare results of CT and FOB in diagnosis of cancer in patients with hemoptysis.	CT scans demonstrated all 27 tumors seen at bronchoscopy and an additional 7, 5 of which were beyond bronchoscopic range. In patients with normal chest radiographs, bronchial carcinoma was detected in 5% at both bronchoscopy and CT. In patients with abnormal findings on radiographs, bronchoscopy allowed both location and histologic diagnosis in 78% of carcinomas but was unreliable in locating peripheral tumors demonstrated at CT. CT was insensitive in demonstrating early mucosal abnormalities, bronchitis, squamous metaplasia, and a benign papilloma, all detected at bronchoscopy.	2
16. Thirumaran M, Sundar R, Sutcliffe IM, Currie DC. Is investigation of patients with haemoptysis and normal chest radiograph justified? <i>Thorax</i> . 2009; 64(10):854-856.	Observational-Dx	270 patients	A group of patients with haemoptysis and normal chest radiograph were analyzed to determine whether further investigations were justified.	275 episodes of haemoptysis with normal chest radiograph were investigated further in 270 patients (60% males). The median age was 60 years. 26 patients were diagnosed to have respiratory tract malignancies (larynx, 1; trachea, 1; lung, 22; carcinoid, 1; and leiomyoma, 1). 8 (31%) of the 26 patients with respiratory tract malignancy had radical treatment. FOB was diagnostic of cancer in 14 (54%) of the 26 patients with malignancy. CT of the thorax was suggestive of cancer in 24 (96%) of the 25 patients with malignancy.	3
17. Lee YJ, Lee SM, Park JS, et al. The clinical implications of bronchoscopy in hemoptysis patients with no explainable lesions in computed tomography. <i>Respir Med</i> . 2012; 106(3):413-419.	Review/Other-Dx	228 patients	To describe the clinical course and long-term outcomes of patients with hemoptysis whose chest CT shows no lesion to explain the hemoptysis.	The bronchoscopic findings of 191 patients (83.8%) were negative for hemoptysis and showed the possible causes of bleeding in 37 patients (16.2%). 43/191 patients with negative bronchoscopic findings had oronasopharyngeal problems or were using anticoagulants. After excluding these 43 patients, hemoptysis recurred in 29 (19.6%) of the remaining patients. 13 of the patients whose bronchoscopic findings identified the possible causes of bleeding (35.1%) experienced recurrence. Only 1 patient (0.4%) was diagnosed with lung cancer by the initial bronchoscopy, and no patient developed malignancy during the follow-up period.	4

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18. Church TR, Black WC, Aberle DR, et al. Results of initial low-dose computed tomographic screening for lung cancer. <i>N Engl J Med.</i> 2013;368(21):1980-1991.	Experimental-Dx	53,439 participants: 26,715 in low-dose CT group and 26,724 in radiography group	To describe the screening, diagnosis, and limited treatment results from the initial round of screening in the National Lung Screening Trial to inform and improve lung-cancer-screening programs.	A total of 7,191 participants (27.3%) in the low-dose CT group and 2,387 (9.2%) in the radiography group had a positive screening result; in the respective groups, 6,369 participants (90.4%) and 2,176 (92.7%) had at least one follow-up diagnostic procedure, including imaging in 5,717 (81.1%) and 2,010 (85.6%) and surgery in 297 (4.2%) and 121 (5.2%). Lung cancer was diagnosed in 292 participants (1.1%) in the low-dose CT group vs 190 (0.7%) in the radiography group (stage I in 158 vs 70 participants and stage IIB to IV in 120 vs 112). Sensitivity and specificity were 93.8% and 73.4% for low-dose CT and 73.5% and 91.3% for chest radiography, respectively.	3
19. Parrot A, Antoine M, Khalil A, et al. Approach to diagnosis and pathological examination in bronchial Dieulafoy disease: a case series. <i>Respir Res.</i> 2008; 9:58.	Review/Other-Dx	7 patients	To describe the clinical presentation of a series of patients diagnosed with Dieulafoy disease of the bronchus and provide information about the pathological diagnosis approach.	7 heavy smoker (49 pack years) patients (5 males) mean aged 54 years experienced a massive hemoptysis (350-1000 ml) unrelated to a known lung disease and frequently recurrent. Bronchial contrast extravasation was observed in 3 patients, combining both CT scan and bronchial arteriography. Efficacy of bronchial artery embolization was achieved in 40% of cases before surgery. Pathological examination demonstrated a minute defect in 3 cases and a large and dysplastic superficial bronchial artery in the submucosa in all cases.	4

