# Angiographic Treatment of Bronchial to Pulmonary Artery Fistula

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## AUTHORS' CONTRIBUTIONS

- **Gianluca Sellaro**: Conceptualization, data collection, writing - original draft, corresponding author.
- **Dario Poretti**: Performed the procedure, data collection, writing - review & editing.
- **Vittorio Pedicini**: Supervision, critical review of the manuscript.
- **Marco Francone**: Methodology, writing - review & editing.
- **Ezio Lanza**: Project administration, supervision.
- **Giuseppe Ferrillo**: Data collection, technical support.

## ACKNOWLEDGEMENTS

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## DISCLOSURES

The authors declare no conflicts of interest related to this case report.

## CONSENT

The data in this case report have been fully anonymized. Therefore, written informed consent from the patient for publication was not required.

## HUMAN AND ANIMAL RIGHTS

All procedures performed were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### Ethical Statement

The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. All patient data have been completely anonymized throughout the manuscript and related files, and written informed consent was obtained from the patient for publication of this case report.

### Conflict of Interest

The authors declare no conflicts of interest related to this article.

## ABSTRACT

This case report describes the successful angiographic treatment of a bronchial to pulmonary artery fistula in a 43-year-old male with a history of right testicular cancer. The patient was found to have a pulmonary vascular anomaly during preoperative evaluation for an abdominal hernia repair. Imaging confirmed a bronchial to pulmonary artery fistula, which was effectively managed through selective embolization using arterial and venous catheters.

# CASE REPORT

## BACKGROUND

This case report highlights the successful angiographic treatment of a bronchial to pulmonary artery fistula, a rare vascular anomaly with potentially severe clinical implications if left untreated. The case provides valuable insight into the diagnostic imaging findings, therapeutic approach, and follow-up in such conditions. It adds to the literature by illustrating the use of selective embolization with combined microcoils and glue to achieve complete exclusion of the pathological connection. This report emphasizes the importance of early detection and management to prevent life-threatening complications.

### Imaging Findings

CT and MRI angiography identified a bronchial to pulmonary artery fistula. Subsequent arteriography confirmed the findings. The arteriography showed ectasia of a branch of the right lower lobe pulmonary artery, measuring 15mm in diameter, increased from 12mm in 2020. Additionally, diffuse ectasia of the right bronchial artery and its branches was observed.

### Management and Treatment

A selective embolization was performed using a double puncture approach with a 4F arterial catheter for the femoral artery and a 5F venous catheter for the femoral vein. Detailed navigation was achieved using a Carnelian 1.9F microcatheter. The abnormal connection was occluded using detachable microcoils (6mm and 5mm) and a suspension of Lipiodol and Glubran (1:1), resulting in complete arrest of the pathological flow.

### Follow-up

Follow-up CT angiography confirmed the successful occlusion of the bronchial artery in the subcarinal region. Weak enhancement of some small distal branches was noted only in the venous phase, with no significant perfusion in the arterial phase. The aneurysmal dilation of a branch of the right lower lobe pulmonary artery was reduced to a maximum diameter of 14mm from 16mm previously.

## DISCUSSION

### Etiology & Demographics

Bronchial to pulmonary artery fistulas are rare vascular anomalies that often arise secondary to prior trauma, infection, or as congenital anomalies. They are more common in males, typically presenting in the fourth or fifth decade of life.

### Clinical & Imaging Findings

Clinically, patients may present with nonspecific symptoms, and the diagnosis is usually made incidentally during imaging for unrelated conditions. Imaging findings typically include ectasia of the involved arteries and a direct communication between the bronchial and pulmonary arteries, best visualized on CT or MRI angiography.

### Treatment & Prognosis

Endovascular embolization is the treatment of choice for these fistulas, offering a minimally invasive alternative to surgery with a good prognosis. However, close follow-up is necessary to monitor for potential recurrences, as small collaterals may continue to supply the fistula.

