

Case Report

Lumbar azygos vein producing an azygos lobe in the right lung

Muhammad Saeed, MBBS, M.Phil, Amin A. Rufai, MBBS, PhD, Salah E. Osman El-Sayad, FRCS, PhD.

ABSTRACT

The continuation of the azygos vein with the inferior vena cava and a well demarcated azygos lobe of the right lung were detected during routine dissection of a 65-years-old white male cadaver. The azygos arch was found dilated and malpositioned to create an aberrant azygos fissure in the right superior lobe which, was occupied by a fold of parietal pleura. The developmental and clinical significance of the azygos lobe is discussed.

Keywords: Mesazygos, aberrant azygos arch, inferior vena cava.

Saudi Med J 2002; Vol. 23 (4): 471-473

Variations in the venous system are quite common. Like most superficial veins of the body, the deep veins of the mediastinum are subjected to variations of origin, morphology, size and termination.¹⁻³ The azygos vein is usually inconstant in origin.⁴ Embryologically, the azygos vein represents the persistent stem of right postcardinal vein and the supracardinal vein.⁵ It starts from the inferior vena cava just above the renal veins, and its functional commencement is frequently by the union of ascending lumbar and subcostal veins of the right side.⁶ Inferiorly the connection of ascending lumbar vein to inferior vena cava is usually transformed into an avascular fibrous cord. If this connection remains patent, the azygos vein is named as lumbar azygos vein.⁷ The azygos vein passes through the aortic hiatus under shelter of the right crus of the diaphragm, and ascends in the posterior mediastinum to the level of the 4th thoracic vertebra, where it arches forward over the root of the right lung to terminate in the superior vena cava before entering the pericardium.⁶ The azygos vein receives 4th to 11th right posterior intercostal veins, right superior intercostal vein, 2 left hemiazygos veins and drains some of the thoracic viscera. Through anastomoses

of posterior and anterior intercostal veins, the azygos system is linked to the internal thoracic veins, whereas through ascending lumbar vein to inferior vena cava. The azygos system is also in communication with the vertebral venous plexus.⁸ Owing to these widespread communications, the azygos vein drains venous blood from virtually all the posterolateral parts of the thoracic and abdominal wall. Moreover it provides an important valveless, collateral channel between superior and inferior vena cava, when any of these vessels are obstructed.⁹ Descent of the heart and pericardium during morphogenesis, causes the right posterior cardinal vein (azygos vein) to arch over the root of the right lung.¹⁰ This arched course of the azygos vein produces a deep sulcus on the medial surface of the superior lobe of the right lung. Aberrant lobes are frequently associated with abnormal branching of the tracheobronchial tree. Abnormal growth of the right superior lobe bronchus, medial to the azygos vein (instead of lateral) may lead to formation of an azygos lobe.¹¹ Sometimes an unusual proximal branch of the right principal bronchus passing superior to the azygos arch (which is then enclosed in

From the Department of Anatomy, College of Medicine and King Khalid University Hospital, King Saud University, Riyadh, Kingdom of Saudi Arabia.

Received 15th June 2001. Accepted for publication in final form 28th October 2001.

Address correspondence and reprint request to: Dr. Muhammad Saeed, 28-King Khalid University Hospital, PO Box 2925, Riyadh 11461, Kingdom of Saudi Arabia. Tel. +966 (1) 4825922/4672545. Fax. +966 (1) 4671300. E-mail: shafi@ksu.edu.sa or msaeedshafi@hotmail.com

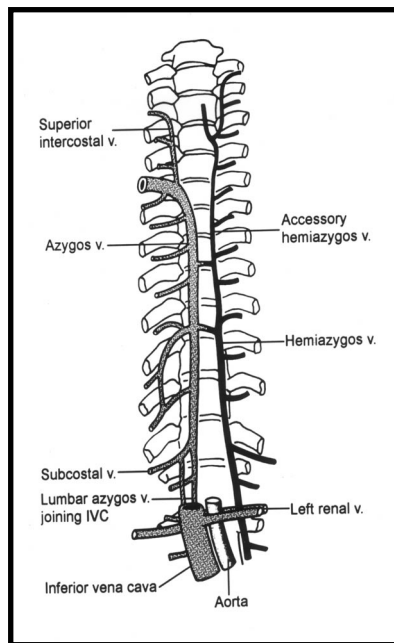


Figure 1 - Schematic representation of lumbar azygos vein.

an accessory fissure in the medial surface of the right upper lobe) is associated with an azygos lobe.¹² Rarely, abnormal positioning of the arch of the azygos vein indents the superior lobe of the lung dividing it into medial and lateral portions.¹²⁻¹³ Such an accessory fissure in the superior lobe of the right lung is designated as azygos fissure and maybe the sole site of pleural effusion.¹² To remember the varying venous pattern in the mediastinum and to avoid an intraoperative "trial and error" procedure, it is important to evaluate pre-operatively the course and branching patterns of the mediastinal vessels by means of doppler ultrasonography, magnetic resonance venography and computerized tomography (CT). Computerized tomography is useful, not only in recognition of enlargement and anomalies of the azygos vein, but also in evaluation of its etiology for the institution of the appropriate treatment of the disease.

