Scholars Journal of Applied Medical Sciences (SJAMS)
Abbreviated Key Title: Sch. J. App. Med. Sci.
ISSN 2320-6691 (Online)
ISSN 2347-954X (Print)

A Unit of Scholars Academic and Scientific Society, India
www.saspublishers.com

Anatomy

A Study on the Variations of Pulmonary Veins Draining Into the Left Atrium in Manipur Population

G. Tempy Sangma[1], Sanjenbam SD[2*], Peela T[3], Tombisana S[4], Purnabati S[5]
[1]Assistant Professor, Department of Anatomy, RIMS, Imphal, Manipur, India
[2]Senior Resident, Department of Anatomy, RIMS, Imphal, Manipur, India
[3]PostGraduate Trainee, Department of Anatomy, RIMS, Imphal, Manipur, India
[4]Senior Resident, Department of Surgery, RIMS, Imphal, Manipur, India
[5]Associate Professor, Department of Anatomy, RIMS, Imphal, Manipur, India

Original Research Article

***Corresponding author**
Sanjenbam SD

Article History
Received: 11.10.2018
Accepted: 25.10.2018
Published: 30.10.2018

DOI:
10.36347/sjams.2018.v06i10.063

Abstract: Pulmonary veins carry oxygenated blood from the lungs to the left atrium of the heart. During early embryonic life, absorption of pulmonary venous network by the left primitive atrial chamber results in opening of four pulmonary veins which drain independently into its chamber. The extent of absorption and hence, the number of pulmonary veins which open into left atrium may vary. The present study was done on 30 fetal hearts. The left atrium of these hearts was studied from external aspect for the number of pulmonary veins draining into the left atrium and from the internal aspect for the drainage pattern. In 10 out of 30 hearts (33.3%), variationin number of pulmonary veins was observed. In the present study, the most common variation of right pulmonary veins is three veins (13.3%), and the most common variation of the left pulmonary veins is a single vein (10%). Understanding the formation, termination and relationships of the pulmonary veins is crucial for cardiologists, because they tend to be the major trigger in atrial fibrillation.
Keywords: Pulmonary veins, Pulmonary ostia, Left atrium, Fetus.

INTRODUCTION

There are usually four pulmonary veins(PV), two from each lung. All the main tributaries of the pulmonary veins receive smaller tributaries, both intra- and intersegmental; by serial junctions, tributary veins finally form a single lobar trunk, i.e. three in the right lung, two in the left. The right middle and superior lobar veins usually unite and so two veins, superior and inferior, leave each lung [1]. Earlier, it was considered that the variations in the number and course of pulmonary veins were rare and they were confined only too few reports [2]. Recently, however, it has been found that variations in pulmonary venous anatomy were seen in 36% of patients.

Though knowledge of these variations is valuable in cardio-thoracic surgeries and radiological procedures such as radiofrequency ablations in atrial fibrillation, cardiac valve replacements, pulmonary lobectomy and others, but literature regarding these variations is scarce, although a few radiological studies are available. Postmortem is arguably the best standard for such type of study, but such data are rarely available [3]. Therefore, the present study is done on the fetuses with the following aims:

- To find the number of hearts with variation in number of PV, irrespective of side, draining into the left atrium.
- To find the variations in number of right and left PV draining into the left atrium.

MATERIALS AND METHODS

After taking due clearance from the Institutional Ethics Committee, 30 formalin fixed fetuses having CRL > 36cm were selected for the present study,in the Department of Anatomy, Regional Institute of Medical Sciences, Imphal. Fetuses with any external abnormality were excluded for the study. Left atria of these hearts were studied from external aspect, for the variation in the number of pulmonary veins which drained into it. The left atrium was then opened by giving a midline incision along the whole length of its posterior wall, to study the drainage pattern of PV. The hearts having any anatomical defects or anomalies were not included.Variations in the pulmonary ostia (PO) on right side as well as on left side were observed, noted down and photographed. Percentage of variations found on right and left side was calculated. Percentage

of most common variation on both the sides was also calculated. Then the present study was compared with the available data.

RESULTS

Ten hearts (33.3%) out of thirty hearts showed variation in the number of PV. These variations were either on the right side or on the left side of the left atrium. Only one heart showed variation in both right side (4PV) and left side (1PV) simultaneously, shown in Fig. 1.