### Differential Diagnoses

Differential diagnoses include pulmonary arteriovenous malformations, bronchial artery aneurysms, pulmonary sequestration, and infected pulmonary cavitations. These entities can be distinguished based on their specific imaging characteristics across different modalities.

## TEACHING POINT

This case emphasizes the importance of early detection and intervention in managing bronchial to pulmonary artery fistulas. Effective treatment with selective embolization can prevent complications and lead to favorable patient outcomes.

## QUESTIONS & ANSWERS

**Question 1:** Which of the following imaging findings is most characteristic of a bronchial to pulmonary artery fistula?

1. Hypointense signal on MRI-T1
2. Hyperintense signal on MRI-T2
3. Ectasia of pulmonary artery on CT (applies)
4. Restricted diffusion on MRI-DWI
5. Homogeneous enhancement on CT

**Explanation**: The characteristic finding on CT is ectasia of the pulmonary artery with a direct connection to the bronchial artery, which is the most indicative of a bronchial to pulmonary artery fistula. [Clinical & Imaging Findings section]

**Question 2:** What is the most common treatment for a bronchial to pulmonary artery fistula?

1. Surgical resection
2. Endovascular embolization (applies)
3. Radiation therapy
4. Chemotherapy
5. Observation without intervention

**Explanation**: The most common and preferred treatment for a bronchial to pulmonary artery fistula is endovascular embolization, which is minimally invasive and effective in most cases. [Treatment & Prognosis section]

**Question 3:** Which of the following is a potential risk factor for developing a bronchial to pulmonary artery fistula?

1. Congenital heart disease
2. Prior trauma (applies)
3. Diabetes mellitus
4. Hypertension
5. Pulmonary embolism

**Explanation**: Prior trauma, infection, or vascular anomalies are known risk factors for developing a bronchial to pulmonary artery fistula. [Etiology & Demographics section]

**Question 4:** What imaging modality is most useful for visualizing the detailed anatomy of a bronchial to pulmonary artery fistula?

1. X-ray
2. Ultrasound
3. MRI
4. CT/AngioCT (applies)
5. Scintigraphy

**Explanation**: CT or AngioCT is the most useful imaging modality for visualizing the detailed anatomy of a bronchial to pulmonary artery fistula, allowing for precise identification of the ectasia and connection between the arteries. [Clinical & Imaging Findings section]

**Question 5:** What finding on a follow-up CT scan suggests the need for further treatment of a bronchial to pulmonary artery fistula?

1. Reduction in aneurysmal dilation size
2. No enhancement in arterial phase
3. Weak enhancement in venous phase (applies)
4. Complete resolution of the fistula
5. Absence of pulmonary symptoms

**Explanation**: Weak enhancement in the venous phase on follow-up CT may indicate that small collaterals are still supplying the AVM, suggesting that further treatment may be necessary. [Follow-up section]

