Bronchial Artery Embolization in Massive Hemoptysis

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Disclosures

I have no relevant relationships with commercial interests to disclose.

Case

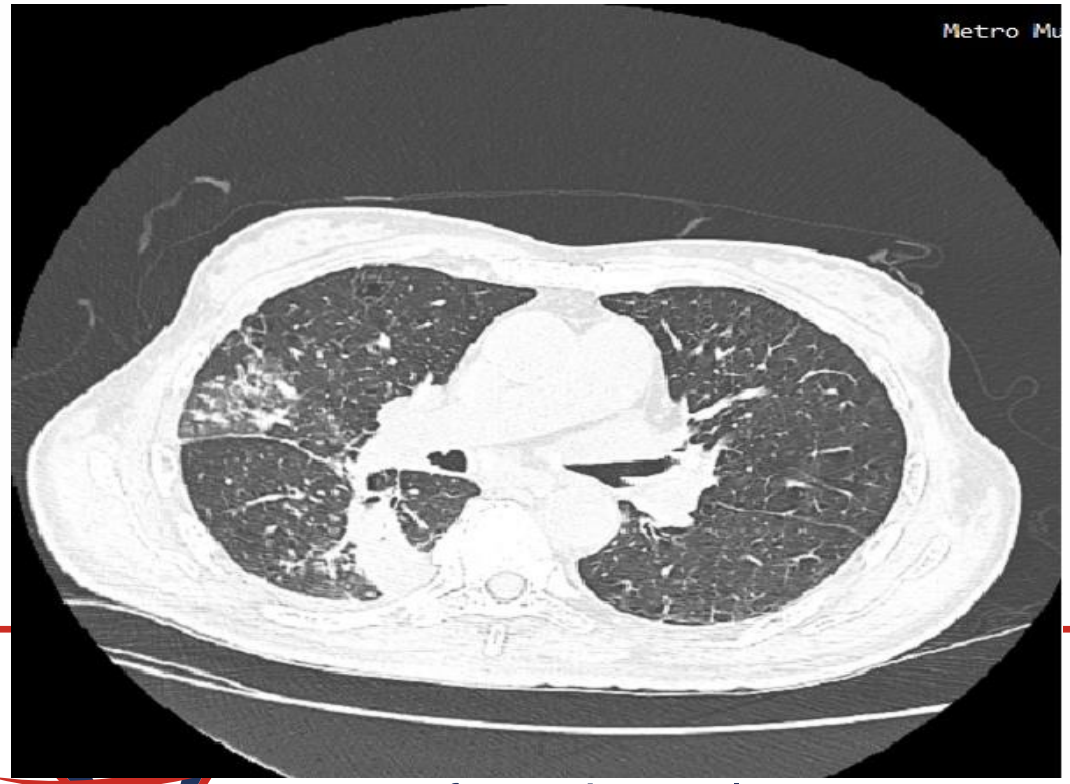
C/C – Hemoptysis x 5-6 days

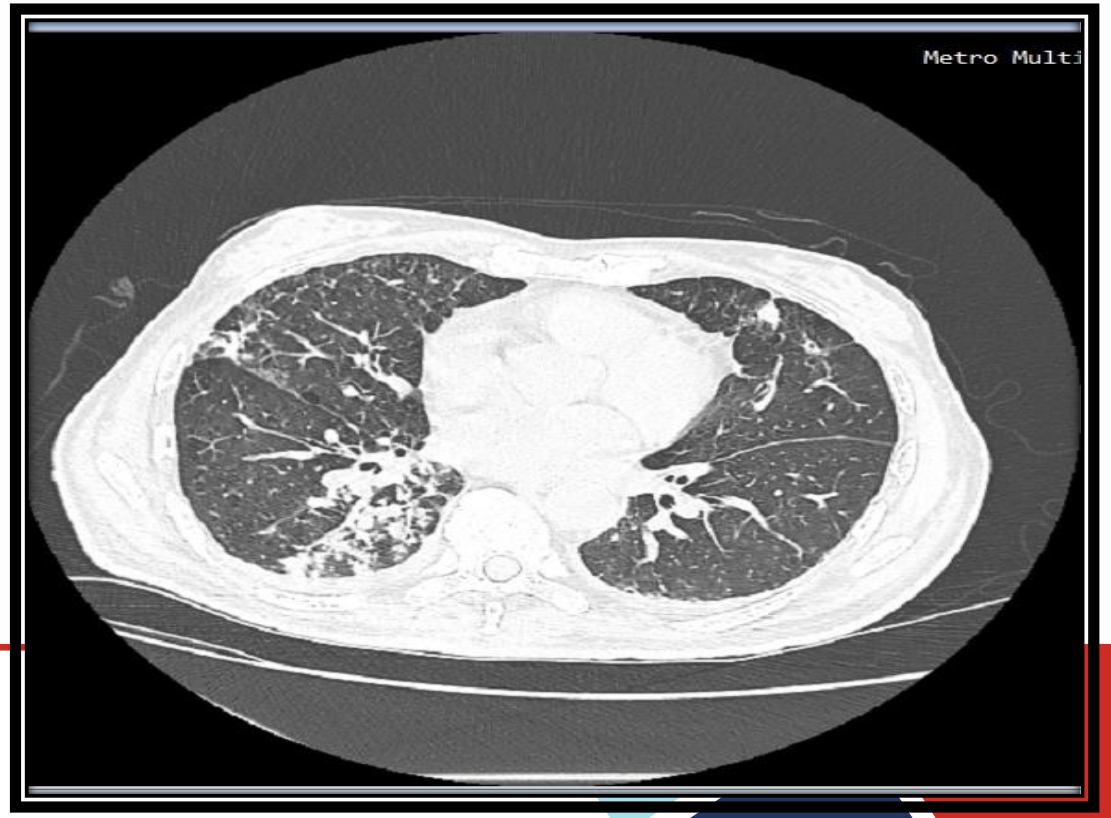
HPI - 69-year male with diabetes and recent history of Pulmonary Tuberculosis with fungal pneumonia. Started anti - tubercular drugs 3 weeks ago