On the right side, the most common variation in the number of PV observed is 3PV (13.3%), followed by 1PV and 4PV (3.3% each). On the left side, the most common variation is 1PV (10%), followed by 3PV (6.7%) (Table I).

The most common variation in the drainage pattern of the right PV is 3PV with 2PO (10%) as shown in Fig. 2. While the most common variation in the drainage pattern of the left PV is 1PV with 1PO (10%). The normal pattern of 2PV with 2PO is reported in 73.3% and 76.7% of the hearts, on the right and left side respectively. (Fig. 3).

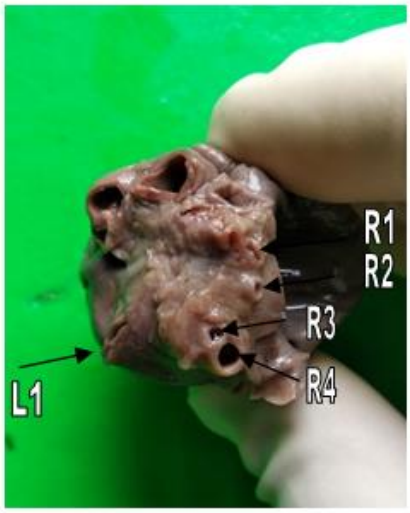

Fig-1: Heart showing four PV on right side (R1,R2,R3,R4) and one PV on left side (L1)

Fig-2: Heart showing three PV with two PO on the right side (R1,R2,R3)

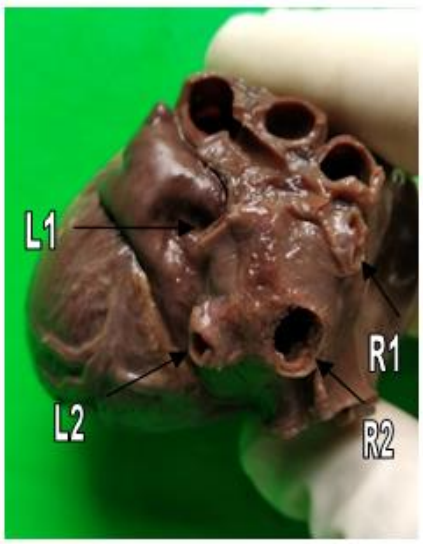

Fig-3: Heart showing normal pattern of pulmonary veins, two PV on both right (R1,R2) and left side (L1,L2)

Table-1: Number of hearts showing variation of pulmonary veins.

Side	Right				Left			
No. of PV	1	2	3	4	1	2	3	4
No.of hearts (%)	1	24	4	1	3	25	2	0
Percentage	3.3	80	13.3	3.3	10	83.3	6.7	0

Table-2: Comparison of drainage pattern of right pulmonary veins

Number of PV	Number of PO	Marom et al	Shukla et al	Present study
2	2	50	75.9	73.3
3	2	21	10.3	10
2	1	0	0	6.7
1	1	2	3.4	3.3
3	3	24	6.9	3.3
4	3	0	0	3.3
4	4	2	3.4	0
6	5	1	0	0

Table-3: Comparison of drainage pattern of left pulmonary veins

Number of PV	Number of PO	Marom et al	Shukla et al	Present study
2	2	86	79.3	76.7
1	1	14	17.2	10
2	1	0	0	6.7
3	2	0	3.4	6.7

DISCUSSION

Most of the wall of the left atrium is smooth because it is formed by incorporation of the primordial pulmonary vein. This vein develops as an outgrowth of the dorsal atrial wall, just to the left of the septum primum. As the atrium expands, the primordial pulmonary vein and its main branches are incorporated into the wall of the left atrium. As a result, four pulmonary veins are formed[4].

Supernumery or accessory pulmonary veins with their own ostia occur by over incorporation of the pulmonary veins beyond their first division and such variations are usually found on the right side.Very few workers have studied the variations and drainage patterns of pulmonary veins in cadavers[5]. Marom *et al*. [3] studied the anatomy of pulmonary veins in 201 patients by using Computer Tomography. They reported 3-5 ostia on the right side in 28% patients; and 14% patients had a single ostium on the left side. In a study done by Shukla *et al*. [6], 3-4 ostia were observed on the right side in 10.3% hearts. On the left side, a single ostium was observed in 17.2% hearts. But in the present study, not more than 3 ostia was seen in any of the thirty hearts. In 6.7% of the hearts, 3 ostia were observed on the right side of the heart. Single ostium was observed in 16.7% hearts on the left side.