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## FIGURES

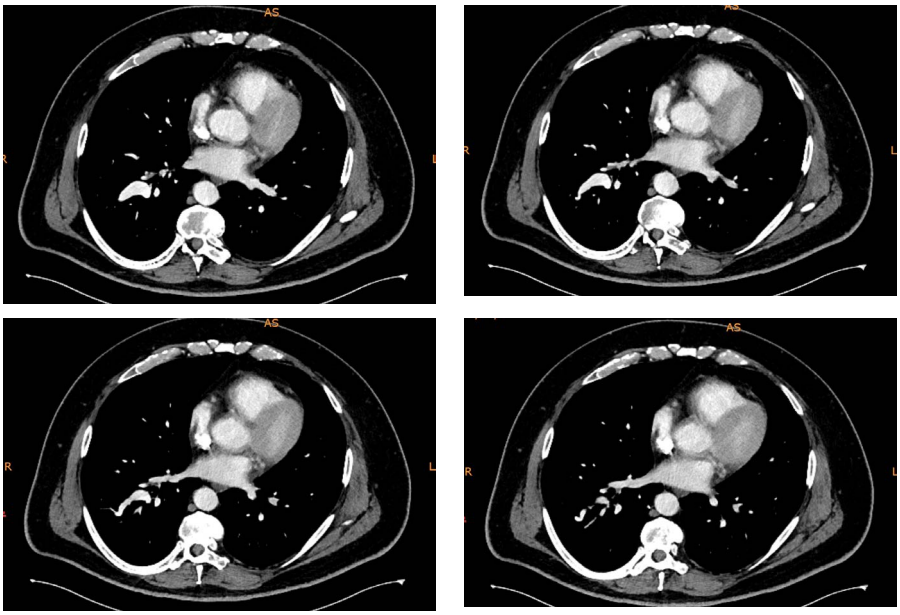

**Figure 1**

☐ **Age, gender, diagnosis**: 43-year-old male with bronchial to pulmonary artery fistula.

☐ **Findings**: Pre-procedural arterial phase CT scan showing the enhanced fistula.

☐ **Technique**: CT scan with contrast, arterial phase, 120kVp, 5mm slice thickness, 120ml iohexol.

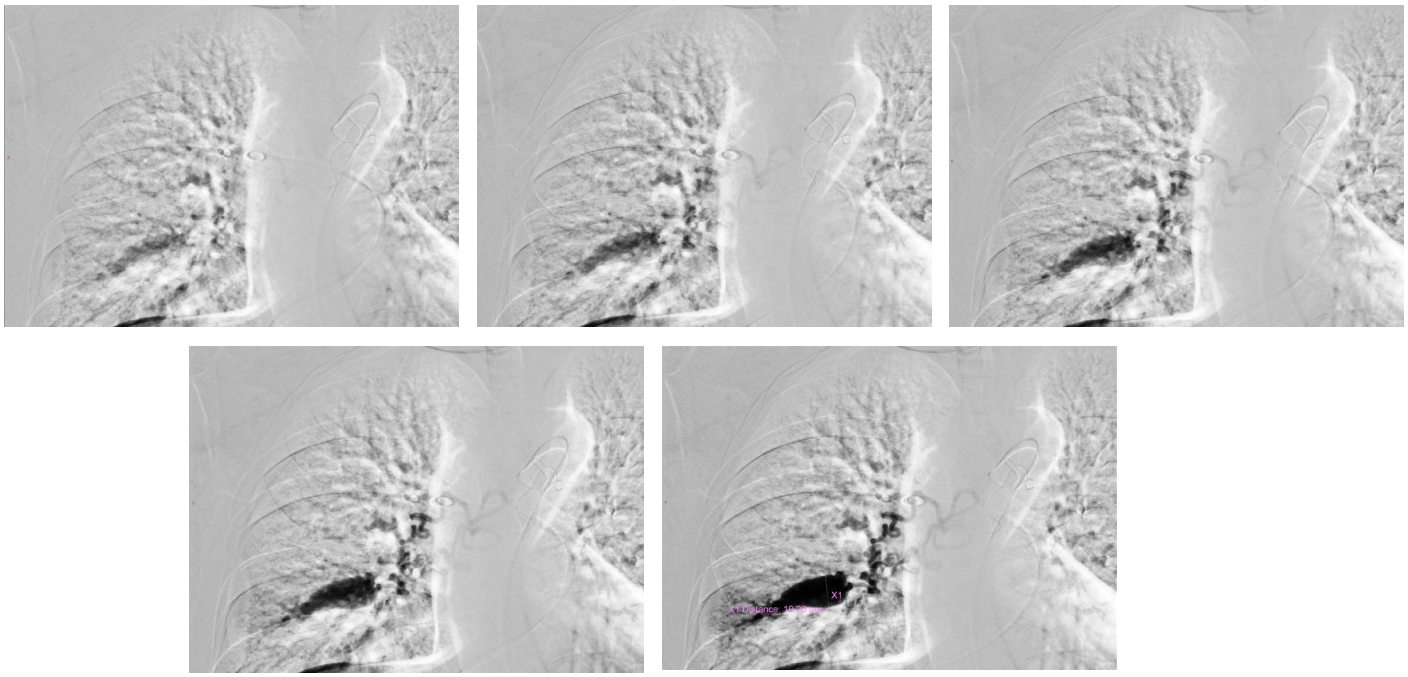

**Figure 2**

☐ **Age, gender, diagnosis**: 43-year-old male with bronchial to pulmonary artery fistula.