Case Report. During routine dissection of a 65-year-old white male cadaver, at the Anatomy Laboratory of the College of Medicine, King Saud University, Riyadh, Kingdom of Saudi Arabia. We observed anomalous origin, course and termination of the azygos vein. It was emanating from the posterior surface of the inferior vena cava at the level of the right renal vein (**Figure 1**). In the posterior mediastinum (at thoracic T⁴ and T⁵) it was enclosed in a double layered fold of parietal pleura "the mesazygos", indenting vertically the superior lobe of the right lung into medial and lateral segments (**Figure 2**). The mesazygos carrying azygos arch in

its depth, was lying in an azygos fissure between medial and lateral segments of the superior lobe of the right lung (**Figure 2**). The azygos vein was covering the upper thoracic sympathetic chain. The left renal vein was in a circumaortic configuration (the 2 left renal veins encircling the aorta), whereas the superior vena cava, inferior vena cava, portal, hepatic and right renal veins were found to be normal. The heart, liver, spleen and all other abdominal viscera were normal in appearance and position. On exploration of the branching pattern of the superior lobar bronchus, the azygos lobe was found to be aerated by 2 medial branches of tertiary bronchus, of the right apical bronchopulmonary segment. The arch and fissure of the azygos vein were found to be partially dividing the superior lobe into a small medial and larger lateral segments (**Figure 1**). The only narrow connection between these 2 parts was at the depth of the azygos fissure. The external diameter of the azygos vein at its termination into superior vena cava was 13 mm. This is the first case of coexistence of azygos lobe and azygos continuation of inferior vena cava detected in our department during the past 14 years.

Discussion. The azygos lobe, a common malformation, was first described in 1777 with a reported incidence of 0.4%-1%.¹⁴ It is more common in males¹⁵ with a strong familial inheritance.¹⁶ The anatomical basis for this anomaly is the failure of the normal migration of the azygos vein from the chest wall to its usual position in the tracheo-bronchial angle.¹² So the invaginated visceral and parietal layers (mesazygos) persist to form the azygos fissure. Previously the presence of azygos lobe was assumed to be of no clinical significance, but its existence renders video assisted thoracoscopic surgery very difficult.¹⁷ This anomaly poses a significant risk during endoscopic thoracic sympathectomy.¹⁸ Although the association of the

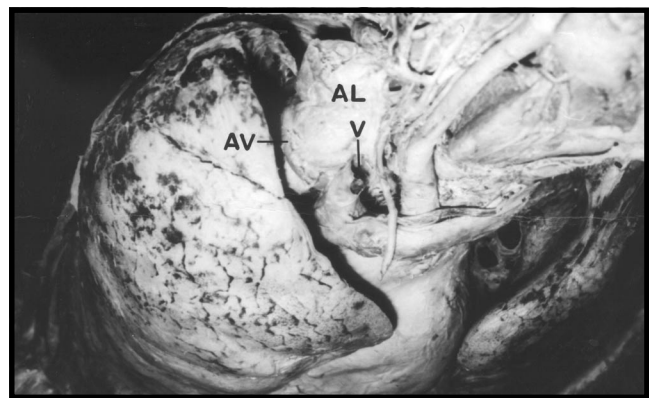


Figure 2 - Photograph showing sternocostal surface of the right lung and a well demarcated azygos lobe, covered by pleura.

azygos lobe with localized pleural effusion¹² and spontaneous pneumothorax have been described.¹⁹ Sadikot et al¹⁷ advocated the protective role of the azygos lobe in reducing the incidence of spontaneous pneumothorax.¹⁷ As the distribution of mechanical stresses within the lungs is much higher towards the apex,²⁰ the mesazygos and 2 layers of regional visceral pleura may act as a septum, protecting the apex of the lung by diverting the transmission of transient forces away from the apex. The altered anatomy at the apex of the lung caused by azygos lobe formation, somehow protects the apex from the development of blebs and bullae associated with spontaneous pneumothorax.

Azygos vein dilatation is frequently associated with direct inferior vena caval connection to azygos vein and congenital absence of intra-hepatic segment of inferior vena cava.²¹ Also the anomalous formation of azygos lobe is a potential factor for anatomical displacement and dilatation of vena azygos.²² In the present case, the positional displacement by azygos lobe and the inferior vena caval-azygos continuation could be the causative factors for dilatation of the azygos arch. Such a dilated azygos vein, lying parallel to the descending thoracic aorta may mimic aortic pathology.²³ Azygos vein traumatic injury is uncommon but potentially lethal²⁴ and frequently associated with right hemothorax or mediastinal temponade.²⁵ Enlarged azygos arch may simulate adenopathies and mediastinal or retroperitoneal mass on radiographic examination. Hence the awareness of aberrant anatomy of the azygos system is imperative for diagnostic and surgical procedures employed for mediastinal and infra-diaphragmatic pathologies.

