

Persistent patent foramen ovale in elderly cadaver- A Case Report

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Abstract: Foramen ovale plays an important role in foetal circulation. Knowledge of persistent patent foramen ovale is very important for its association with various congenital & other valvular heart diseases. Patent foramen ovale is one of the common forms of atrial septal defect rarely observed in the elderly people. With this background we are reporting a case of persistent patent foramen ovale in an elderly female cadaver heart specimen from the Department of Anatomy, Sree Narayana Institute of Medical Sciences, Ernakulum. This observation was noted during routine dissection for I MBBS students (2014 batch). Patients with isolated atrial septal defects have been benefited from important recent advances in the diagnosis, evaluation & management of their conditions.

Keywords: Patent foramen ovale, atrial septal defect, congenital heart disease.

INTRODUCTION

The presence of an interatrial channel in the fetal heart has been known since the time of Galen [1]. This foramen ovale is bordered by the limbus of the fossa ovalis (septum secundum) and is guarded by the valve of the fossa ovalis (septum primum). The latter serves as a flap-valve to ensure unidirectional blood flow through its fenestration (ostium secundum) from the right atrium to the left atrium. Foramen ovale is a slit like opening in the atrial septum at the site of foramen secundum of the septum primum. The septum secundum surrounds the foramen secundum in a crescentic shape and leaves a slit-like opening which is covered in a valve like manner by the free edge of septum primum. In the intrauterine life, foramen ovale has the important role of transmitting highly oxygenated inferior vena caval blood to the left atrium. High right atrial pressure in foetal life keeps the valve of foramen ovale open. Left atrial pressure rises shortly after birth and the flap is lightly pushed against the septum secundum and closes the foramen ovale functionally. As a result, the valve of the fossa ovalis is pressed against the limbus and forms a competent seal. During the first year of life, fibrous adhesions develop between the limbus and the valve effect which seals the atrial septum [2]. In few cases, the foramen ovale does not seal and therefore maintains a potential interatrial channel through which blood may shunt whenever right atrial pressure exceeds left atrial pressure [3]. This condition was designated as "Probe patency of the foramen ovale" by Patten [2] and "Valvular competent patent foramen ovale" by Schroeckenstein *et al.* [4].

Atrial septal defect is one of the most common but least severe forms of congenital heart diseases in

adults. Congenital heart diseases are estimated at 6–8% of live births, patent foramen ovale is a hemodynamically insignificant interatrial communication present in >25% of the adult population. Most common form of atrial septal defect is ostium secundum type of patent foramen ovale which occurs more frequently in females than in males and progressively declines with increasing age. Hoffman *et al.* [5] suggested that an atrial left-to-right shunt resulting from an incompetent foramen ovale may exist in patients without heart disease for more than a year, with eventual closure of the communication. Anatomic patency may occur for several months and 50% of all infants have probe patency foramen ovale at the end of 1st year of life. In >25 % of all persons, probably anatomic closure never occur.

OBSERVATION/ CASE REPORT

During routine dissection of the thoracic region in the Department of Anatomy, Sree Narayana Institute of Medical Sciences, Ernakulum for I MBBS students, we observed an abnormal opening in the interatrial septum of the heart of an elderly female cadaver. On observation, the opening was in the superior part of fossa ovalis which suggested it as patent foramen ovale. Konstantinides S *et al.* [6] provided a clinical classification of atrial septal defects of which our observation belongs to ostium secundum type which was overlapped by the limbus fossa ovalis when viewed from right atrium. Other chambers of the heart were also opened and observed. The dimensions of PFO were measured by using vernier calliper scale. It was a slit like aperture into the atrial septal wall surrounded by a rim of tissue, the limbus fossa ovalis which is depicted in the Figure-1. The vertical dimension of fossa ovalis

was 27.5 mm and 19 mm horizontally, PFO was 22.3 mm away from tricuspid valve, 22.8 mm from superior vena caval opening, 32.9 mm from inferior vena caval opening and 29.5 mm from coronary sinus opening. The maximum dimension of PFO was 18.5 mm vertically and 10 mm horizontally. Figure-2 shows the features from the left atrial surface, where PFO resembled like a flap, measuring 19.7 mm in length and the distance

from mitral valve opening was 20 mm. The distance between superior and inferior vena caval opening within the right atrial chamber was 64.2 mm vertically. The great vessels from heart (pulmonary trunk and aorta) had normal openings. The other chambers of heart, septum in between ventricles and orifices did not reveal any anomalies.



Fig-1: Patent foramen ovale (PFO) at the upper part of inter-atrial septum surrounded by limbus fossa ovalis seen from right atrium. SVC - Superior vena cava, IVC - Inferior vena cava, FO - Fossa ovalis, CS - Coronary sinus, PFO - Patent foramen ovale, LFO - Limbus fossa ovalis.