☐ **Findings**: Diagnostic angiography showing the fistula.

☐ **Technique**: Arteriography with selective catheterization, 5F catheter, 4ml iohexol.

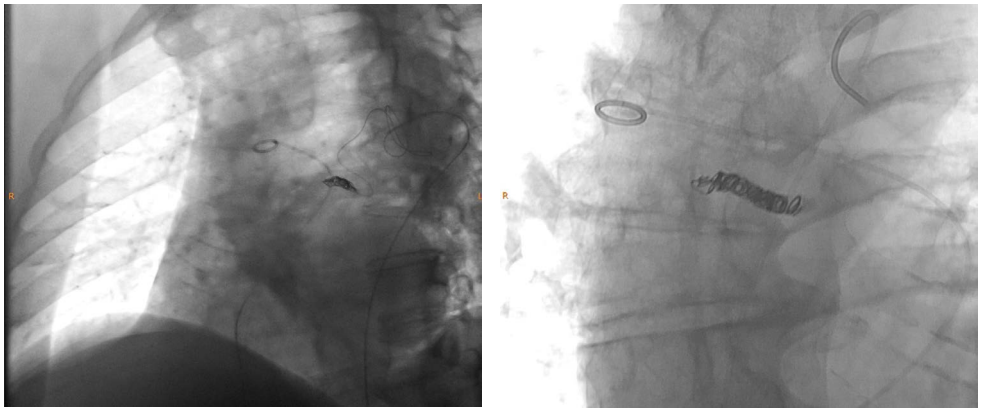

**Figure 3**

- **Age, gender, diagnosis**: 43-year-old male with bronchial to pulmonary artery fistula.
- **Findings**: Angiography with all microcoils inserted and glue behind the coils.
- **Technique**: Arteriography post-embolization, 6mm and 5mm microcoils, 1:1 Lipiodol-Glubran mix.