- Hemoptysis for 5-6 days. Initially mild but increased amount and frequency to 200 ml / day
- Started on IV Antibiotics and supportive treatment.
- Triple phase Chest CT for further review

Chest CT

- Consolidation in Right lower lobe with infiltrates in right upper and right middle lobe.
- Ground glass opacifications in Rt middle and lower lobe
- Bilateral thickening of bronchial wall with centrilobular emphysematous changes in bilateral lung fields
- No Pulmonary artery aneurysm or mass consistent with malignancy





Massive Hemoptysis :

- > 300ml / 24 hour **OR** more than 100mL/day x 3 days
- Any hemorrhage compromising clinical or hemodynamic status
- FEV1 < 35% of predicted in someone with hemoptysis
- Chronic but non-massive hemoptysis that impairs a patient's quality of life

Semin Intervent Radiol 2011;28:48–62

Treatment Options

- Treatment Option – Partial Lobectomy (surgery) vs Bronchial Artery Embolization

- Multi disciplinary team discussion –
  - Pulmonologist
  - Critical care intensivist
  - Thoracic surgeon
  - Endovascular Interventionalist

- Given the diffuse nature of disease and underlying lung condition, patient deemed unfit and high risk for surgery.

Semin Intervent Radiol 2012;29:155–160

Bronchial Artery Anatomical Overview

Arise from the descending Aorta at or below the level of the Carina

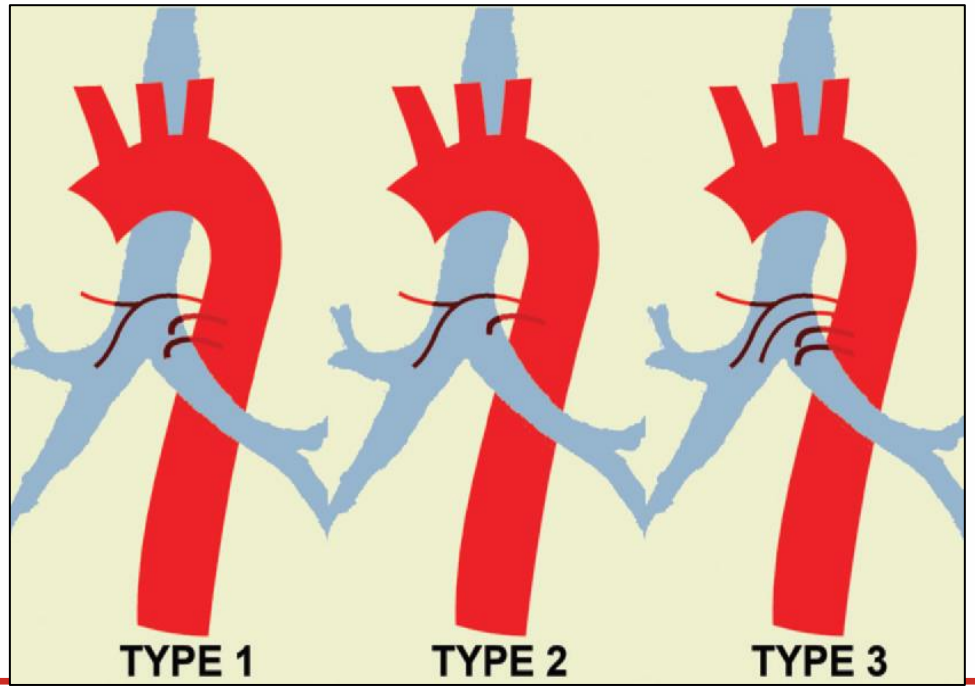


Table 1: Bronchial Artery Classification In 150 Cadavers

Type	Occurrence (%)	No. of Left Bronchial Arteries	No. of Right Bronchial Arteries
1	40.6	2	1
2	21.3	1	1
3	20.6	2	2
4	9.7	1	2
5	4.0	3	1
6	2.0	3	2
7	0.6	2	3
8	0.6	4	1
9	0.6	1	4

Source.—Reference 15.
Note.—In the study, 66.8% of right bronchial arteries arose from a common ICBAT.

(Semin Intervent Radiol 2012;29:155–160)

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Procedure Protocol