Fig-2: Opening of patent foramen ovale (PFO) at the upper part of inter-atrial septum seen from left atrium (Postero-superior view). RA - Right atrium, LA - Left atrium, IAS - Inter-atrial septum.

DISCUSSION

Atrial septal defect is one of the most common congenital heart disease in which blood flows between the right and left atria. Normally, the atria are separated by a dividing wall called interatrial septum. If this septum is defective or absent, then oxygen rich blood

can flow directly from the left side of heart to mix with the oxygen poor blood in the right side of heart or vice versa. This can lead to lower than normal oxygen levels in the arterial blood that supplies the brain, organs and tissues. Different types of atrial septal defects are described which are significant clinically. 1) Upper

sinus venosus defect, 2) Lower sinus venosus defect, 3) Ostium secundum defect, 4) Defect involving coronary sinus and 5) Ostium primum defect. 70-80% of all adult ASD's account for ostium secundum type of ASD. Other less common forms of adult atrial septal defects include ostium primum type (15%), sinus venosus type (10%), and the unroofed coronary sinus (<1%) [6]. PFO is a small channel that has some haemodynamic consequence; it is a remnant of foetal foramen ovale. Clinically, it is linked to decompression sickness, paradoxical embolism and migraine. In approximately 25% of people, foramen ovale fails to close properly, leaving patients with a patent foramen ovale. Ostium secundum type of ASD is a true defect and the least severe, usually bordered by the edge of the fossa ovalis and the exposed circumference of ostium secundum [7]. Shape varies from circular to oval. Less often, strands of tissue cross the defect creating a fenestrated appearance that suggests multiple defects. Rarely, a defect can extend posteriorly and inferiorly, approaching the site of inferior vena cava entrance into the right atrium. Our observation in this case report belongs to ostium secundum type of defect and was slit like. Persistent PFO was the only anomaly observed in the current specimen.

An ostium primum atrial septal defect is located in the most anterior and inferior aspect of the atrial septum and often associated with trisomy 21. Coronary sinus atrial septal defects are located in the portion of the atrial septum that includes the coronary sinus orifice. They are characterized by the absence of at least a portion of the common wall that separates the coronary sinus and the left atrium. Coronary sinus defects are often associated with a persistent left superior vena cava that drains into the coronary sinus; they may also be associated with complex congenital heart lesions [8]. Patients with small shunts may live a normal life span. Large shunts cause disability as age increases. Raised pulmonary vascular resistance secondary to pulmonary hypertension rarely occurs in childhood or adult life in secundum defects but is more common in primum defects [9].

In the case of patent foramen ovale, a blood clot from venous circulatory system is able to pass from the right atrium to left atrium via the opening and ultimately into systemic circulation. Patent foramen ovale is common in patients with atrial septal aneurysm which is also linked to cryptogenic stroke. Complications may include the development of pulmonary hypertension, supraventricular arrhythmias (atrial fibrillation and atrial flutter) and right-sided heart failure from right ventricular volume overload [10]. Paradoxical systemic arterial embolization is a concern, especially in patients with pulmonary hypertension or venous thrombosis. Paradoxical embolism is an unusual cause of cerebrovascular incidents in the elderly [11]. There are no risk factors for the development of patent foramen ovale. It is mostly a benign condition and its

incidental finding in asymptomatic patients requires no specific therapy. The management of patent foramen ovale in aged patients should include careful evaluation of potential co-morbidities and eventual contraindications, such as severe diastolic dysfunction due to hypertensive cardiomyopathy and coronary heart disease [12]. Treatment for patent foramen ovale includes surgical closure, percutaneous device closure, anticoagulant therapy and antiplatelet agents [13].

If the opening is large enough, oxygen rich blood from the left atrium flows into the right atrium. This causes more work for the heart. ASDs can be located in different places on the atrial septum, and they can be of different sizes. Mayo Clinic autopsy studies revealed that size of PFO increases from a mean of 3.4 mm in 1st decade to 5.8 mm in 10th decade of life, as the valve of fossa ovalis stretches with age. In addition, the prevalence decreased with age (34% in those aged 1-29 years, 25% in those 30-79 years, and 20% in those aged 80 years or more) [14]. In present case report the size of the opening in inter-atrial septum was 18.5 mm in a formalin fixed specimen.

CONCLUSION

Patients with isolated atrial septal defects (ASD) have been benefited from important recent advances in the diagnosis, evaluation, & management of their conditions. PFO can lead to fat embolism and bilateral central retinal artery occlusion, thus leading to blindness. Knowledge about PFO is important as it can be a cause of cryptogenic brain infarction and play a crucial role in various congenital and other valvular heart diseases[15].

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