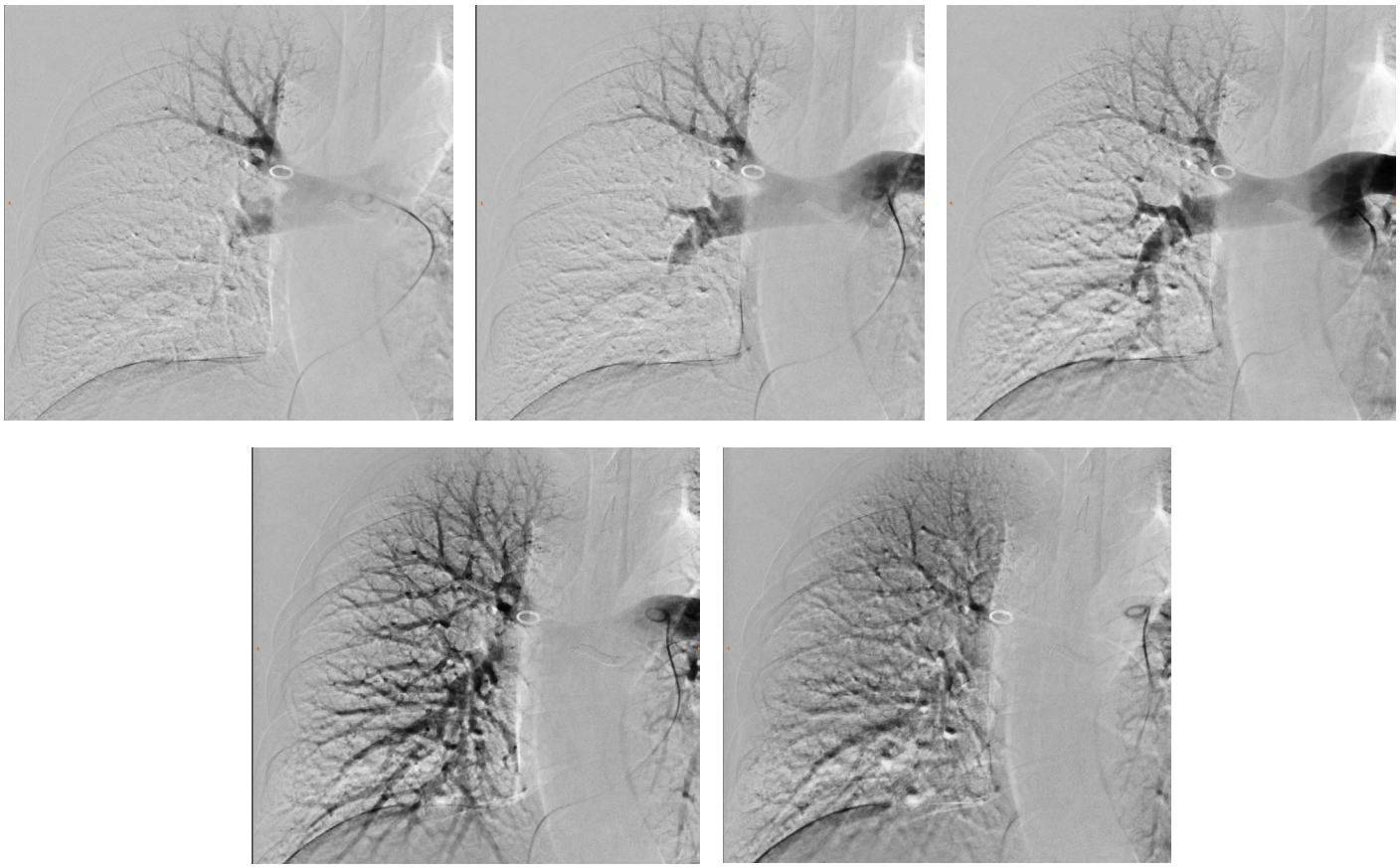

**Figure 4**

- **Age, gender, diagnosis**: 43-year-old male with bronchial to pulmonary artery fistula.
- **Findings**: Angiography showing the final result with no enhancement of the previously visible fistula.
- **Technique**: Arteriography final phase post-embolization, 4F catheter, 4ml iohexol.