Approximately 70% of the general population has four pulmonary veins: right superior & inferior and

left superior & inferior veins with four pulmonary independent ostia[7]. In a study conducted by Parsanna et al[5], 28% cases showed variable pulmonary vein on right side and only 6% showed variation on left side. There were 14% specimens with a single ostium on right side & 6% specimens had 1 venous ostium on the left side.According to Marom et al, the most common drainage pattern was 2 pulmonary veins each on right and left side with 2 separate ostia, coinciding with the present study (Table II and III). The second common pattern on the right side as reported by Marom et al is 3 pulmonary veins with 3 ostia (24%).Whereas, in our study, it is 3 pulmonary veins with 2 ostia (10%), which is similar with the results observed by Shukla *et al*. (10.3%). (Table II) Both Marom *et al*. (14%) and Shukla *et al*. (17.2%) reported the second most common pattern on the left side as a single pulmonary vein with a single ostium. In the present study also the second most common pattern is a single pulmonary vein with a single ostium (10%) (Table III).

Pulmonary venous anomalies were one of the etiologies for ectopic heart beats[8]. The major sources of these ectopic beats appear to be the myocardial sleeves of the distal pulmonary veins which are simple extensions of the left atrial myocardium over the outer surface of pulmonary veins[9]. This is the reason why they became a target of interventional cardiology procedures such as catheter radiofrequency pulmonary vein isolation[10]. Hence, anatomy and morphology of pulmonary veins are crucial for planning and performing invasive procedures by eletrocardiologists and surgeons[11].

CONCLUSION

There is substantial variation in the number and drainage pattern of pulmonary veins. Knowledge on such variations is significantly important for radiologists, cardiologists and thoracic surgeons prior to the procedures which directly or indirectly involve the pulmonary veins.

REFERENCES

1. Gray H, Carter HV. Heart and great vessels. In: Susan Standring, editor. Gray's Anatomy. The Anatomical Basis of Clinical Practice. 39th edition. Churchill Livingstone: Elsevier. 2000.p.1027.
2. Alfke H, Wagner HG, Klose KJ. A case of an anomalous pulmonary vein of the right middle lobe. Cardio vascInterventRadiol.1995;18:406-9.
3. Marom EM, Herndon JE, Kim YH, Mcadams HP. Variations in pulmonary venous drainage tothe left atrium: Implications for radiofrequency ablation. Radiology. 2004;230:824-9.
4. Moore KL, Persuad TVN. The cardiovascular system. In: Moore Persuad, editor. The developing Human- Clinically Oriented Embryology. 7th edition. Philadelphia: Pennyslvania, Saunders, Elsevie. 2004.p.345-7.
5. Parsanna LC, Praveena R, D Souza AS, Bhat KMR. Variations in the Pulmonary Venous Ostium in the Left Atrium and its Clinical Importance. Journal of Clinial and Diagonostic Research. 2014 feb;8(2):10-11.
6. Shukla L, Gaur N, Soni G, Dhall U. Variation in number and drainage pattern of pulmonary veins draining into the left atrium. J AnatSoc India. 2012;61(1):5-8.
7. Hall SM, Hislopm AA, Haworth SG. Origin, differentiation and maturation of human pulmonary veins. Am J RespirCell MolBiol. 2002;26:333-40.
8. Tsao HM, Wu MH, Yu WC, Tai CT, Lin YK, Hsieh MH, Ding YA, Chang MS, Chen SA. Role of right middle pulmonary vein in patients with paroxysmal atrial fibrillation. Journal of cardiovascular electrophysiology. 2001 Dec;12(12):1353-7.
9. Saito T, Walki K, Becker AE. Left atrial myocardial extension onto pulmonary veins in humans: anatomic observations relevant for atrial arrhythmias. Journal of cardiovascular Electrophysiology. 2000;11:888-94.
10. Chen SA, Tai CT, Tsai CF, Hsieh MH, Ding YA, Chang MS. Radiofrequency catheter ablation of atrial fibrillation initiated by pulmonary vein ectopic beats. Journal of Cardiovascular Electrophysiology. 2000;11:218-27.
11. Gill JS. How to perform pulmonary vein isolation. Europace. 2004;6:83-91.