



# Fetal Left Brachiocephalic Vein (LBCV): Visualization and Its Measurements in Indian Population

Nupur Shah<sup>1,2</sup> 

Received: 18 October 2019 / Accepted: 3 January 2020 / Published online: 14 January 2020  
© Society of Fetal Medicine 2020

**Abstract** Left brachiocephalic vein, also known as innominate vein runs in upper mediastinum posterior to the thymus and anterior to the transverse aortic arch and aortic branches. LBCV can be visualized on gray scale as well as color Doppler ultrasound at the level above the 3 vessel view. This is the first Indian study to demonstrate the significance of its routine visualization and its measurements on prenatal ultrasound. Isolated intrathymic LBCV is a normal variant and in isolation does not warrant an alteration in routine management of pregnancy. Absent LBCV or dilated LBCV are pathological and warrant a thorough anomalies scan and fetal echocardiography.

**Keywords** Left brachiocephalic vein · Prenatal · Ultrasound · LBCV · Innominate vein

## Introduction

The left brachiocephalic vein, also known as the innominate vein runs in the upper mediastinum posterior to the thymus and anterior to the transverse aortic arch and aortic branches [1, 2]. Anatomically, the left brachiocephalic vein (LBCV) connects the left jugular vein to right superior vena cava. Embryologically, three pairs of cardinal veins drain the fetus between the 4th and 8th embryonic weeks. The LBCV is an anastomotic transverse vein between the anterior cardinal veins, with regression of the left anterior cardinal vein. Failure of

formation of the LBCV results in persistence of the left anterior cardinal vein as a persistent LSVC draining into the coronary sinus [2]. Anatomically, left and right brachiocephalic veins are formed by the union of the internal jugular and subclavian veins of the respective side. While the LBCV courses horizontally in the mediastinum as described above, the right courses almost vertically. Left and right veins converge to form the superior vena cava [1, 3]. On prenatal ultrasound, LBCV is visualized in the upper mediastinal transverse plane, above the three vessel trachea view [4]. The visualization of LBCV on prenatal ultrasound has interested many researchers, there is however, no Indian data available so far. This study aims to find out the significance of its routine visualization in prenatal ultrasound scans and detection of its variants and/or abnormalities.

## Materials and Method

A prospective study including all singleton pregnancies from 18 to 34 weeks was carried out from year 2016 to 2018. The ultrasound equipment used was Voluson E8 (GE Healthcare, Milwaukee, WI) and WS80A (Samsung Medison Ltd, Korea). On the transabdominal sonological approach, LBCV was visualized in the transverse section above the three vessel view, where it normally runs horizontally posterior to the thymus and anterior to the transverse aortic arch. Cranial to this level, three aortic branches are seen posterior to the vein and thymus and sternum anterior to vein. Frozen 2D images and cine loops were stored. In the transverse view the anteroposterior diameter of the vein was measured in absence of fetal breathing (as it may alter venous return) and in late systole (as the venous return is maximum in this phase). In the sagittal plane, a

✉ Nupur Shah  
nupurshah@gmail.com

<sup>1</sup> Zydus Hospital, Ahmedabad, India

<sup>2</sup> Paras Bliss, Panchkula, India

cross section of LBCV was seen just anterior to ascending aortic arch. Any abnormality in the course and size of the vein as well as its absence were noted. In case of deviation from normalcy, a thorough search of associated structural anomalies was done. Invasive testing was offered only in the presence of associated abnormalities. Data was plotted on a scatter plot.

