CASE REPORT

Dual arterial supply to normal lung: within the sequestration spectrum

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ABSTRACT. We report a rare case of dual arterial supply to an otherwise normal left lower lobe. In addition to normal pulmonary arterial supply, the lower lobe of the left lung also received systemic arterial supply from the coeliac axis. The relevant anatomy and literature are reviewed. To the best of our knowledge, there are no other reported cases of anomalous systemic arterial supply from the coeliac axis to the basal segments of the left lower lobe with normal bronchial branching and pulmonary arterial supply.

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Systemic arterial supply to the lungs can be congenital or acquired. In the commonly reported congenital form of systemic arterial supply to the basal segments of the left lower lobe, there is abrupt tapering of the left lower lobar pulmonary artery distal to the origin of the superior segmental artery and the aberrant systemic artery originates from the descending thoracic aorta [1, 2]. We report a rare case of dual arterial supply from the pulmonary and systemic arteries to the basal segments of the left lower lobe with a normal bronchial tree.

Case report

A 47-year-old woman presented with history of occasional blood-streaked sputum for the past 9 years. There was no history of excessive sputum production or past history of tuberculosis. Clinical examination was unremarkable, as were routine laboratory investigations.

The chest radiograph showed a few linear opacities in the left retrocardiac region (Figure 1). Bronchoscopy was normal. High-resolution computed tomography (HRCT) of the thorax was carried out to look for underlying bronchiectasis as the cause of haemoptysis. HRCT revealed a few asymmetrical dilated vessels in the left lower lobe; there was minimal adjacent ground-glass opacity and few linear opacities, suggesting post-inflammatory changes (Figure 2). In view of the presence of dilated vessels, a vascular malformation was suspected and CT angiography was performed. The CT angiogram showed aberrant systemic arterial supply to the basal segments of the left lower lobe; this arterial supply arose from the coeliac axis. This anomalous artery entered the thorax via the oesophageal hiatus, traversed parallel and to the left of the oesophagus and entered the left lower lobe via the pulmonary ligament, supplying

the basal segments. There was no arteriovenous malformation. Pulmonary arterial supply to the left lower lobe was also present with normal arborisation. Although the descending pulmonary artery appeared slightly smaller than on the right side, all the basal segmental branches were identified. The normal pattern of venous drainage into the inferior pulmonary vein was seen. The lung parenchyma showed mild linear and ground-glass opacity with normal branching of the bronchial tree (Figures 3, 4, 5, 6, 7 and 8). The patient was not keen on surgery or endovascular treatment and is on follow-up.

Discussion

Congenital causes of systemic arterial supply to the lungs include various congenital heart and lung anomalies. Lung diseases such as bronchopulmonary sequestrations and hypogenetic lung syndromes are associated with a high prevalence of systemic arterial supply by large arteries, often from the aorta [3].

Sequestration is traditionally defined as a non-functioning mass of lung tissue that lacks normal communication with the tracheobronchial tree and which receives its arterial blood supply from the systemic circulation [4]. However, modifications to this definition have been suggested by different authors to incorporate a wider spectrum of abnormalities. The “sequestration spectrum” includes various combinations of abnormal bronchial connection, arterial supply and venous drainage under the same spectrum [5]. Anomalous systemic arterial supply to normal segments of the lung has been classified as Pryce Type I sequestration [6]. As seen in the case we describe, there is normal bronchial connection to the affected lung with the normal number and distribution of segmental bronchi, and the lung is perfused by pulmonary and systemic arteries.

Anomalous systemic arterial supply to the lungs without bronchial sequestration (*i.e.* to normal lung)

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Figure 1. Chest radiograph, posteroanterior view. Linear opacities are visible in the left retrocardiac region (arrow).

could be in the form of isolated systemic supply to normal lung (ISSNL) or associated with normal pulmonary artery supply (dual arterial supply). ISSNL is more common than dual arterial supply and is more commonly described in the basal segments of the left lower lobe. Classically described findings include the absence of the interlobar artery distal to the origin of the superior segmental artery and the abrupt tapering of the left lower lobar pulmonary artery distal to the origin of superior segmental artery, with an aberrant systemic artery originating from the descending thoracic aorta. The arterial branches access the lung through the pulmonary hilum or inferior pulmonary ligament, and there are mild lung parenchymal findings such as

Figure 2. High-resolution CT scan through the lower lobes in lung window. Dilated vessels are apparent in the left lower lobe (arrow); normal lung parenchyma apart from mild ground-glass opacity.

Figure 3. Axial CT through lower lobes of lungs in lung window. Normal segmental branches (arrows) of the left lower lobar pulmonary artery accompany the normal segmental bronchi.

ground-glass opacity and some volume loss [2, 7, 8]. Variations have been reported, as in the case described by Singh et al [9], where the entire left lung was supplied by collateral vessels from the coeliac trunk and the left subclavian artery; in this case, there was a normal tracheobronchial tree and severe hypoplasia of the pulmonary artery. When the basal segments of the right lower lobe are involved, the systemic arterial supply could be from the descending thoracic aorta, abdominal aorta or coeliac axis [10–12].

There is a single case report of the peripheral parts of an otherwise normal left lung supplied by major systemic arteries arising from the left subclavian, internal mammary and coeliac arteries. In this case, described by Fernandez-Martorell et al [13], the patient had systemic arterial supply to the lung through the transpleural route.