- Pre-Procedure:
  - Identify site of bleeding by Chest Xray or CT scan
    - Right or Left or Bilateral
  - (If possible) identify location of vessels
    - Which Artery – Bronchial / Intercostal / RIMA/LIMA / Any other vessel
    - Location and take off of culprit vessels
- Contrast Limit of 3 times GFR
- Right Femoral Artery access

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  - Identify site of bleeding by CT scan
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Procedure Protocol (Contd)

- Catheters - Cobra, SIMS, Judkins Right(JR), Left Internal Mammary Catheter(LIMA)
- Work horse .014” Guidewire (eg: Fielder FC, Sion Blue) and crossing catheter (eg: Progreat)
- 300uM PVA Particles

- Can use DSA for imaging, but patients often cough on injection, difficult to hold breath
- Selective angiogram of Bronchial arteries
- Selective angiogram of intercostals
- Subclavian Angiogram
- Selective angiogram of RIMA and LIMA

Embolization Protocol

Embolization Procedure

- 300uM PVA particles
- Mix particles with equal amount saline and contrast in a bowl
- Inject particles particles in artery of interest with 2 or 3 ml syringe
- This is followed by 2 or 3 ml of saline flush
- Intermittently inject contrast in the artery to determine if more particles/embolization is required.
- Prefer to inject sub-selectively using a micro catheter into the artery of interest
- Given atypical vessel take off's and vessel tortuosity, catheter support may be suboptimal and unable to advance microcatheter – inject directly into the parent artery very slowly and carefully

Embolization Protocol

PVA particles

Correct mixture consistency of PVA particles mixed with contrast and saline

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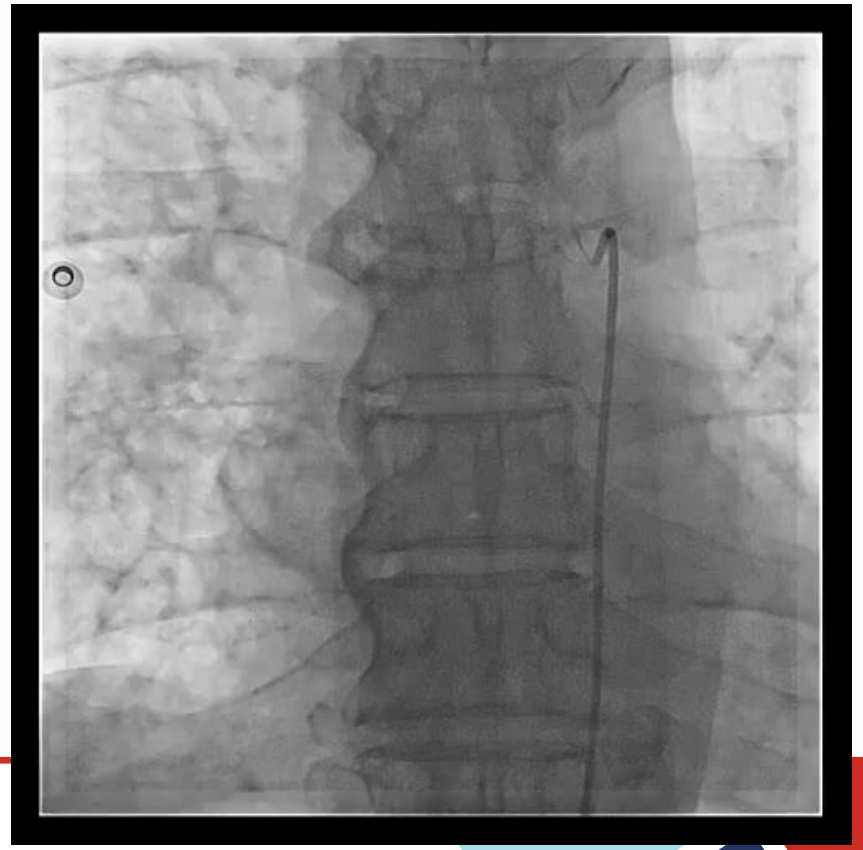
1st Vessel – Accessory Bronchial Artery