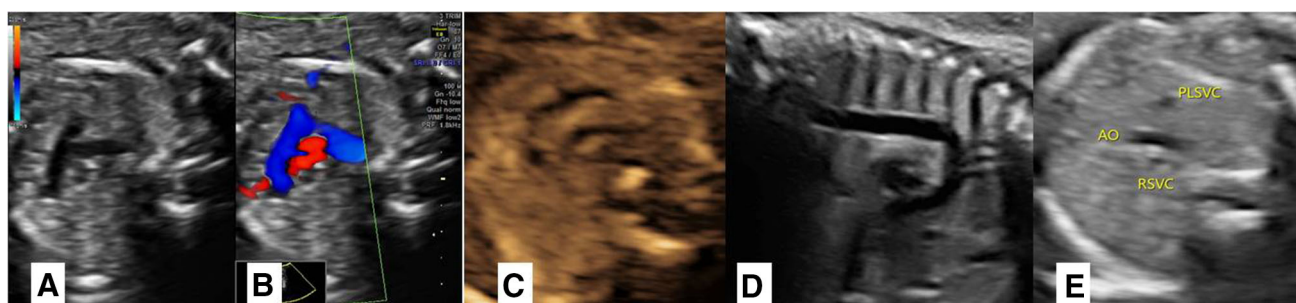
## Results

During this period, 1534 pregnancies were studied. LBCV was visualized in all 1534 cases (100%) on ultrasound. Normally, the vein runs horizontally in the upper mediastinum from left to right, posterior to the thymus and anterior to the branches of the aorta. This normal course of vein was seen in 1519 cases (99.02%) (Fig. 1a, b). An intrathymic course wherein the vein runs through the substance of the thymus, was noted in 11 cases (0.71%) (Fig. 1c, d). Here the vein was visualized as a curved/arched structure traversing through the thymus at the level of the upper mediastinum. No associated cardiac or extra-cardiac anomalies were seen in these cases and neonatal outcome was normal. LBCV was absent in 3 cases (0.19%) with persistent left superior vena cava (bilateral superior vena cavae) (Fig. 1e). Two out of these cases had coarctation of aorta which was diagnosed in 3rd trimester and the third case had associated chromosomal abnormality (12 pder). Normal course of LBCV was noted in one case with a right aortic arch. The anteroposterior diameters of the vein plotted on a scatter plot show a rising trend with advancing gestation. LBCV was prominently dilated in 2 cases wherein TAPVC (total anomalous pulmonary venous connection) was suspected.

## Discussion

This is the first Indian study to describe assessment and measurements of LBCV on prenatal ultrasound between 18 and 34 weeks. This gestation range was so chosen because before 18 weeks and after 34 weeks consistent visualization of the vein may be difficult owing to its small size, restricted views, fetal position etc. In this study, the vein could be consistently visualized in all fetuses on prenatal ultrasound between 18 and 34 weeks gestation. This means that LBCV can be checked at the time of routine anomaly scan or a routine growth scan.

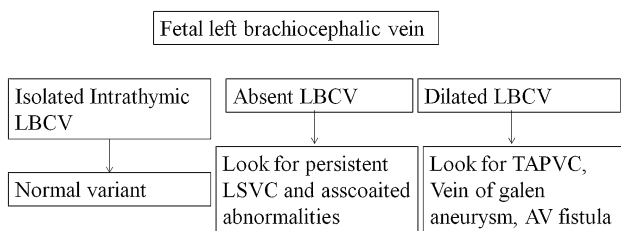
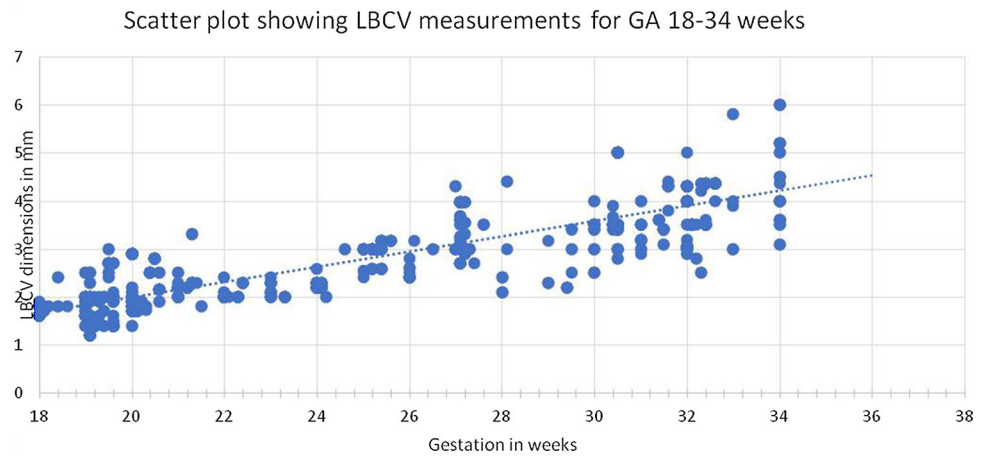
Normally, the left brachiocephalic vein is seen running horizontally posterior to thymus and anterior to aortic branches in a transverse view of upper mediastinum on grayscale/Doppler ultrasound. Ninety nine percent of the fetuses in this study showed a normally coursing LBCV. Aberrant courses of LBCV reported in the literature are intrathymic, retroaortic and subaortic [1, 2]. In this study, an intrathymic course of LBCV was noted in 0.71% cases which had no associated abnormalities and normal neonatal outcomes. Hence, an isolated intrathymic LBCV with normal anteroposterior measurements can be considered a normal anatomical variant. This was also concluded by Sinkovskaya et al. [1] and Karl et al. [2]. In the case of right aortic arch in this study, LBCV had a normal course cranial to both large arteries which was unlike that of Karl K et al. where in the course was subaortic [2]. Absent LBCV was noted in 0.19% cases in this study, which also had persistent left superior vena cava (bilateral superior vena cavae). Persistent left SVC in cases with absent LBCV can be explained by its embryological development. Embryologically, the LBCV bridges the jugular vein to right SVC and thereby the left SVC (left anterior cardinal vein) regresses. But failure of development of LBCV leads to persistence of LSVC [1, 2]. Persistent LSVC is known to be associated with other anomalies like coarctation of the aorta, so a thorough fetal echo must be done in these



