



## ANATOMICAL VARIATIONS OF PULMONARY VEINS AT THE HILUM OF THE LUNG

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**ABSTRACT** Pulmonary veins carry oxygenated blood from lungs to left atrium. Normally from each lung there are two pulmonary veins. They open into the smooth part of the left atrium. Variations in number of these veins are quite common. They form an important source of ectopic atrial electrical activity, frequently initiating paroxysms of atrial fibrillation. Thus, detailed knowledge of pulmonary venous anatomy and relationships between the pulmonary veins and the left atrium is important during mapping and ablation procedures. Ectopic beats could arise from these anomalous veins. For these reasons, cross-sectional imaging (magnetic resonance [MR] imaging or computed tomography [CT]) may be performed prior to radiofrequency ablation to map the pattern of pulmonary venous drainage and to identify variant veins. The present study was undertaken to evaluate the incidence of different draining patterns of the right and left pulmonary veins at the hilum by dissecting the human fixed cadaveric lungs. In 54% of cases, the right superior lobar vein and right middle lobar vein were found to be united together to form the right superior pulmonary vein. In contrast to this, in 12% of cases, the right superior lobar vein, the right middle lobar vein, and the right inferior lobar vein drained into a common vein forming the right single unilateral central pulmonary vein while in 27% of cases, the right superior lobar vein, right middle lobar vein, and right inferior lobar vein drained separately. Remaining 7% have shown different anatomical variations.

Approximately 70% of the general population have four pulmonary veins: right superior and inferior pulmonary veins and left superior and inferior pulmonary veins. The purpose of our study was to evaluate the frequency of variability in pulmonary venous anatomy and to classify the various drainage patterns of the pulmonary veins.

**KEYWORDS :** Lungs, Pulmonary Veins, Left Atrium.

### Introduction

Pulmonary veins drain oxygenated blood from the lungs to the left atrium of the heart. The lobular tributaries lie chiefly in the interlobular septa. One main vein drains each bronchopulmonary segment. Veins also run between the segments and on the mediastinal surface of the lungs. The veins of the right medial segment of inferior lobe frequently arise from the veins of the middle lobe. The superior right pulmonary vein drains the right superior and middle lobe. The superior left pulmonary vein drains the left superior lobe. The right inferior pulmonary vein and left inferior pulmonary veins drain the respective inferior lobes. The present study is to study the incidence of different draining patterns of the right pulmonary veins at the hilum of the right lung, as it is clinically very important to look into the anatomy of the veins during MR imaging and CT angiography.

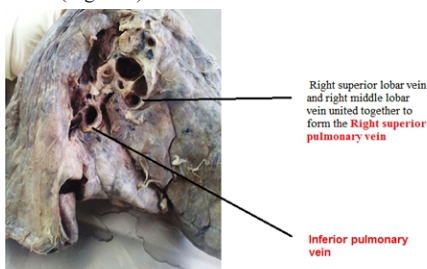
### Material and Methods

The study involved forty formalin-fixed adult cadaveric lungs of unknown sex from Apollo Institute of Medical Sciences and Research, Hyderabad, Telangana State. The dissection initially involved identifying the pulmonary veins at the hilum, and correspondingly identifying their opening into the Left Atrium. The pulmonary veins were lifted up. Different patterns in the drainage of pulmonary veins into Left Atrium were studied.

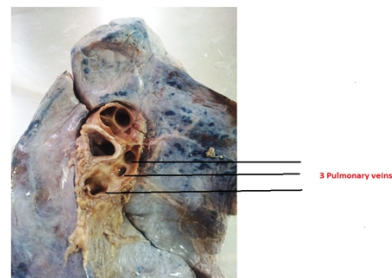
### Results

The different draining patterns noted are as follows.

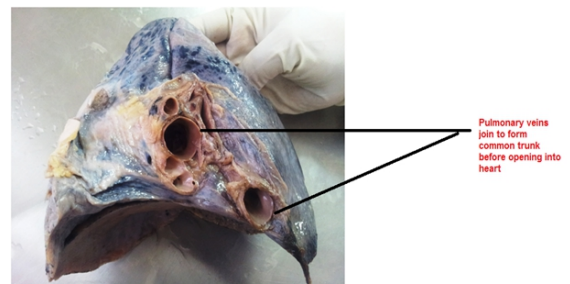
In 54% of dissected lungs the right superior lobar vein and right middle lobar vein united together to form the right superior pulmonary vein drained separately at the hilum. Inferior lobar vein drained separately at the hilum. (Figure 1).



In 27% of dissected lungs, the right superior lobar vein and the right middle lobar vein did not join, and all the three lobar veins drained separately at the hilum. (Figure 2).



In 12% of dissected lungs, the right superior lobar vein, the right middle lobar vein, and the right inferior lobar vein drained into a common vein forming the right single unilateral central pulmonary vein.



### Discussion

The most common cause of cardiac arrhythmia is Atrial fibrillation which leads to significant morbidity and mortality [1, 3]. The ectopic beat commonly originates in the ostia of the pulmonary vein. Electrocardiography is the classic diagnostic tool for this condition. There are many methods for treatment, starting with anti-arrhythmic medications, cardioversion or pacemaker, surgical procedure, and percutaneous ablation [2, 3]. Since ablation therapy is increasingly performed, radiologists should be familiar with the normal and

anatomical variations of the pulmonary vein.

Different types of drainage patterns of the pulmonary veins of the right lung have been reported in the literature. In our study, different drainage pattern of three lobar veins of the right lung has been discussed. If more than one pulmonary vein drains anomalously, the volume is usually sufficient to produce the characteristic pattern of the right ventricular diastolic overload.

The ectopic beats arise from the anomalous pulmonary veins. This knowledge could increase the success rate of radiofrequency ablation. Pulmonary veins play a critical role in the pathophysiology of atrial fibrillation. Knowledge of normal pulmonary venous anatomy is required for preablation planning and for evaluation of postablation complication [4].

### Conclusion

Pulmonary venous anatomy and drainage pattern is important during mapping and ablation procedures. Awareness of vascular anomalies is very important in excising the pulmonary lobe for lung cancer. Especially closer attention is required in thoracoscopic procedures as the surgical view is more limited than in a thoracotomy. Keeping such vascular anomalies in mind will help thoracic surgeons to prevent potential morbidity and mortality from complications. In this study, variations in pulmonary venous anatomy were seen in 46.03% of dissected lungs. These variations helped us to come to a conclusion on an anatomical classification, depending on the drainage patterns of the right pulmonary vein at the hilum.

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