Right Acc Bronchial Artery Angiogram

Injection of PVA particles mixed with saline and contrast

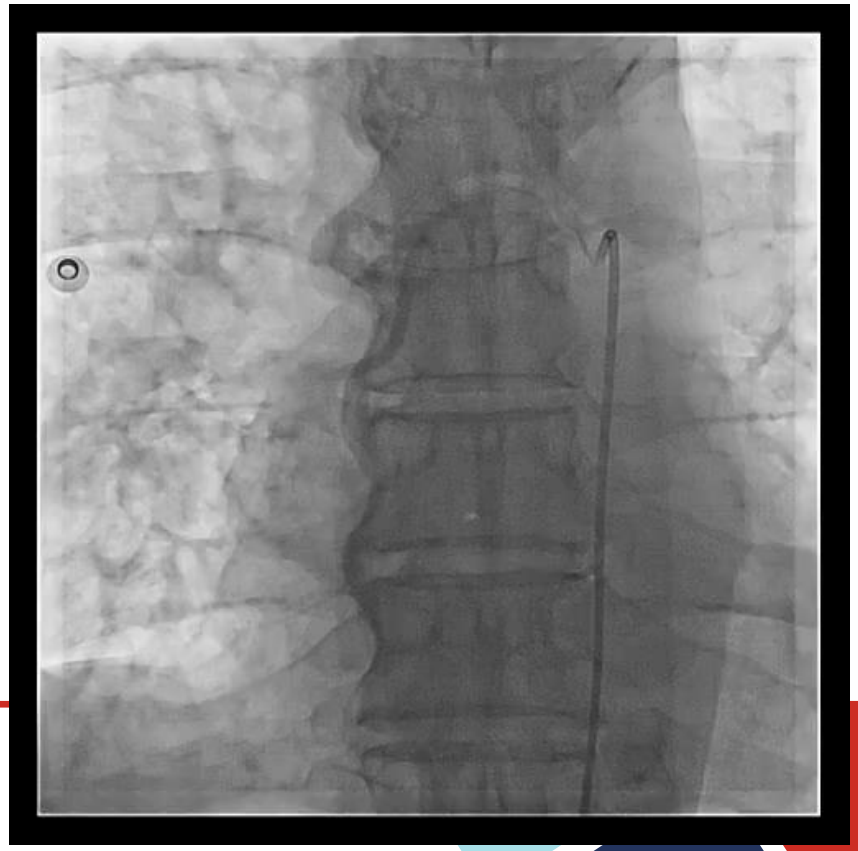


Vessel Embolization

PRE

Post Embolization

(total of 6cc – 3cc x 2 embolization)