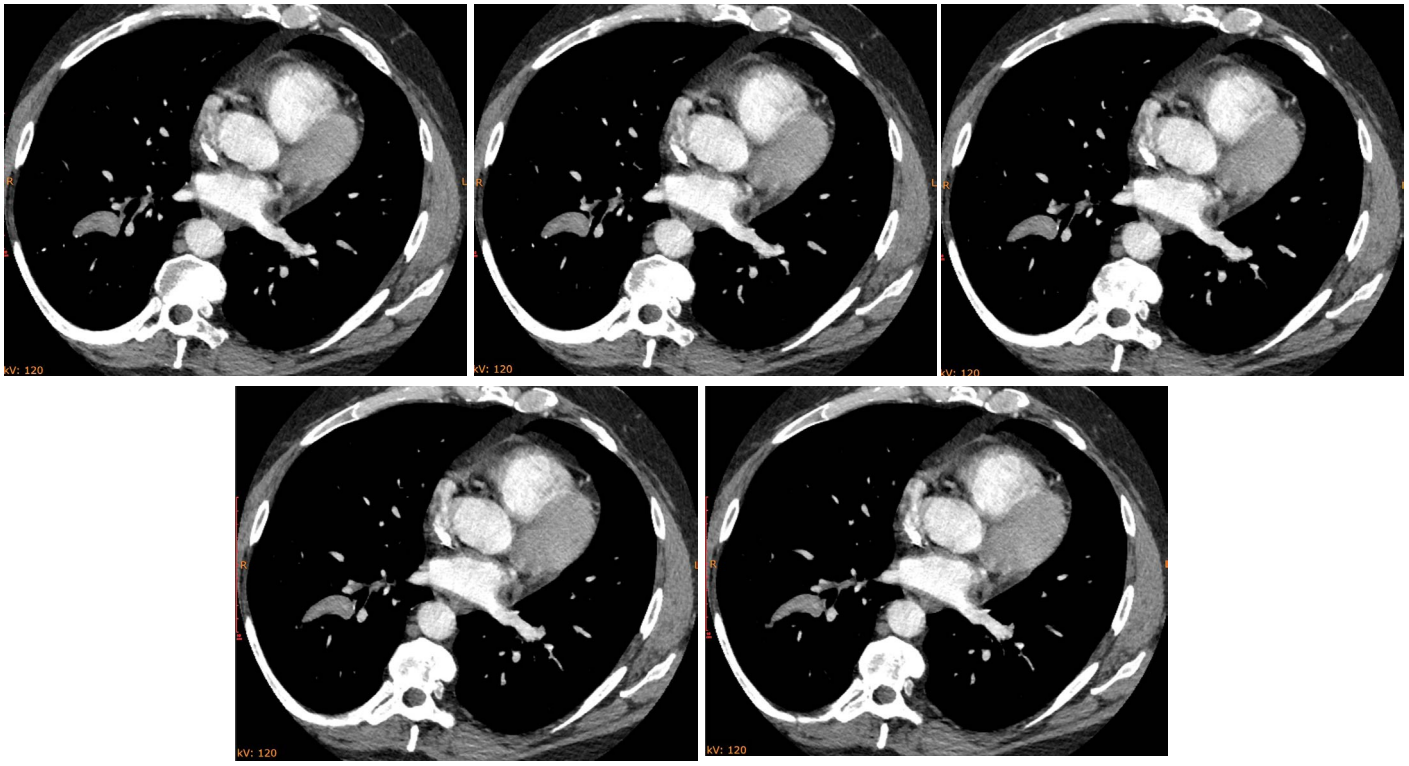

**Figure 5**

- **Age, gender, diagnosis**: 43-year-old male with bronchial to pulmonary artery fistula.
- **Findings**: Post-procedural pure arterial phase CT scan after a day also showing no enhancement of the fistula.
- **Technique**: CT scan with contrast, pure arterial phase, 120kVp, 5mm slice thickness, 120ml iohexol.

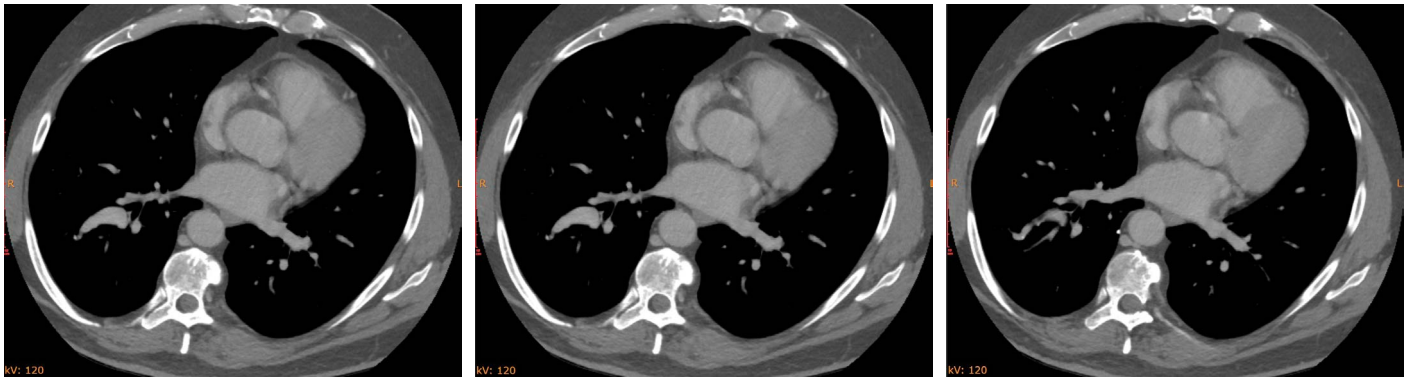

**Figure 6**

- **Age, gender, diagnosis**: 43-year-old male with bronchial to pulmonary artery fistula.
- **Findings**: Post-procedural venous phase axial CT scan showing minimal enhancement of the fistula.
- **Technique**: CT scan with contrast, venous phase, 120kVp, 5mm slice thickness, 120ml iohexol.