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20. Yoon YC, Lee KS, Jeong YJ, Shin SW, Chung MJ, Kwon OJ. Hemoptysis: bronchial and nonbronchial systemic arteries at 16-detector row CT. <i>Radiology</i> . 2005; 234(1):292-298.	Observational-Dx	22 patients	To retrospectively evaluate 16-detector row CT compared with conventional angiography in depiction of bronchial and nonbronchial systemic arteries in patients with hemoptysis.	52 (30 right and 22 left) bronchial arteries and 33 nonbronchial systemic arteries were visible at CT. 34 (20 right and 14 left) of 52 bronchial arteries were traceable from their origins to the hilum. 31 (16 right and 15 left) of 46 (27 right and 19 left) bronchial arteries and 26 of 64 nonbronchial systemic arteries evaluated at angiography were causing hemoptysis. 40 (87%, 23 right and 17 left) of 46 bronchial arteries seen at angiography were also detected at CT. All 31 bronchial arteries and 16 (62%) of 26 nonbronchial systemic arteries causing hemoptysis were detected at CT. 23 (74%) of 31 bronchial arteries causing hemoptysis were traceable from their origins to the hilum, and 1 (11%) of 9 bronchial arteries not causing hemoptysis was traceable (P = .002).	3

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21. Hartmann IJ, Remy-Jardin M, Menchini L, Teisseire A, Khalil C, Remy J. Ectopic origin of bronchial arteries: assessment with multidetector helical CT angiography. <i>Eur Radiol.</i> 2007; 17(8):1943-1953.	Observational-Dx	214 patients; 77 patients with at least one bronchial artery were studied	To determine noninvasively the frequency of ectopic bronchial arteries (ie, bronchial arteries originating at a level of the descending aorta other than T5-T6 or from any aortic collateral vessel) on CTA obtained in patients with hemoptysis.	147 ectopic arteries were depicted, originating as common bronchial trunks (n=23; 19%) or isolated right or left bronchial arteries (n=101; 81%). The most frequent sites of origin of the 124 ostiums were the concavity of the aortic arch (92/124; 74%), the subclavian artery (13/124; 10.5%) and the descending aorta (10/124; 8.5%). The isolated ectopic bronchial arteries supplied the ipsilateral lung in all but three cases. Bronchial artery embolization was indicated in 26 patients. On the basis of CTA information, (1) bronchial embolization was attempted in 24 patients; it was technically successful in 21 patients (orthotopic bronchial arteries: 6 patients; orthotopic and ectopic bronchial arteries: 3 patients; ectopic bronchial arteries: 12 patients) and failed in 3 patients due to an instable catheterization of the ectopic bronchial arteries; the absence of additional bronchial arterial supply and no abnormalities of nonbronchial systemic arteries at CTA avoided additional arteriograms in these 3 patients; (2) owing to the iatrogenic risk of the embolization procedure of ectopic bronchial arteries, the surgical ligation of the abnormal vessels was the favored therapeutic option in 2 patients.	3
22. Flume PA, Mogayzel PJ, Jr., Robinson KA, Rosenblatt RL, Quittell L, Marshall BC. Cystic fibrosis pulmonary guidelines: pulmonary complications: hemoptysis and pneumothorax. <i>Am J Respir Crit Care Med.</i> 2010; 182(3):298-306.	Review/Other-Dx	N/A	To present the Cystic Fibrosis Foundation's Pulmonary Therapies Committee recommendations for the treatment of hemoptysis and pneumothorax.	The expert panel completed the survey twice, allowing refinement of recommendations. Numeric responses to the questions were summarized and applied to a priori definitions to determine levels of consensus. Recommendations were then developed to practical treatment questions based upon the median scores and the degree of consensus. These recommendations for the management of the patient with cystic fibrosis with hemoptysis and pneumothorax are designed for general use in most individuals but should be adapted to meet specific needs as determined by the individuals, their families, and their health care providers.	4