Clinically, anomalous systemic arterial supply to normal lungs is usually asymptomatic or minimally symptomatic. Frank haemoptysis and blood-stained

Figure 4. Axial CT through lower lobes of lungs in lung window inferior to Figure 3. Subsegmental pulmonary arterial branches (white arrows) accompanying their corresponding bronchi. The anomalous systemic artery (curved black arrow) is also seen in the pulmonary ligament.

Figure 5. Axial CT scan through lower lobes of lungs in lung window inferior to Figure 4. Subsegmental pulmonary arterial branches (arrows) and larger calibre branches (curved arrows) from the anomalous systemic artery are apparent. The anomalous systemic artery (arrow head) is also seen lateral to the oesophagus.

sputum are the most frequent clinical symptoms. Other signs and symptoms of this disease are exertional dyspnoea, a lower thoracic murmur and congestive heart failure owing to left heart overload.

Chest radiography can show lung opacity, most commonly in the left retrocardiac area. CT of the thorax is the most useful test in the evaluation of cases of suspected sequestration or anomalous systemic arterial supply to the lungs, as it clearly shows both the bronchial and vascular anatomy of the lung. CT angiography can clearly depict the origin of aberrant systemic arteries to the lungs. Bronchoscopy is helpful in excluding endobronchial causes of haemoptysis. Although most patients are minimally symptomatic, increased blood supply to the lungs in the course of time can lead to congestive heart failure or haemoptysis. Various treatment modalities have been described including lobectomy or segmentectomy, endovascular treatment (such as coil

Figure 6. Axial CT through lower lobes of lungs in mediastinal window. The anomalous systemic artery (curved arrow) is apparent lateral to the oesophagus.

Figure 7. Three-dimensional reconstruction from the CT angiogram showing normal branching of the left descending pulmonary artery (arrows) and the anomalous systemic artery (curved arrows).

embolisation of the aberrant artery) and systemic artery to pulmonary artery anastomosis. Our patient chose to defer treatment and is on follow-up.

In conclusion, anomalous systemic arterial supply to normal lung could be considered as part of the spectrum

Figure 8. Three-dimensional reconstruction from the CT angiogram showing the anomalous systemic artery (arrow) arising from the coeliac artery (arrow head), ascending into the thorax and supplying basal segments of the left lower lobe.

of sequestration-like anomalies. Systemic arterial supply might be the sole supply to the involved lung or there could be dual supply from normal pulmonary artery branches and the anomalous systemic artery. This anomaly is more common in basal segments of the left lower lobe with aberrant isolated supply from the descending thoracic aorta. To the best of our knowledge, this is a unique case in which there is dual arterial supply to the basal segments of the left lower lobe with the aberrant systemic supply arising from the coeliac axis.

References

1. Ko SF, Ng SH, Lee TY, Wan YL. Anomalous systemic arterialization to normal basal segments of the left lower lobe: helical CT and CTA findings. *J Comput Assist Tomogr* 2000;24:971–6.
2. Kurosaki Y, Kurosaki A, Irimoto M, Kuramoto K, Itai Y. Systemic arterial supply to normal basal segments of left lower lobe: CT findings. *J Comput Assist Tomogr* 1993;17:857–61.
3. Ellis K. Fleischner lecture. Developmental abnormalities in the systemic blood supply to the lungs. *Am J Roentgenol* 1991;156:669–79.
4. Landing BH, Dixon LG. Congenital malformations and genetic disorders of the respiratory tract (larynx, trachea, bronchi and lungs). *Am Rev Respir Dis* 1979;120:151.
5. Sade RM, Clouse M, Ellis FH. The spectrum of pulmonary sequestration. *Ann Thorac Surg* 1974;18:644–58.
6. Pryce DM. Lower accessory pulmonary artery with intralobar sequestration of lung: a report of seven cases. *J Pathol* 1946;58:457–67.
7. Yamanaka A, Hirai T, Fujimoto T, Hase M, Noguchi M, Konishi F. Anomalous systemic arterial supply to normal basal segments of the left lower lobe. *Ann Thorac Surg* 1999;68:332–8.
8. Kim TS, Lee KS, Im JG, Goo JM, Park JS, Kim JH. Systemic arterial supply to the normal basal segments of the left lower lobe: radiographic and CT findings in 11 patients. *J Thorac Imaging* 2002;17:34–9.
9. Singh AS, Subbain SK, Subramanian KG, Agarwal R, Dave DJ, Kulkarni S, et al. Pseudosequestration of the left lung. *Tex Heart Inst J* 2007;34:195–8.
10. Litwin SB, Plauth WH Jr, Nadas AS. Anomalous systemic arterial supply to the lung causing pulmonary-artery hypertension. *N Engl J Med* 1970;283:1098–9.
11. Campbell DC Jr, Murney JA, Dominy DE. Systemic arterial blood supply to a normal lung. *J Am Med Assoc* 1962;182:497–9.
12. Flisak ME, Chandrasekar AJ, Marsan RE, Ali MM. Systemic arterialization of lung without sequestration. *Am J Radiol* 1982;138:751–3.
13. Fernandez-Martorell P, Yoo SJ, Benson LN. An unusual form of anomalous systemic arterial supply to the left lung. *Cardiol Young* 2006;16:305–7.