PATENT FORAMEN OVALE: CURRENT CONCEPTS ON THE MAIN THERAPEUTIC METHODS

FORAME OVAL PATENTE: CONCEITOS ATUAIS SOBRE OS PRINCIPAIS MÉTODOS TERAPÊUTICOS

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ABSTRACT

The foramen ovale is a structure present in the fetal period that allows a contour of the non-functional pulmonary circulation of this period. This foramen remains in about 20% to 25% of the population, and it is renamed as patent foramen ovale, which can have clinical repercussions. This study reported a case of patent foramen ovale and discussed the main updates for managing patients with this condition. In recent years, renowned institutions have reviewed evidence from studies to define the principles needed in the decision-making and management of these patients. Interdisciplinarity in decision-making aiming for proper management is crucial, and individual risk must consider the clinical, anatomical, and imaging characteristics of the patient.

Keywords: Anatomy; atrioventricular communication; fetal heart; foramen ovale.

RESUMO

O forame oval é uma estrutura presente no período fetal que permite um contorno da circulação pulmonar não funcionante desse período. Em cerca de 20% a 25% da população, esse forame permanece, sendo chamado de forame oval patente, e pode trazer repercussões clínicas. O presente estudo visa relatar um caso de forame oval patente e discorrer sobre as principais atualizações no manejo de pacientes portadores dessa condição. Nos últimos anos, renomadas instituições revisaram evidências de estudos a fim de definir os princípios que devem ser seguidos na tomada de decisão e do manejo desses pacientes. A interdisciplinaridade na tomada de decisão visando o manejo adequado é incontestável, e o risco individual deve levar em conta fatores como características clínicas, anatômicas e de imagem do paciente.

Palavras-chave: Anatomia; Comunicação atrioventricular; Coração fetal; Forame oval.

INTRODUCTION

The foramen ovale is a normal interatrial communication of the fetal circulatory system, present in the interatrial septum and formed by the fusion of the primum and secundum septa, which allows a contour of the non-functional pulmonary circulation in the fetal period[1,2]. In about 75% of the population, this foramen closes after birth due to increased blood flow to the lungs and elevation of pressures on the left side of the heart3. However, the foramen ovale remains beyond early childhood in 20% to 25% of the population, which may have clinical repercussions; when this occurs, it is named patent foramen ovale (PFO).

A hypothesis states that strokes are associated with PFO since they involve the passage of paradoxical emboli by this foramen. The mean diameter of the PFO (4.9 mm) allows the passage of emboli large enough to occlude the middle cerebral artery (3 mm) and the main cortical branches (1 mm). Paradoxical emboli are clots or embolic particles that originate in the venous circulation and pass into the arterial circulation via a right-to-left shunt. Apparently, its size increases with age, and its incidence decreases at older ages[2,5].

In some affected patients, PFO is often asymptomatic and may be responsible for blood clot-related disorders. Among the several associa-

ted conditions, congenital heart disease, stroke, transient ischemic attacks, migraine, and obstructive sleep apnea can be highlighted. Many patients with PFO are asymptomatic and are only considered for diagnosis after cryptogenic stroke or transient ischemic attack[6,7]. About 40% to 50% of patients who had a cryptogenic stroke, which does not have a well-defined etiology, had PFO. Thus, these conditions may be associated. Moreover, the presence of PFO, along with atrial septal aneurysms, is a significant predictor of the recurrence of stroke[3,4].

PFO diagnosis must be considered in patients with dyspnea and low arterial saturations without other known causes, young patients with cryptogenic stroke, transient ischemic attacks, or associated congenital heart diseases. In these cases, the test used to detect right-left shunts and the PFO are transthoracic echocardiography or transesophageal echocardiography[6,7]. Although the study of microbubbles with transesophageal echocardiography imaging is the gold standard, the semi-invasive nature limits its widespread use. Other resources that can be adopted are transcranial Doppler and transthoracic echocardiography[4].

From this perspective, this study aimed to report a case of PFO and discuss the main updates for managing patients who have this condition.

CASE REPORT

The present study was conducted at the Department of Anatomy of the Federal University of Pernambuco. During the dissection of the digestive system in the department, the presence of PFO was noted in one of the systems.

Initially, the thoracoabdominal region of a cadaver fixed in 10% formalin was opened. For the dissection of the heart and great vessels, the pericardial cavity was opened with a cruciform incision, rebutting the four flaps. Then, the inferior vena cava and the pulmonary vena cava were sectioned at the level of their entry into the pericardium, the pulmonary trunk, 2 cm above the valve, and then the superior vena cava when penetrating the pericardium. Last, the aorta was sectioned 5 cm above its valve, and the heart was removed.

With a dermographic pencil, incision lines were drawn on the outer surface of the heart. The first line started from the superior to the inferior vena cava, passing parallel and anteriorly to the terminal groove of the right atrium. The second line started in the aorta artery and went towards the coronary sulcus, close to the origin of the posterior interventricular artery, passing equidistantly between the pulmonary veins.

Then, a section was performed along the lines drawn, opening the right and left atria of the heart. In the right atrium, the terminal crest, the absence of the inferior vena cava valve, and the coronary sinus valve were identified. The foramina of the minimal cardiac veins, the interatrial septum, the oval fossa, the limbus of the oval fossa, and the PFO were observed. In the left atrium, in the interatrial septum, PFO was detected in the oval fossa.

For morphometry, a digital caliper was used to measure the diameters of the PFO, which presented a maximum potential diameter of 5 mm.

