

Vieussens ring: An important though rarely seen coronary collateral (between conus artery and diagonal artery)

Santosh Kumar Sinha*

Santosh Kumar Sinha. Vieussens ring: An important though rarely seen coronary collateral (between conus artery and diagonal artery). *Cardiol Curr Res* 2022;9(2):1-2

Vieussens' ring is an embryologic remnant that requires clinical significance as an intercoronary collateral vessel in ultra-modern coronary artery disease. Its origin as a peritruncal structure recently in embryologic spread, and its

syndicate with congenital pulmonary artery fistula, produce a crucial insight into the recent stages of the coronary circulation. This review explains the embryologic basis of Vieussens' ring in link to the development of the coronary arteries, which describes its location, appearance, and clinical importance.

Keywords: Chronic total occlusion; conus branch; diagonal artery; vieussens ring

INTRODUCTION

In patients with a serious stenosis or total occlusion of the Left Anterior Descending (LAD) coronary artery or Right Coronary Artery (RCA), the conus artery may be the beginning of a rich collateral network at the foundation of the heart circling the great vessels. The course of this collateral pathway seem to partially form a large, ring-shaped structure on all sides of the pulmonary outflow tract [1]. This structure is termed Vieussens' ring, or the arterial circle of Vieussens, after its first description 300 years before by anatomic dissection [2,3]. This collateral system attach the LAD to the RCA, allowing preserved flow despite significant obstruction in either vessel. In some cases, anomalous LAD to pulmonary artery fistula has been categorized as developing from Vieussens' ring. No other connection with congenital heart disease has been explained.

Raymond de Vieussens (1641-1715) was a French physician and anatomist who subscribe numerous original examination of cardiac and neurologic anatomy and physiology. In 1706, he noted many important new cardiac things, including a vascular connection of the conus branch of the RCA grooming around the aorta to the left arterial system. Contemporary angiographic and Computed Tomographic (CT) hellucinated demonstrates the origin of Vieussens' ring either in a conus branch of the RCA or as a different conus artery. The vessel then passes anteriorly and superiorly to the right ventricular outflow tract, and connects the LAD before it enters the interventricular groove. The defining features of the ring are: The vessel passes around the conus, or infundibulum of the right ventricle; and the vessel then anastomoses with the LAD in its proximal position [2].

CASE PRESENTATION

A 74-year-old diabetic and hypertensive male presented with exertional angina which was Canadian Cardiovascular Society (CCS) class II for past 2 years progressing to class III for past 6 weeks despite guideline directed medical therapy. His routine blood examinations and biochemistry were normal [3]. Transthoracic echocardiogram revealed mild concentric left ventricular hypertrophy, grade-II diastolic dysfunction, and normal systolic function with an ejection fraction of 60%. He was taken up for coronary angiogram after informed consent by transradial route. Angiogram revealed normal appearing left main, discrete lesion with critical stenosis of proximal left circumflex (LCx), while Left Anterior Descending artery (LAD) revealed diffuse disease of mid segment with critical stenosis and dissection [4]. However, diagonal branch could not be visualized. Both LAD and LCx were

supplying grade I renetrop inter-coronary collaterals to Right Coronary Artery (RCA). Right coronary artery revealed chronic total occlusion of mid segment. However, the large and tortuous conal branch was filling the large diagonal branch LAD. In lieu of angiographic finding, he was subsequently referred for coronary artery bypass surgery [5].

In patients with critical stenosis or total occlusion of either the left anterior descending artery or right coronary artery, the conus branch of RCA sometimes serves as a major source of inter-coronary collateral [6]. These collateral channels form the Vieussens ring. Although conus branch arises as a first branch of RCA in majority of cases, it can arise separately from right sinus in about 40% of cases where it is known as Isolated Conus Artery (ICA). Under such circumstances, failure to recognize this normal variant, one may miss the feeding branch and thus non-visualization of LAD [7]. It may either lead to incorrect interpretation of angiogram, or patient may undergo additional modalities of investigation like coronary tomography or magnetic resonance coronary angiography [8]. The anterior and superior course of the conus artery is usually short, and supplies the right ventricular outflow tract and the supraventricular crest. Occasionally, it forms an anastomoses with the left anterior descending artery (left conus artery), thereby forming the so-called "arterial circle of Vieussens or Vieussens ring."

DISCUSSION

Since collaterals are generally taken as to be the product of vascular remnants that have full grown (arteriogenesis) rather than new vessels (neovascularization), the existing of this uniquely shaped structure instinctively raises the question of its origin. This review expalins the embryologic basis of Vieussens' ring in connection to the origination of the coronary arteries, which explain its location and aspect, as well as its importance clinically [9]. This vascular network is available most often in the context of LAD occlusion. It arranges collateral blood flow to the myocardium distal to the occlusion, decreases of the ischemia and protecting the myocardium from infarction. It is present in about 5% of cases in few series and is hallucinated d by opacification through choosy angiography of the conus artery or CT scanning [10]. Its identification may provide important diagnostic and therapeutic data in cases of chronic left main or LAD occlusion (Figures 1 to 3).