**Table 1: Summary Table**: Contains high yield information about the reported entity.

| **Field** | Information |
|---|---|
| Etiology | Likely secondary to previous trauma or infection, considering the patient's medical history. |
| Incidence | Rare, with fewer than 100 cases reported in the literature. |
| Gender Ratio | More common in males, with a 2:1 male-to-female ratio. |
| Age Predilection | Typically presents in the fourth to fifth decade of life. |
| Risk Factors | History of trauma, infection, or vascular anomalies. |
| Treatment | Endovascular embolization is the preferred treatment option. |
| Prognosis | Generally good with successful embolization; however, close follow-up is necessary to monitor for recurrences. |
| Findings on Imaging | Ectasia of the pulmonary artery with a direct connection to the bronchial artery. |

**Table 2:** Differential Diagnoses:

| **Condition** | **X-Ray** | **CT** | **MRI - T1** | **MRI - T2** | **Contrast Enhancement** | **Scintigraphy** | **PET** |
|---|---|---|---|---|---|---|---|
| Bronchial to Pulmonary Artery Fistula | Often not visible on X-ray | Ectasia of pulmonary artery, connection with bronchial artery | Hypointense signal | Hyperintense signal | Homogeneous enhancement | Rarely used | FDG uptake in associated conditions |
| Pulmonary Arteriovenous Malformation (AVM) | Often not visible on X-ray | Vascular mass with simultaneous opacification of artery and vein | Hypointense signal | Hyperintense signal | Heterogeneous enhancement | Rarely used | FDG uptake in associated conditions |
| Bronchial Artery Aneurysm | Often not visible on X-ray | Pulsating mass near the bronchial artery; possible rupture visible as hemorrhage | Hypointense signal | Hyperintense signal | Homogeneous enhancement | Rarely used | FDG uptake in associated conditions |
| Pulmonary Sequestration | Often not visible on X-ray | Well-defined mass, usually in the lower lobe, with anomalous arterial supply | Hypointense signal | Hyperintense signal | None or minimal enhancement | Rarely used | FDG uptake in associated conditions |
| Infected Pulmonary Cavitation | Area of increased radiolucency with a surrounding radiopaque rim, sometimes present | Irregular cavity with thick walls; potential embolization of surrounding tissue | Hypointense signal | Hyperintense signal | Variable enhancement depending on infection status | Rarely used | FDG uptake related to inflammation. |

**Table 3:** Imaging Findings

| **Imaging Modality** | **Key Findings** |
|---|---|
| **CT/AngioCT** | Ectasia of a branch of the right lower lobe pulmonary artery (15mm), increased compared to previous studies (12mm). Diffuse ectasia of the bronchial artery and its branches. |
| **MRI Angiography** | Confirmation of the pulmonary vascular anomaly, precise identification of the bronchial-pulmonary artery fistula. |
| **Arteriography** | Direct visualization of the connection between the bronchial artery and the pulmonary artery; confirmation of the position and size of the ectasia. |
| **Follow-up CT** | Confirmation of successful embolization, with arrest of pathological flow and slight residual enhancement only in the venous phase. Reduction of the aneurysmal dilation diameter to 14mm. |

ABBREVIATIONS

AVM = ARTERIOVENOUS MALFORMATION
CT = COMPUTED TOMOGRAPHY
MRI = MAGNETIC RESONANCE IMAGING
FDG = FLUORODEOXYGLUCOSE

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