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23. Cremaschi P, Nascimbene C, Vitulo P, et al. Therapeutic embolization of bronchial artery: a successful treatment in 209 cases of relapse hemoptysis. <i>Angiology</i> . 1993; 44(4):295-299.	Review/Other-Tx	N/A	To examine the role of bronchial artery embolization in patients with hemoptysis.	In the last seven years, together with the traditional angiographic techniques, selective digital angiography was performed, above all in preliminary control phases, to evaluate occlusion during embolization. selective digital angiography reduced catheterization time and the mean quantity of contrast administered, decreasing side effects; 98% of hemoptysis was controlled in the first twenty-four hours, the other 2% in the following forty eight hours; 16% relapses occurred within the first year; 27 patients needed reembolization (15 patients twice, 11 patients three times, 1 patient five times). No complications were seen. If diagnosis, therapeutic indications, operative technique, and equipment selection are adequate, BAE has a high reliability in patients affected by relapsing hemoptysis, which is difficult to resolve.	4
24. Dave BR, Sharma A, Kalva SP, Wicky S. Nine-year single-center experience with transcatheter arterial embolization for hemoptysis: medium-term outcomes. <i>Vasc Endovascular Surg</i> . 2011; 45(3):258-268.	Observational-Tx	128 transcatheter arterial embolization performed in 58 patients	To determine the medium-term efficacy of transcatheter arterial embolization for hemoptysis.	Technical and clinical successes were estimated at 58 (100%) of 58 and 57 (98%) of 58, respectively. Recurrent hemoptysis occurred in 40% (23/58). In all, 34% (20/58) died during follow-up. Kaplan-Meier estimates for primary and secondary efficacy of transcatheter arterial embolization at 2, 4, 6, and 8 years were 0.82, 0.46, 0.17, and 0.09 (benign disease) and 0.30, 0, 0, and 0 (malignant disease), respectively.	3
25. Khalil A, Fartoukh M, Parrot A, Bazelly B, Marsault C, Carette MF. Impact of MDCT angiography on the management of patients with hemoptysis. <i>AJR Am J Roentgenol</i> . 2010; 195(3):772-778.	Observational-Dx	400 patients	To evaluate the ability of MDCT angiography to modify early results in patients undergoing endovascular embolization for hemoptysis.	Differences between the groups were statistically significant for patient age (P<0.05), endovascular treatment failure among patients >70 years (P<0.05), pulmonary artery vasoocclusion in comparison with diagnostic pulmonary artery angiography (P<0.0001), and urgent surgical resection (P=0.034). The impact of MDCT angiography was significant in reducing the rate of vascular catheterization failure in patients >70 years, increasing the number of pulmonary artery vasoocclusions, and reducing the number of urgent surgical resection.	3

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26. Chun JY, Belli AM. Immediate and long-term outcomes of bronchial and non-bronchial systemic artery embolisation for the management of haemoptysis. <i>Eur Radiol.</i> 2010; 20(3):558-565.	Observational-Tx	50 patients	To evaluate the immediate and long-term results of arterial embolization in the management of haemoptysis and to identify factors influencing outcome.	The most frequent causes of haemoptysis included bronchiectasis (16%), active tuberculosis (12%) and aspergilloma (12%). A total of 126 bronchial and non-bronchial systemic arteries were embolized in 62 procedures. Immediate cessation of haemoptysis was achieved in 43 patients (86%). Haemoptysis emoptysis was controlled in 36 patients (72%), recurred in 14 (28%) and 11 (22%) required repeat embolization. The worst outcomes were observed in patients with aspergilloma: all 6 suffered recurrent bleeding and 3 (50%) died from massive haemoptysis. Aspergilloma was also associated with an increased risk of haemoptysis recurrence (P<0.05). A good clinical outcome was achieved in those with active tuberculosis and malignancy. Complication rates were low and included transient chest pain, false aneurysm and one case of lower limb weakness.	2
27. Khalil A, Fartoukh M, Bazot M, Parrot A, Marsault C, Carette MF. Systemic arterial embolization in patients with hemoptysis: initial experience with ethylene vinyl alcohol copolymer in 15 cases. <i>AJR Am J Roentgenol.</i> 2010; 194(1):W104-110.	Review/Other-Tx	15 patients	To evaluate the use of ethylene vinyl alcohol copolymer to treat patients with hemoptysis of systemic arterial origin.	The indications for embolization were mainly early recurrence of hemoptysis with reperfusion of systemic arteries in 7 cases; unstable microcatheter in 2 cases; large ectopic bronchial artery in 2 cases; and, in 1 case each, bronchial arterial bleeding through a small anastomotic network, aneurysm of the left internal thoracic artery in a patient with invasive aspergillosis, a potentially risky connection between the bronchial and right coronary arteries, and occlusion of a systemic artery due to Pryce type 1 intralobar lung sequestration. Hemoptysis was controlled in all but one case and did not recur in the other 14 cases. The injection procedure was well tolerated.	4