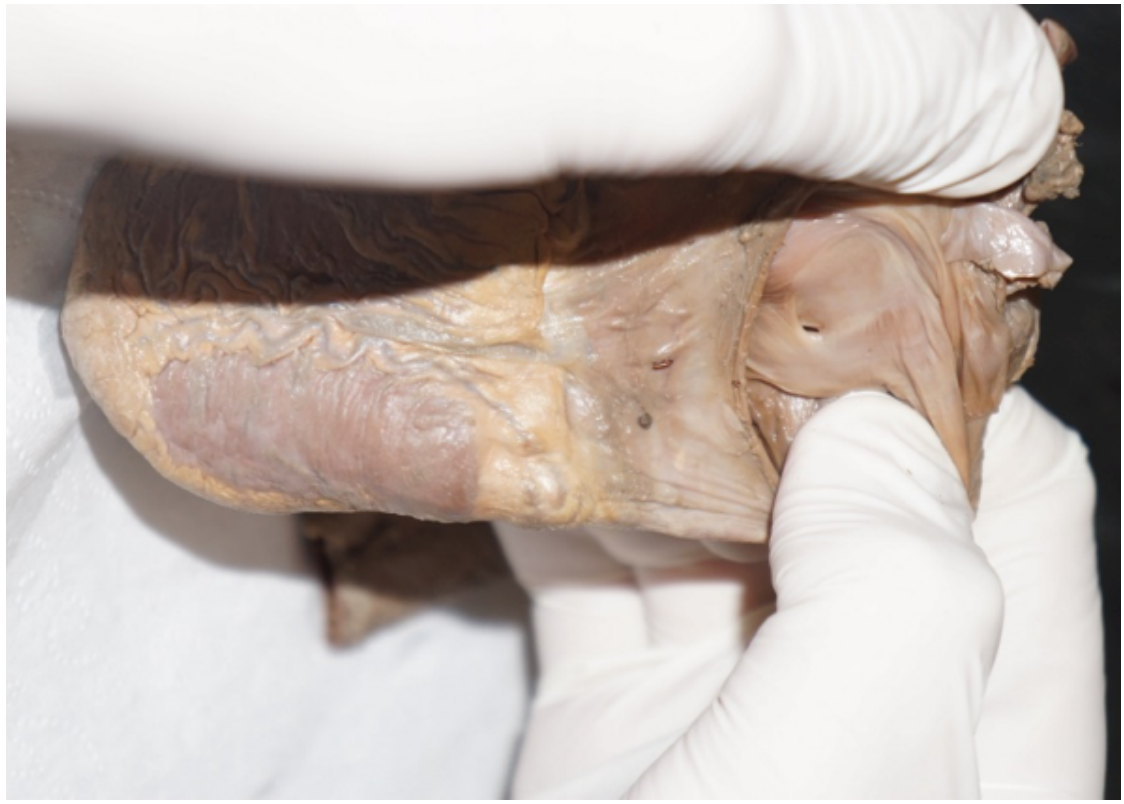

Figure 1. Left atrium open. Interatrial septum with presence of patent foramen ovale in the oval fossa.

DISCUSSION

The presence of PFO is associated with some clinical conditions. In recent years, well-known institutions, such as the European Association of Percutaneous Coronary Interventions, have reviewed evidence from studies to define the principles needed in the decision-making and management of patients with PFO[8,9].

PFO may be associated with cardiovascular events of the left circulation to various organs, causing ischemia and leading to significant clinical repercussions.

At the initial approach to patients with repercussions (e.g., thromboembolism), two aspects guide decision-making[7]: the first is to verify whether the PFO has significant relevance in the clinical event; the second is to identify the probability of the occurrence of this event. Treatment will be targeted according to these aspects.

The FOP must be closed if a high correlation between the foramen and the clinical event is identified. In cases with low probability, drug therapy should be considered. As for patients with intermediate probability, targeted clinical judgment is required in decision-making.

Regarding the clinical management of patients with PFO, it is crucial to adopt interdisciplinary and targeted interventions, as well as insert patients during the process. A 12-lead electrocardiogram, cardiac telemetry, or 24-hour Holter is recommended[7].

The treatment options in patients with PFO who suffered associated thromboembolism encompass antiplatelet agents, oral anticoagulants, PFO closure via percutaneous procedure, and surgical closure. Of these, percutaneous closure has the highest success rates, in which complete closure of the PFO occurs in up to 93% of patients followed for one year. On the other hand, a surgical closure is not advised in these cases[7].

One of the possible complications associated with PFO is the formation of gaseous emboli related to decompression sickness, which is typical of populations that perform diving. The association between these conditions has been discussed in the literature. Controlling risk factors in these populations by avoiding the formation of emboli can prevent paradoxical embolism, regardless of the presence of PFO, since

the decision to close the emboli is individualized[8].

Lifestyle modifications, such as smoking control, adequate body weight, and hydration before and after diving, may prevent decompression sickness. On the other hand, the closure of the PFO can be proposed for patients who cannot implement these measures, and studies have evidenced the decreased incidence of this pathology[8].

Literature suggested a correlation between migraine and PFO after a higher prevalence of this foramen was identified in patients with migraine, especially with aura. However, closing the PFO as a routine treatment is not recommended for these patients. Due to data controversies, PFO closure should be considered only in clinical trials or compassionate use in the case of migraine with aura[8].

The method used and the accuracy of the diagnosis may result in varied incidences and diameters of the PFO, despite some studies reporting reduced diameters of the PFO as age advances. No consistent data correlated PFO with race and sex. A limitation of this study is the lack of epidemiological data on the individual[2].

Last, this study described a case of PFO with a potential maximum diameter of 5 mm. This data is compatible with the passage of emboli that is capable of occluding cerebral branches, such as the middle cerebral artery and large cortical branches, given the greater causal association between strokes with the largest PFO diameter and atrial septal hypermobility.

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