



Ischemic Cerebellar Stroke During Embolization Procedure on Hemoptysis Patient

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Abstract. Hemoptysis represents one of the most challenging conditions that are potentially life-threatening. Bronchial artery embolization (BAE) is effective method for controlling hemoptysis, but it also has complication risk like nontarget embolization in 0,6–5,5% cases. The Purpose of this case report is to know the complications and early management of embolization procedures, so the radiologist can minimize the complication. Conducting a literature review and medical records. A 33-yo female Aspergilloma patient with moderate hemoptysis treated with embolization. Embolization was performed through cannulation of the right intercostal artery and right costocervical trunk artery. Embolization was carried out with PVA and showed a decrease in supply of 60% - 70%. Before finishing the embolization, the patient complained of acute vertigo that showed nontargeted embolization which is probably due to embolism in posterior (vertebrobasilar) circulation. CT and MRI scans showed infarction in the right cerebellum. The patient received ischemic stroke therapy and the patient's condition improved without complaint of hemoptysis and vertigo. Nontarget embolization is complication risk of BAE. The complication rate depends on the the vascular territory, sharp angle of branching, tortuosity, caliber of the artery, and operator's experience. The anatomical location of the costocervical trunk adjacent to the vertebral arteries would be the risk of nontargeted embolization to the areas vascularized by posterior (vertebrobasilar) circulation. BAE is an effective method for controlling hemoptysis, but this procedure has complication risk. Imaging of anatomical pathologies, multidisciplinary team planning, and increasing competence can minimize complications of embolization procedures.

Keywords: nontarget embolization · hemoptysis · stroke

1 Introduction

Aspergilloma is a mass-like fungus ball that is caused by *Aspergillus fumigatus*. Aspergilloma occurs in patients with abnormally-structured lungs with preexisting cavities (Ofori et al., 2016). Hemoptysis is one of the most common symptoms in patients with respiratory disease and accounts for more than 50% of mortality in massive hemoptysis (Shao et al., 2015). Pulmonary aspergilloma is sometimes asymptomatic for several years. However, hemoptysis is the most frequently identified symptom in the majority of

reported cases (Chen et al., 2012; Muniappan et al., 2014). Bronchial artery embolization (BAE) is a safe and effective emergency management procedure for massive hemoptysis or chronic, recurrent hemoptysis. The success rate of bronchial arteriography and direct embolization is reported to be in the range of 75–98% (Shao et al., 2015). Apart from the benefits gained, the undertaking of embolization also poses possible risks and complications. These consist of shivering, vomiting, mild fever throughout the process, irritative cough, dysphagia, or unanticipated non-target embolization (Agmy et al., 2010).

2 Methods

The method that used in this case report is literature review, patient's history, and medical records.

3 Result

A 33-year-old female came with complaints of recurrent hemoptysis for the past 8 years that grew more severe 9 months prior. The expelled volume was ± 250 cc accompanied by pains in the chest area. The patient had a history of tuberculosis 8 years ago and has completed her category-1 medication program.

Chest X-ray revealed characteristics of infiltrates in the patient's right lung which suggests pulmonary TB compared to the previous chest X-ray, indicating that there is a reduction in infiltrates. The examination was continued by performing CT angiography, which displayed features of pulmonary TB with aspergilloma at the apical segment of the right superior lobe with feeder arteries coming from the right bronchial arteries, right supreme intercostal arteries, and right pulmonary artery of the posterior subsegmental branch in the apical segment. The patient then underwent a CT scan evaluation with features of consolidation and multiple cavities alongside those of fungus balls inside, forming an air crescent sign with a relatively-decreasing in size (Fig. 1).

During laboratory examination, the results of the complete blood test were within the normal limit. Upon conducting a rapid molecular test for *Mycobacterium tuberculosis*, the microbiological examination using the sputum sample from the bronchoalveolar

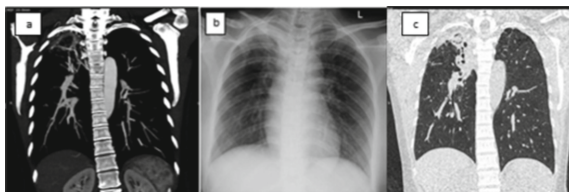


Fig. 1. A. CT scan angiogram showing feeder arteries coming from the right bronchial arteries, right supreme intercostal arteries, and right pulmonary artery of the posterior subsegmental branch in the apical segment. Figure B. Chest X-ray post embolization procedure, indicating features of infiltrates in the apex of the right lung. Figure C. CT scan evaluation with features of consolidation and multiple cavities alongside those of fungus balls inside, forming an air crescent sign with a relatively-decreasing in size.