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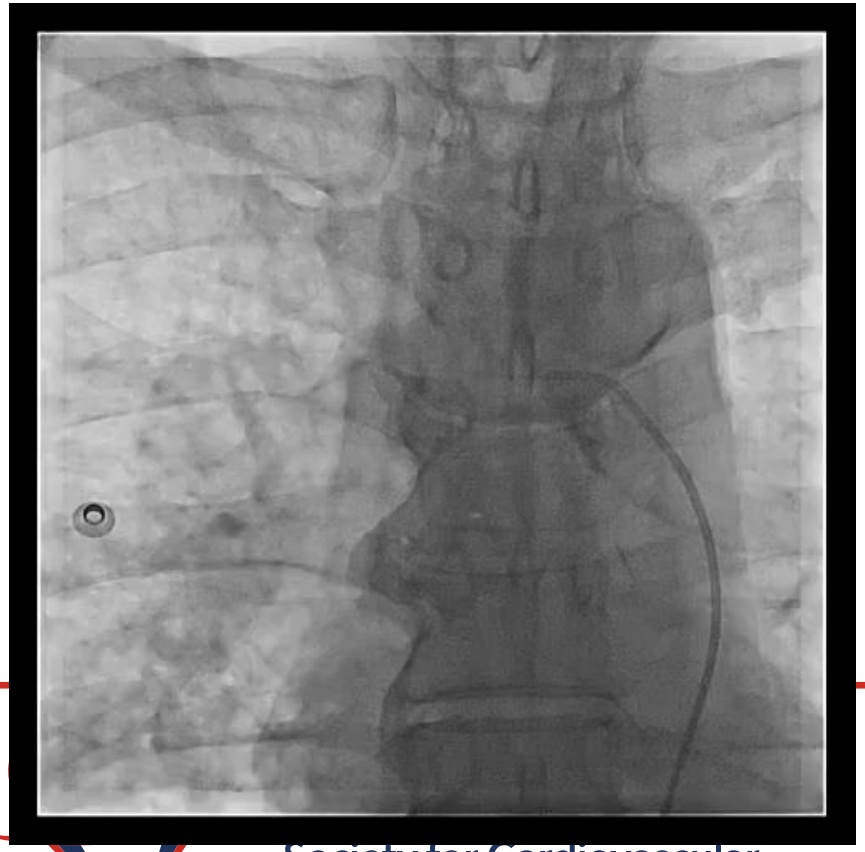
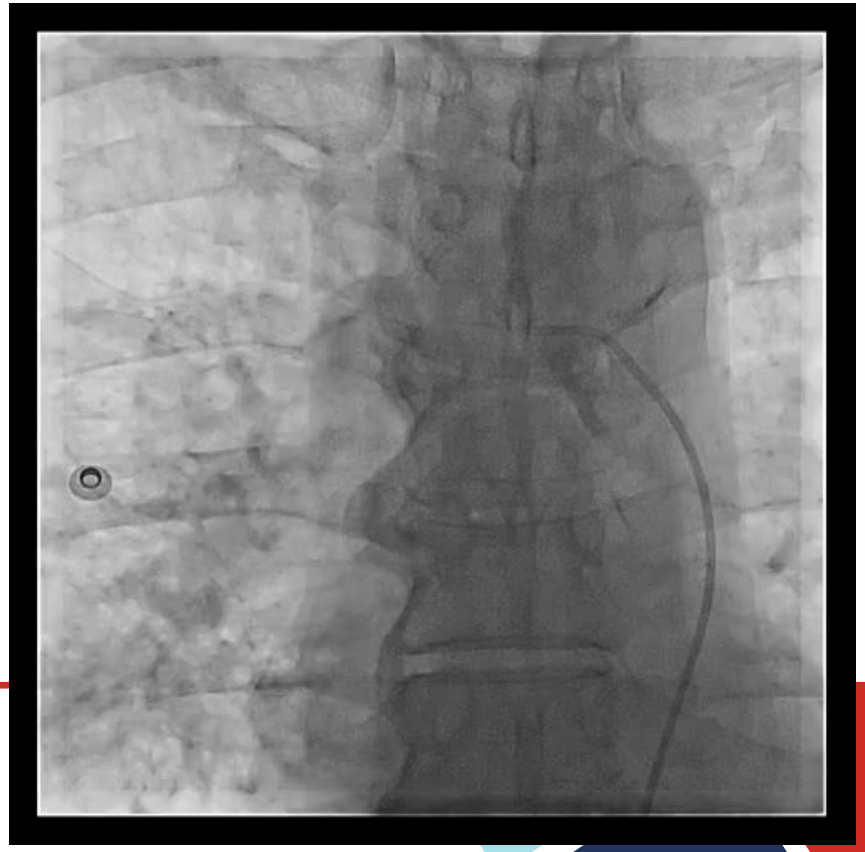
2nd Artery – Right Bronchial Artery

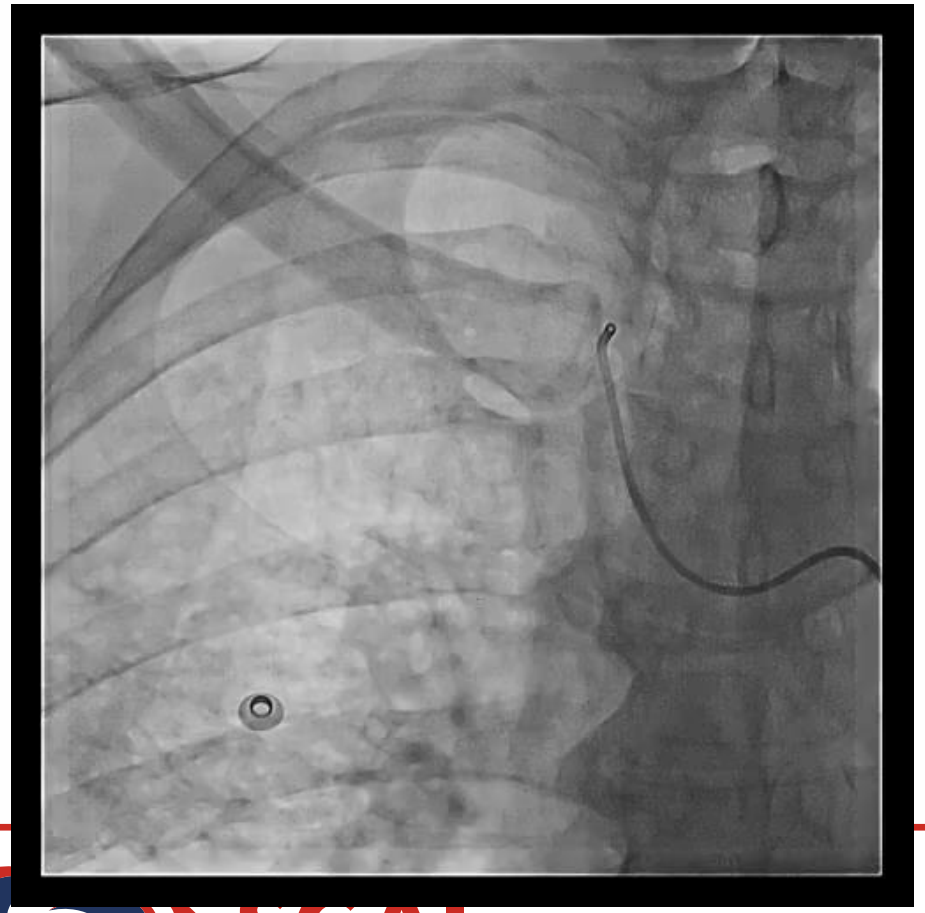
- Right Bronchial engaged with Cobra 1 catheter
- Right Bronchial Artery Angiogram