Department of Cardiology, LPS Institute of Cardiology, Uttar Pradesh, India,

Correspondence: Santosh Kumar Sinha, Department of Cardiology, LPS Institute of Cardiology, Uttar Pradesh, India, E-mail: fionasan@rediffmail.com

Received: October 07, 2020, Manuscript No. PULCRC-20-20366; **Editor assigned:** October 09, 2020, PreQC No. PULCRC-20-20366(PQ); **Reviewed:** October 23, 2020, QC No. PULCRC-20-20366; **QI No:** PULCRC-20-20366 **Revised:** July 22, 2022, Manuscript No. PULCRC-20-20366 (R); **Published:** August 19, 2022.



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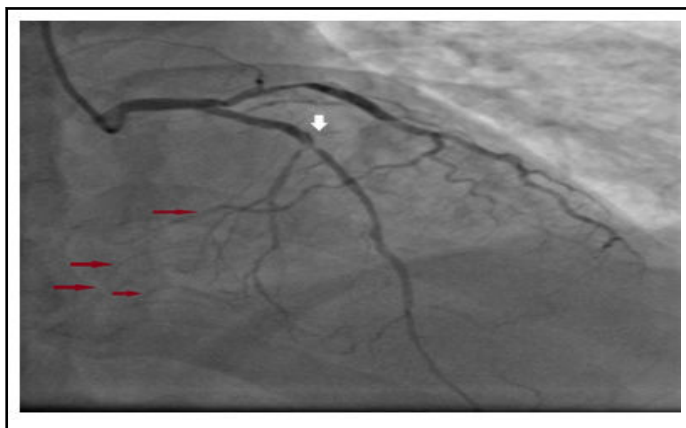


Figure 1: Antero-posterior view showing diffuse disease of LAD along with a dissection with total occlusion (white arrow) of diagonal branch (D) while LCx is showing discrete lesion. Both are giving faint collaterals (red arrow) to RCA

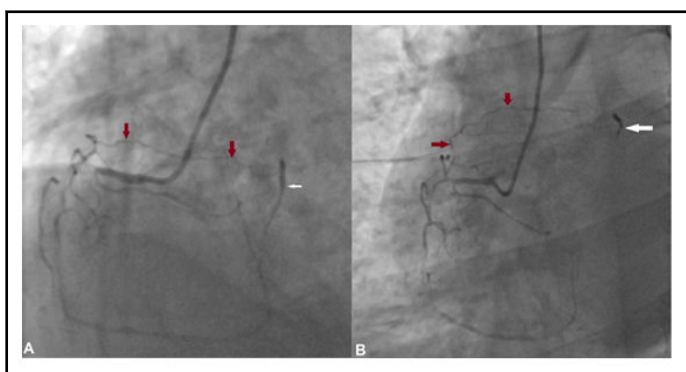


Figure 2: RCA showing chronic total occlusion in its mid segment. Diagonal branch (white arrow) of LAD is being filled by Vieussens ring (red arrow) from RCA (A-Straight lateral view; B-Left anterior oblique view)

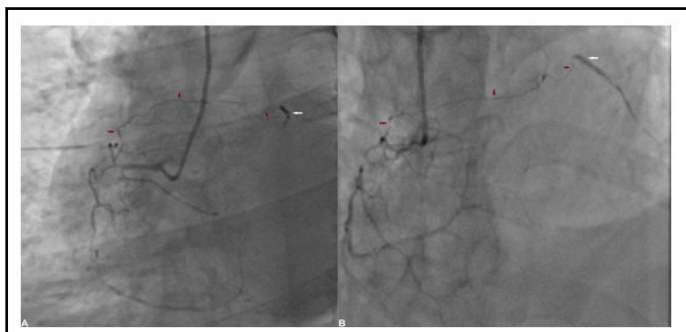


Figure 3: RCA showing chronic total occlusion in its mid segment. Diagonal branch (white arrow) of LAD is being filled by Vieussens ring (red arrow) from RCA (A-Antero-posterior view with cranial angulation; B- Right anterior oblique view with cranial angulation)

CONCLUSION

In our case, Vieussens ring was serving as collateral to diagonal branch instead of LAD. It has both diagnostic, as well as therapeutic implication. It helps surgeon to avoid any inadvertent damage to the conus artery especially if surgery involves manipulation of the right infundibulum. Furthermore, if it has separate origin, one may need to selectively cannulate the conus branch for retrograde injection in case of ante grade recanalization of chronic occlusion of the LAD to visualize the distal segment of LAD and advancing the guidewire correctly. Sometimes, it may serve as an alternative to the retrograde route when the lesion cannot be successfully crossed using an antegrade approach if it is feeding LAD but one should always choose epicardial collateral as the last resort as these are very tortuous, and their perforation may be catastrophic.

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