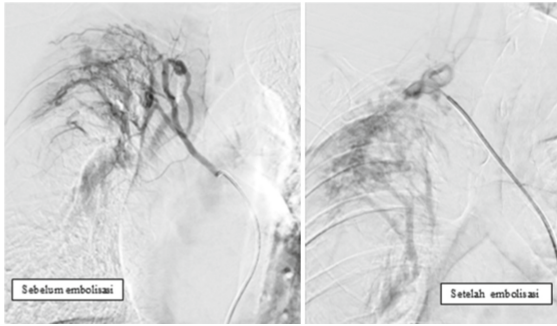


Fig. 2. Embolization through the cannulation of the right costocervical trunk, and upon performing DSA, there seems to be blushing and tortuous intercostal arteries. Superselective cannulation and embolization with PVA 355 – 500 microns were done until a stasis and a \pm 60% – 70% decrease in supply.

lavage (BAL) did not show any typical fungal morphology and *Pseudomonas oleovorans* was identified in the sputum culture.

The patient received symptomatic medication, comprising tranexamic acid and codeine, fluconazole for mycosis, and antibiotics for the bacterial infection. Despite these measures, the patient's hemoptysis did not show any improvements. Then, the patient performed embolization to reduce the hemoptysis symptom (Fig. 2).

Embolization was undertaken through the cannulation of the right intercostal arteries at the Th5/6, and the DSA presented intercostal artery tortuosity and blushing. Afterward, superselective cannulation and embolization were performed with PVA at 355 – 500 microns until a stasis, which were continued with a post-embolization DSA that did not present any blushing. There also appeared to be tortuosity on the branch of the right costocervical trunk, which was then subjected to a superselective cannulation and embolization with PVA at 355–500 microns until a stasis, continued with a post-embolization DSA that did not show any signs of blushing and indicated a \pm 60–70% decrease in supply. During the process of embolization, the patient complained acute vertigo, nystagmus, without any neurological deficit symptoms. The embolization procedure was halted once the patients experienced any symptoms due to the possibility of non-target embolization. As a countermeasure to these complications, the patient was injected with 5000 IU of heparin, which was followed by head CT scan.

The head CT scan showed hypodense lesion with ill-defined borders at the right cerebellum, and the MRI examination showed lesion hypointense on T1WI and hyperintense on T2WI/FLAIR, restricted diffusion on DWI, and non-blooming SWI at the right cerebellum, suggesting features of an acute infarct of the right cerebellum. The patient was then treated by the physicians, receiving a neuroprotective drug (citicoline) and symptomatic drugs for her vertigo (flunarizine, dimenhydrinate, and betahistine). Throughout the treatment process, the patient's condition has shown improvements.

4 Discussion

Globally, it is estimated that 1.2 million people suffer from chronic pulmonary aspergillosis (CPA) as a sequela of TB, particularly in TB endemic regions Africa, West Pacific, and Southeast Asia (Denning et al. 2016). Most aspergilloma cases are asymptomatic and 10% of them resolve spontaneously (Pohl et al. 2013). Some non-specific symptoms consist of hemoptysis, coughing, chest pain, and fever. Hemoptysis in patients is caused by the erosion of adjacent secondary blood vessels due to systemic hypervascularization, resulting in bronchial artery hypertrophy and neovascularization through the parietal arteries (Harmouchi et al. 2020). Features of aspergilloma appear as excavated simple-cavity lesions with thick walls, accompanied by features of fungus ball developing within the cavities, forming what's called "air crescent"(Harmouchi et al. 2020). Chest CT scan in lateral decubitus position can help if there is no clear diagnosis by visualizing the mobilization of fungus ball according to the gravity (Monod Sign). This patient's CT scan examination showed opacity in the "air crescent" cavities and the position of the fungus ball corresponding to the gravity, marking features of pulmonary aspergilloma (Fig. 3).

The patient received antifungal and symptomatic medications, albeit his persistent hemoptysis at ± 250 cc twice a week. Clinician planned embolization to reduce hemoptysis and performed CT angiography as a vascular mapping for the eventual embolization. Based on the volume of hemoptysis expelled, the level of hemoptysis is divided into three: mild, moderate, massive. If the volume of hemoptysis is less than 100 mL/day or less than 50 mL/episode, it is considered as mild hemoptysis. Moderate hemoptysis is when the volume is 100–300 mL/day or more than three attacks of more than 100 mL/day in one week. Massive/severe/life-threatening hemoptysis is when: a) hemoptysis is more than 300 mL / day, b) hemoptysis with any volume that causes a decrease in hemoglobin (> 1 g/dL reduction) or hematocrit ($> 5\%$ reduction) or respiratory failure (SPaO₂, $< 60\%$), or hypotension (systolic blood pressure < 90 mm Hg) (Panda et al. 2017). The patient suffered from hemoptysis with a volume of ± 250 cc for twice a