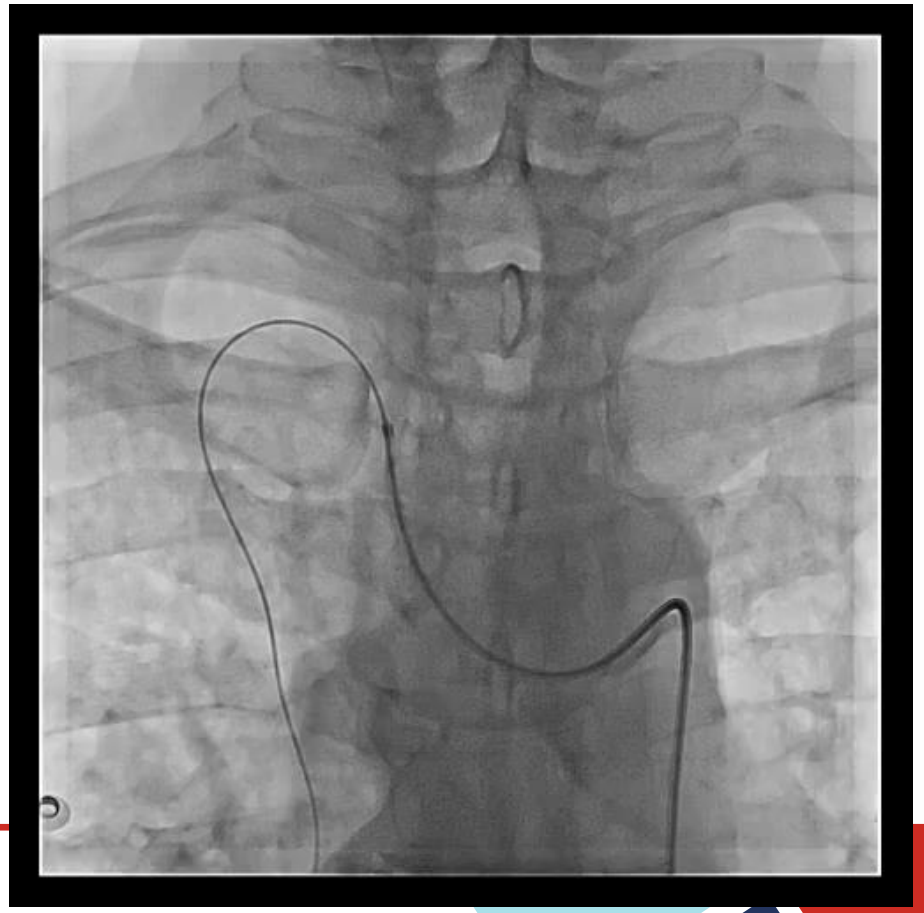


- Embolization - 3cc x 3 (total 9 cc) of PVA embolization
- Post Embolization Angiogram