**Fig. 1** a, b Gray scale and color Doppler images showing left brachiocephalic vein anterior to transverse aortic arch in transverse view at level of upper mediastinum. c, d Transverse and sagittal sections showing intrathymic LBCV seen as an arched vessel inside

the thymic tissue, anterior and away from transverse aortic arch. e Absent LBCV in case of persistent left superior vena cava (bilateral superior vena cava)

**Fig. 2** Scatter plot showing anteroposterior measurements of LBCV in 1534 pregnancies over GA 18–34 weeks



**Fig. 3** Flowchart outlining management in case of LBCV variants or abnormalities

cases [4, 5]. Two out of 3 cases with persistent left SVC and absent LBCV in this study had associated coarctation of aorta. Thus, absent LBCV is an important clue mandating a detailed anomaly scan and fetal echocardiography.

The anteroposterior diameter of the LBCV in normal fetuses increases with increasing gestation as seen in the scatter plot (Fig. 2). These measurements can be used as reference values for Indian fetuses. Prominently dilated LBCV, as noted here, can be seen in scenarios of increased venous return like TAPVC, vein of Galen aneurysm or arteriovenous malformation. Thus, a dilated vein warrants a thorough search for causative anomalies which otherwise would have gone undetected in prenatal period.

**Conclusion**

This study thus outlines the significance of visualization and measurements of fetal LBCV on prenatal ultrasound (Fig. 3). An abnormal course of LBCV, absent LBCV or dilated LBCV provides a clue to search other important anomalies. Hence, LBCV can be included in routine prenatal ultrasound checklist.

**Funding** No funding.

**Compliance with ethical standards**

**Conflict of interest** The author declares that she has no conflict of interest.

**Informed consent** This was a prospective observational study only not involving any interventions.

**References**

1. Sinkovskaya E, Abuhamad A, Horton S, Chaoui R, Karl K. Fetal left brachiocephalic vein in normal and abnormal conditions. *Ultrasound Obstet Gynecol.* 2012;40:542–8.
2. Karl K, Sinkovskaya E, Abuhamad A, Chaoui R. Intrathymic and other anomalous courses of the left brachiocephalic vein in the fetus. *Ultrasound Obstet Gynecol.* 2016;48:464–9.
3. Bennett WF, Altaf F, Deslauriers J. Anatomy of the superior vena cava and brachiocephalic veins. *Thorac Surg Clin.* 2011;21:197–203, viii.
4. Abuhamad A, Chaoui R. *A practical guide to fetal echocardiography: normal and abnormal hearts.* Philadelphia: Lippincott-Williams & Wilkins; 2010.
5. Berg C, Knuppel M, Geipel A, Kohl T, Krapp M, Knopfle G, Germer U, Hansmann M, Gembruch U. Prenatal diagnosis of persistent left superior vena cava and its associated congenital anomalies. *Ultrasound Obstet Gynecol.* 2006;27:274–80.

**Publisher’s Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.