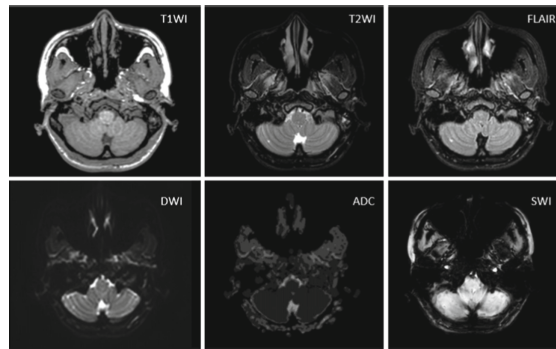


Fig. 3. MRI images showing lesions hypointense on T1WI and hyperintense on T2WI/ FLAIR, restricted diffusion on DWI, and non-blooming SWI at the right cerebellum, suggesting features of an acute infarct. No features of stenosis, aneurysm, and any vascular malformation are visible on the carotid and vertebrobasilar artery.

week. Therefore, the patient's condition is classified as moderate hemoptysis that did not improve with medications. As a result, this becomes one of the indications for the embolization procedure.

Percutaneous transcatheter embolization is defined as an intravascular embolization that uses a device or agent (solid or liquid) to produce vascular occlusion. Vascular embolization can be performed at any level, from major arteries to capillary arteries, and both temporary or permanent (Angle et al. 2010). One indication of the undertaking of embolization is persistent or acute hemorrhage treatments (for instance, hemoptysis, gastrointestinal hemorrhage, post-trauma, iatrogenic hemorrhage, and hemorrhagic neoplasm). The success rate of the management of hemoptysis cases in aspergillosis cases is estimated to be around 58–67% (Angle et al. 2010). The level of complication depends on the operator's experience, the vascular territory that will be embolized, the specific lesion that will be treated, and the patient's clinical condition. The possible complications that may happen are hemorrhage, ischemia on the target, infections, and nontarget embolization where it is likely to take place in 0.6–5.5% of cases (Angle et al. 2010).

In CT angiography, the aspergilloma lesion in this patient received feeder from the right bronchial arteries, right supreme intercostal arteries, and right pulmonary artery of the posterior subsegmental branch in the apical segment. A superselective cannulation was performed at the right intercostal artery on the Th5/6 and the right costocervical trunk, which was followed by the embolization with PVA at 355 – 500 microns until a stasis and a marked $\pm 60\% - 70\%$ reduction in supply. The anatomical location of the costocervical trunk adjacent to the vertebral arteries becomes one of the risks of nontarget embolization to the vascularized area by the vertebral arteries. Technical failures in the procedure may also occur due to the tortuous pathological artery, small caliber of the artery, and sharp branch angle (Wong et al. 1994).

It is identified that 20% of ischemia cases involve neural structures supplied by the posterior (vertebrobasilar) circulation, and dizziness / vertigo is one of the most frequently reported symptoms of vertebrobasilar diseases (Choi et al., 2013). Stroke in the distribution of posterior circulation can manifest as acute spontaneous vertigo and loss of balance. About 17% of patients with infarct on the posterior inferior cerebellar artery (PICA) territory also had vertigo, nystagmus, and postural unsteadiness (Kim and Lee 2013). The patient was injected with 5000 IU of heparin as a preliminary therapy for nontarget embolization. The choice for thrombolysis therapy in acute strokes is the provision of rtPA (alteplase). Warfarin is the first-line treatment on most cardioembolic stroke cases. However, the use of warfarin must be highly considered because it may increase the risks of hemorrhage. For non-cardioembolic stroke cases, the substitution of antiplatelet to warfarin is not advised.

In the CT scan result, an acute infarct is visible at the left side of the cerebellum. This feature is shown by the hypodense feature on the right cerebellum. The MRI images present lesion hypointense on T1WI and hyperintense on T2WI/FLAIR, restricted diffusion on the DWI, non-blooming on the SWI at the right cerebellum, indicating an acute infarct. The patient was then provided with treatment by the neurology physicians

and received a neuroprotectant medication therapy (citicoline) and symptomatic medications to reduce her vertigo complaint, which were flunarizine, dimenhydrinate, dan betahistine.

BAE is an effective method to control hemoptysis, albeit posing risks of complications. When the complications cannot be eliminated completely, their appearance and level of severity can be diminished using competence, expertise on cerebrovascular anatomy and pathology, and formulation of plans in a multidisciplinary team (Alexander et al. 2021).

5 Conclusions

Hemoptysis as a complication of aspergilloma is potentially life-threatening. Bronchial arteries embolization (BAE) is a relatively safe and effective method to control hemoptysis, though this procedure also presents some risks of complications, for instance, nontarget embolization was reported on 0.6 – 5.5% of cases. The degree of complication depends on the vascular area that will be embolized, the sharpness of the branch angle, tortuosity, artery caliber, and the operator's experience. When the complications cannot be eliminated completely, their appearance and level of severity can be diminished using competence, expertise on cerebrovascular anatomy and pathology, and formulation of plans with a multidisciplinary team.