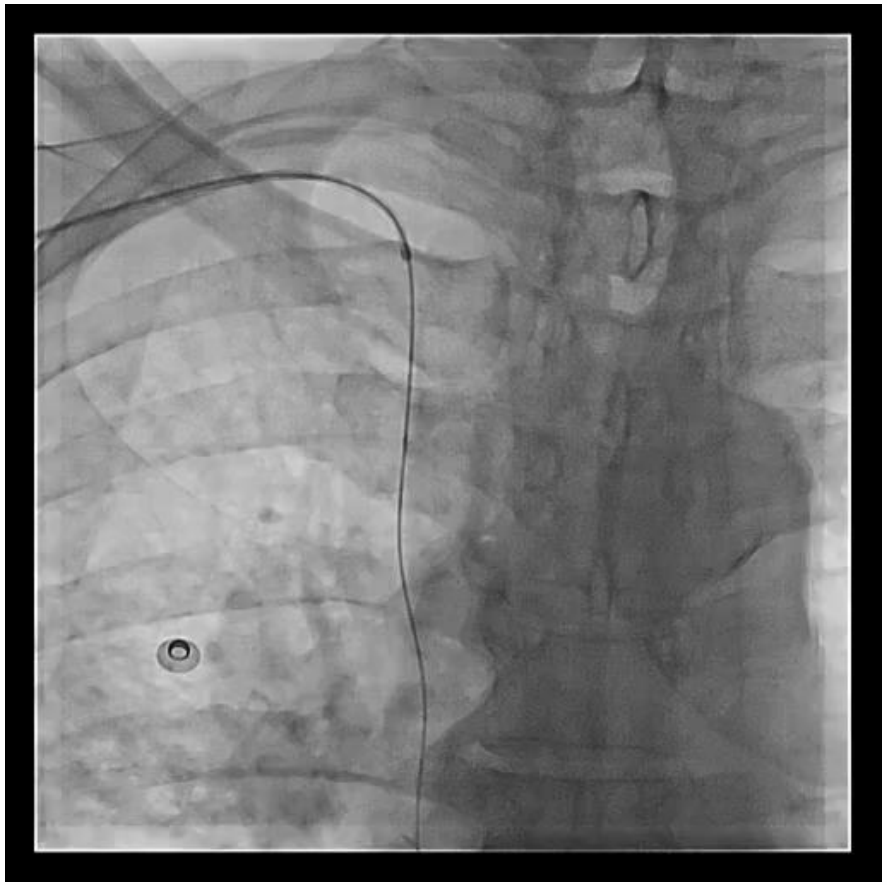


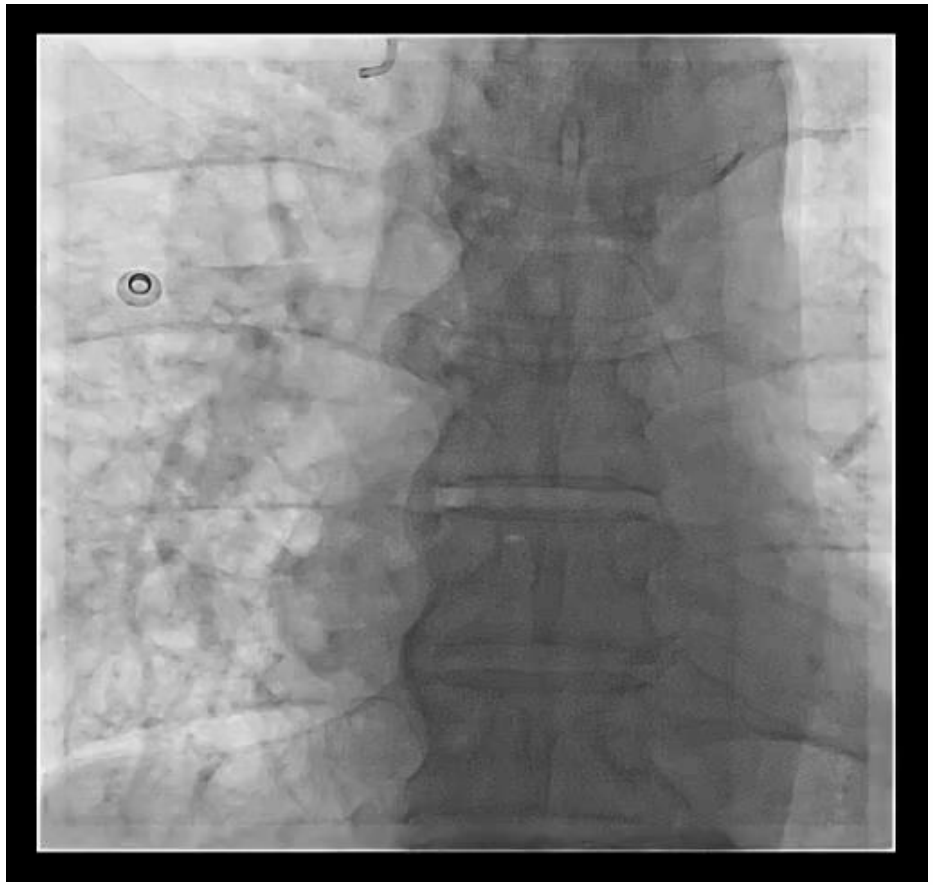
Attempting to Engage Right Internal Mammary