Acknowledgments. We are thankful to Professor H.S. Amonoo-Kuofi for his guidance and help extended in the completion of this research work. The authors would also like to thank Mr. Muhammad Shahid Hanif for his valuable scientific contribution and Mr. Moazam for his secretarial assistance.

References

- Podbielski FJ, Sam II AD, Halldorsson AO, Iasha-Snajder J, Vigneswaran WT. Giant azygos vein varix. *Ann Thorac Surg* 1997; 63: 1167-1169.
- Arslan G, Ozkaynak C, Cubuk M, Sindel T, Luleci E. Absence of the azygos vein associated with double superior vena cava: A case report. *Angiology* 1999; 50: 81-84.
- Chern MS, Ko JS, Tsai A, Wu MH, Teng MM, Chang CY. Aberrant left brachiocephalic vein: CT imaging findings and embryologic correlation. *Eur Radiol* 1999; 9: 1835-1839.
- Gladstone RJ. Development of the inferior vena cava in the light of recent research, with special reference to certain abnormalities and current description of the ascending lumbar and azygos veins. *J Anat* 1929; 64: 70-93.
- Arey LB. The vascular system. In: Developmental anatomy, 7th ed. Philadelphia (PA), London (UK): WB Saunders; 1996. p. 365-367.
- Last RJ. Azygos system of veins. In: Sinnatamby CS, editor. Last's anatomy, regional and applied. 10th ed. London (UK): Churchill Livingstone; 1999. p. 204.
- Gray H. Veins of the thorax. In: Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE, Ferguson MWJ, editors. Gray's Anatomy, 38th ed. London (UK): Churchill Livingstone; 1995. p. 1593-1594.
- Walls EW. The blood vascular and lymphatic system. In: Romanes GJ, editor. Cunningham's textbook of Anatomy, 12th ed. Toronto (CA): Oxford University Press; 1981. p. 944-945.
- Rosse C, Gaddum-Rosse P. The mediastinum. In: Hollinshead's textbook of Anatomy, 5th ed. New York (NY): Lippincott-Raven; 1997. p. 507-508.
- Collins P. Embryology and development. In: Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE, Ferguson MWJ, editors. Gray's Anatomy, 38th ed. London (UK): Churchill Livingstone; 1995. p. 324-325.
- Moore KL, Persaud TVN. The respiratory system. In: The developing human, clinically oriented embryology. 5th ed. Philadelphia (PA): WB Saunders; 1993. p. 233.
- Scothorne RJ. The respiratory system. In: Romanes GJ, editor. Cunningham's textbook of Anatomy, 12th ed. Toronto (CA): Oxford University Press; 1981. p. 514-529.
- Stibbe EP. The accessory pulmonary lobe of the vena azygos. *J Anat* 1919; 53: 305.
- Boyden EA. The distribution of bronchi in gross abnormalities of the right upper lobe, particularly lobes subdivided by the azygos vein and those containing pre-parterial bronchi. *Radiology* 1952; 58: 797-807.
- Fisher MS. Adam's Lobe. *Radiology* 1985; 154: 547.
- Potmus PE, Kerstjens JM, Breed A, Jaut EVD. A family with lobus venae azygos. *Chest* 1986; 90: 298-299.
- Sadikot RT, Cowen ME, Arnold AG. Spontaneous pneumothorax in a patient with azygos lobe. *Thorax* 1957; 52: 579-580.
- Sieunarine K, May J, White GH, Harris JP. Anomalous azygos vein: A potential danger during endoscopic thoracic sympathectomy. *Aust N Z J Surg* 1997; 67: 578-579.
- Weissman JL, Austin JHN. Pneumothorax and an azygos lobe. *J Thorac Imaging* 1989; 4: 6-9.
- West JB. Distribution of mechanical stress in the lung, a possible factor in localisation of pulmonary disease. *Lancet* 1971; 1: 839-841.
- Shin MS, Ho KJ. Clinical significance of azygos vein enlargement: Radiographic and recognition and etiologic analysis. *Clin Imaging* 1999; 23: 236-240.
- Agrawal GG, Ghandhi MS, Gandhi SD. Excessive anteriorisation of the superior vena cava associated with an azygos lobe. *Surg Radiol Anat* 1995; 17: 173-175.
- Blanchard DG, Sobel JL, Hope J, Raisinghani A, Keramati S, DeMaria AN. Infrahepatic interruption of the inferior vena cava with azygos continuation: a problem mimicker of aortic pathology. *J Am Soc Echocardiogr* 1998; 11: 1078-1083.
- Sharma OP, Rawitscher RE. Blunt vena azygos trauma: Report of a case and review of world literature. *J Trauma* 1999; 46: 192-195.
- Butler DA, Schneider RF, Jadali M. Traumatic injury to the azygos vein: Case report. *J Trauma* 1995; 39: 761-762.