References

- Agmy, G. M., Wafi, S. M., Gad, Y. A., Abd El-Salam, A. E.-S. A. & Imam, H. M. (2010). Bronchial and Nonbronchial Systemic Artery Embolization: Experience With 348 Patients. *Chest*, 138(4), 265A. <https://doi.org/10.1378/chest.9523>
- Alexander, M. D., Halbach, V. V. & Hetts, S. W. (2021). "And do no harm": Complications in interventional neuroradiology. In *Handbook of Clinical Neurology* (1st ed., Vol. 176). Elsevier B.V. <https://doi.org/10.1016/B978-0-444-64034-5.00021-3>
- Angle, J. F., Siddiqi, N. H., Wallace, M. J., Kundu, S., Stokes, L., Wojak, J. C. & Cardella, J. F. (2010). Quality improvement guidelines for percutaneous transcatheter embolization: Society of interventional radiology standards of practice committee. *Journal of Vascular and Interventional Radiology*, 21(10), 1479–1486. <https://doi.org/10.1016/j.jvir.2010.06.014>
- Chen, Q. K., Jiang, G. N. & Ding, J. A. (2012). Surgical treatment for pulmonary aspergilloma: A 35-year experience in the Chinese population. *Interactive Cardiovascular and Thoracic Surgery*, 15(1), 77–80. <https://doi.org/10.1093/icvts/ivs130>
- Choi, K. D., Lee, H. & Kim, J. S. (2013). Vertigo in brainstem and cerebellar strokes. *Current Opinion in Neurology*, 26(1), 90–95. <https://doi.org/10.1097/WCO.0b013e32835c5edd>
- Denning, D. W., Cadranel, J., Beigelman-Aubry, C., Ader, F., Chakrabarti, A., Blot, S., Ullmann, A. J., Dimopoulos, G. & Lange, C. (2016). Chronic pulmonary aspergillosis: Rationale and clinical guidelines for diagnosis and management. *European Respiratory Journal*, 47(1), 45–68. <https://doi.org/10.1183/13993003.00583-2015>
- Harmouchi, H., Sani, R., Issoufou, I., Lakranbi, M., Ouadnoui, Y. & Smahi, M. (2020). Pulmonary aspergilloma: from classification to management. *Asian Cardiovascular and Thoracic Annals*, 28(1), 33–38. <https://doi.org/10.1177/0218492319895113>
- Kim, J. S. & Lee, H. (2013). Vertigo due to posterior circulation stroke. *Seminars in Neurology*, 33(3), 179–184. <https://doi.org/10.1055/s-0033-1354600>

- Muniappan, A., Tapias, L. F., Butala, P., Wain, J. C., Wright, C. D., Donahue, D. M., Gaissert, H. A., Lanuti, M. & Mathisen, D. J. (2014). Surgical therapy of pulmonary aspergillomas: A 30-year north American experience. *Annals of Thoracic Surgery*, 97(2), 432–438. <https://doi.org/10.1016/j.athoracsur.2013.10.050>
- Ofori, A., Steinmetz, A., Akaasi, J., Frimpong, G., Norman, B., Obeng-Baah, J., Bedu-Addo, G. & Phillips, R. (2016). Pulmonary aspergilloma: An evasive disease. *International Journal of Mycobacteriology*, 5(2), 235–239. <https://doi.org/10.1016/j.ijmyco.2016.03.002>
- Panda, A., Bhalla, A. S. & Goyal, A. (2017). Bronchial artery embolization in hemoptysis: A systematic review. *Diagnostic and Interventional Radiology*, 23(4), 307–317. <https://doi.org/10.5152/dir.2017.16454>
- Pohl, C., Jugheli, L., Haraka, F., Mfinanga, E., Said, K. & Reither, K. (2013). Pulmonary Aspergilloma: A Treatment Challenge in Sub-Saharan Africa. *PLoS Neglected Tropical Diseases*, 7(10). <https://doi.org/10.1371/journal.pntd.0002352>
- Shao, H. X., Wu, J. P., Wu, Q., Sun, X., Li, L., Xing, Z. H. & Sun, H. F. (2015). Bronchial artery embolization for hemoptysis: A retrospective observational study of 344 patients. *Chinese Medical Journal*, 128(1), 58–62. <https://doi.org/10.4103/0366-6999.147811>
- WONG, K. P., YOUNG, N. & MARKSEN, G. (1994). Bronchial artery embolization to control haemoptysis. *Australasian Radiology*, 38(4), 256–259. <https://doi.org/10.1111/j.1440-1673.1994.tb00193.x>

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