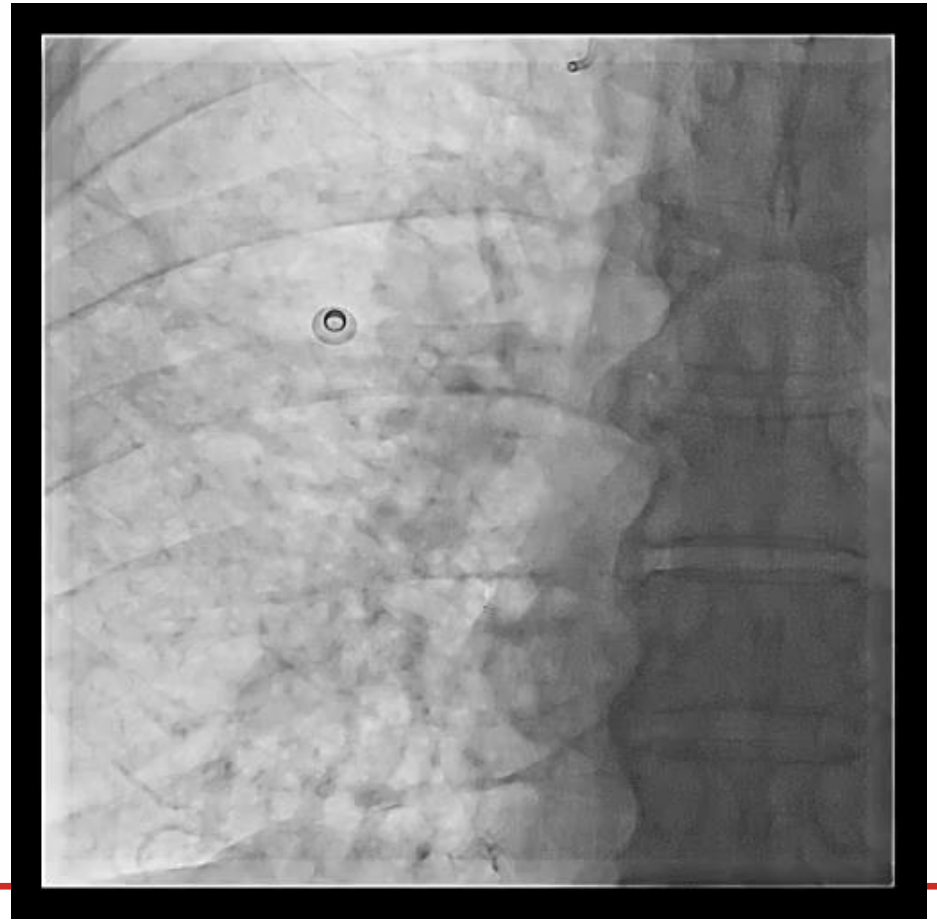


Right Radial Access; Right Internal mammary Angiogram with JR





Post RIMA Embolization



- Total of 3 vessels embolized
  - Right Bronchial Artery
  - Right Acc Bronchial Artery
  - Right Internal Mammary Artery collaterals

Hospital Course & Follow up

- Post procedure course was uneventful
- Continued on IV antibiotics and Anti-tubercular treatment(ATT)
- Complete resolution of hemoptysis and discharged home on POD # 5
- Patient followed up in Vascular clinic after 1 week of discharge with no recurrence and doing well.
- ATT course completed.
- Patient following up in Pulmonary clinic – 1 year follow up and doing well.

What is massive hemoptysis

What is the procedural success rate (as defined by complete cessation of hemoptysis) with Bronchia Artery Embolization?

a. 30-50%
b. 50 – 70%
c. More then 70%

Correct Answer : C

- Bronchial Artery Embolization has an immediate clinical success, as defined as complete cessation of hemoptysis from 70-99%. However recurrence rate remains high, ranging from 10 – 57% depending on the studies. The reasons are incomplete initial embolization, recanalization of embolized arteries and recruitment of new collaterals. Presence of non bronchial systemic collaterals, bronchopulmonary shunting aspergilloma and reactivation of tuberculosis and multidrug resistant tuberculosis are associated with significantly higher recurrence rates.

Diagn Interv Radiol 2017; 23:307–317

Conclusions and Learning Points

Bronchial artery embolization is an emergency life saving procedure for patients with sub-massive to massive hemoptysis. With a high procedural success rate and low complication rate (<0.1%) this is often the first line therapy in an emergency, medically unfit or patients with diffuse bilateral disease.