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28. Yoo DH, Yoon CJ, Kang SG, Burke CT, Lee JH, Lee CT. Bronchial and nonbronchial systemic artery embolization in patients with major hemoptysis: safety and efficacy of N-butyl cyanoacrylate. <i>AJR Am J Roentgenol.</i> 2011; 196(2):W199-204.	Observational-Tx	108 patients	To evaluate the safety and efficacy of N-butyl cyanoacrylate for bronchial and nonbronchial systemic artery embolization in the management of major hemoptysis.	Immediate success was achieved in 105 patients (97.2%). During the follow-up period (range, 5 days-63 months; median, 28.5 months), recurrent hemoptysis was found in 21/105 patients (20%). Repeat angiograms (n=14) revealed incomplete embolization during the initial procedure in seven patients with early recurrence (<3 months) and revascularization of nonbronchial systemic collateral arteries in 7 patients with late recurrence (>3 months). No recanalization of embolized arteries was found on repeat angiograms or at follow-up CT. The cumulative nonrecurrence rates were 91.4% 1 month, 83.4% 1 year, 76.7% 3 years, and 56.8% 5 years after the initial procedure. The procedure-related complications included transient chest pain (n=21) and denudation of the bronchial mucosa (n=3), which was clinically silent but found at bronchoscopy.	2
29. Yoon W, Kim YH, Kim JK, Kim YC, Park JG, Kang HK. Massive hemoptysis: prediction of nonbronchial systemic arterial supply with chest CT. <i>Radiology.</i> 2003; 227(1):232-238.	Observational-Dx	40 patients	To evaluate the diagnostic accuracy of chest CT in the prediction of a nonbronchial systemic arterial supply in patients with massive hemoptysis.	In the determination of a nonbronchial systemic arterial supply, CT had a sensitivity of 80%, specificity of 84%, PPV of 73%, NPV of 91%, and accuracy of 84%. Sensitivity was highest for predicting the branches of subclavian and axillary arterial supply and was lowest for predicting the internal mammary arterial supply. Specificity and accuracy were highest for predicting the intercostal arterial supply.	3
30. Sbano H, Mitchell AW, Ind PW, Jackson JE. Peripheral pulmonary artery pseudoaneurysms and massive hemoptysis. <i>AJR Am J Roentgenol.</i> 2005; 184(4):1253-1259.	Review/Other-Tx	8 patients with pulmonary artery pseudoaneurysms	To determine the incidence and etiology of pulmonary artery pseudoaneurysms in patients undergoing bronchial angiography for massive hemoptysis and to assess patient outcome after the embolization of these pseudoaneurysms.	Peripheral pulmonary artery pseudoaneurysms occur in up to 11% of patients undergoing bronchial angiography for hemoptysis. These are often most easily appreciated on bronchial and/or nonbronchial systemic arterial angiograms because of complete reversal of flow in pulmonary artery branches in the diseased lung. Embolization of bronchial and nonbronchial systemic arteries alone may not be sufficient therapy to control hemoptysis and occlusion of the pseudoaneurysm itself via a pulmonary artery approach is recommended.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
31. Shin S, Shin TB, Choi H, et al. Peripheral pulmonary arterial pseudoaneurysms: therapeutic implications of endovascular treatment and angiographic classifications. <i>Radiology</i> . 2010; 256(2):656-664.	Review/Other-Tx	24 patients	To classify peripheral pulmonary arterial pseudoaneurysms associated with infectious lung diseases according to angiographic findings and to determine treatment options for pulmonary arterial pseudoaneurysms on the basis of angiographic classifications.	For type A or B pulmonary arterial pseudoaneurysms, bronchial and nonbronchial systemic collateral arteries and pulmonary arteries were successively embolized. Hemoptysis was controlled for all type A and type B pulmonary arterial pseudoaneurysms. For type C or type D pulmonary arterial pseudoaneurysms, embolization alone of bronchial and nonbronchial systemic collateral arteries and follow-up pulmonary CTA were performed. Hemoptysis was not controlled in 3/9 patients: In those patients, percutaneous injection therapy (n=2) and surgical resection (n=1) were performed.	4
32. Sakr L, Dutau H. Massive hemoptysis: an update on the role of bronchoscopy in diagnosis and management. <i>Respiration</i> . 2010; 80(1):38-58.	Review/Other-Tx	N/A	To review the literature with regard to the definition, etiology, epidemiology, pathophysiology, diagnosis and treatment of massive hemoptysis, with special emphasis on the role of bronchoscopy as a diagnostic and therapeutic tool.	The authors present the circumstances under which the use of rigid bronchoscopy should be preferred for controlling massive bleeding and also address the crucial importance of multidisciplinary collaboration by illustrating the roles of endovascular therapy and surgery in the optimal management of massive hemoptysis.	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

COPD = Chronic obstructive pulmonary disease

CT = Computed tomography

CTA = Computed tomography angiography

FOB = Fiberoptic bronchoscopy

HRCT = High-resolution computed tomography

MDCT = Multidetector computed tomography

NPV = Negative predictive value

PPV = Positive predictive value