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Patent foramen ovale closure with prosthesis for occlusion of atrial septal defect in lipomatous hypertrophy of atrial septum. Report of two cases

Fechamento de forame oval patente com prótese oclusora de comunicação interatrial em septo atrial lipomatoso.

Relato de dois casos

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DOI: 10.31160/JOTCI202028A20200003

ABSTRACT – Patent foramen ovale is associated with the occurrence of cryptogenic ischemic stroke, and its occlusion decreases the recurrence rate. Percutaneous occlusion is safe and effective, and can be performed by different types of occluders. The choice of the device must consider the anatomy of the interatrial septum and the foramen ovale, the availability of the device and the team's experience. Usually, dedicated devices are preferred. However, in the presence of a lipomatous hypertrophy of the septum, due to its greater thickness, a proper coaptation of the leaflets is not possible using traditional prostheses, and a prosthesis designed for occlusion of atrial septal defect can be chosen. We report two cases in which the choice of prosthesis has taken these principles into account.

Keywords: Foramen ovale, patent; Heart septal defects, atrial; Stroke; Heart defects, congenital

RESUMO – O forame oval patente já foi implicado na ocorrência de acidente vascular encefálico isquêmico criptogênico, e sua oclusão diminui a taxa de recidiva. Essa oclusão por via transcateter é segura e efetiva, podendo ser realizada por diferentes tipos de oclusores. A escolha do dispositivo deve levar em conta a anatomia do septo interatrial e do forame oval, a disponibilidade do dispositivo e a experiência da equipe. Habitualmente, privilegiam-se os dispositivos próprios dedicados, entretanto, na presença de septos lipomatosos, devido à maior espessura, não se consegue boa coaptação dos folhetos com as próteses tradicionais, podendo optar-se por uma prótese que tenha sido concebida para oclusão de comunicação interatrial. Relatamos dois casos em que a escolha da prótese se atentou a esses princípios.

Descritores: Forame oval patente; Comunicação interatrial; Acidente vascular cerebral; Cardiopatias congênitas

INTRODUCTION

The foramen ovale is an anatomical structure located in the interatrial septum. It is formed in the embryonic period and is important for the determination of adequate fetal circulation. After birth, with increased pressure in the left atrium (LA), this structure is physiologically occluded, and its anatomical closure occurs up to the end of the first year of life. However, in approximately 30% of individuals, this structure can remain patent for life.¹

The presence of a patent foramen ovale (PFO) was independently associated with the occurrence of cryptogenic ischemic stroke, i.e., when there is no other apparent cause for the thromboembolic phenomenon, and in the occurrence of this condition, there is evidence in the literature that the percutaneous occlusion of the atrial septum decreases the recurrence rate of this phenomenon (secondary prevention).²

How to cite this article:

Fernandes FH, Amaral LV, Borges PA, França VE, Silva JB, Gardenghi G. Patent foramen ovale closure with prosthesis for occlusion of atrial septal defect in lipomatous hypertrophy of atrial septum. Report of two cases. J Transcat Intervent. 2020;28:eA20200003. <https://doi.org/10.31160/JOTCI202028A20200003>

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Received on:

Apr 14, 2020

Accepted on:

Jun 24, 2020

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Percutaneous PFO occlusion is safe and effective and can be performed with different types of occluders.³ The choice of the occlusive device must consider the anatomy of the interatrial septum and the foramen ovale, availability of the device, and team's experience. The choice usually favors proper devices for closing this structure. Nonetheless, in specific cases, according to the anatomy of the structure, the device chosen may be one designed for atrial septal defect (ASD) occlusion.⁴ A lipomatous septum, thicker than usual, associated with the presence of PFO, is a situation in which a more adequate occlusion is achieved when a prosthesis with a wider waist is used, to encompass the entire length of the septum, as it occurs in ASD occlusion.⁵

We report two cases of PFO closure with unusual prostheses, given the anatomical characteristics of the septum, such as the size of the orifice and the presence of a lipomatous hypertrophy of the septum, justifying the replacement of conventional prostheses for PFO closure with ASD occlusion prostheses guided by sizing balloon.

The Research Ethics Committee of the *Hospital de Urgências de Goiânia* approved this study (CAAE: 85497418.2.0000.0033).

Case report 1

A 67-year-old female patient presented with a transient ischemic attack (TIA) with loss of strength in her right hand lasting about 20 minutes, which led her to see a neurologist. After undergoing neuroimaging exams without alterations and carotid Doppler with no significant obstructions, the patient was referred to our cath lab, since PFO was identified by microbubbles passing from left to right on the transesophageal echocardiography. She had atypical precordialgia upon admission and denied syncope, partial loss of consciousness, vertigo, dyspnea or palpitation. She presented with good functional capacity, New York

Heart Association (NYHA) class I. As comorbidities, the patient reported hypothyroidism, arthritis, migraine without aura (last crisis more than one year before), and varicose veins of the lower limbs, denying hypertension (HTN), diabetes mellitus (DM), dyslipidemia, smoking habit or family history of coronary atherosclerotic disease (CAD). She was on levothyroxine 88mcg, isoflavone with vitamin E, and acetylsalicylic acid (ASA) 100mg. No changes on 24-hour Holter monitoring. Risk of Paradoxical Embolism (RoPE) score of 4. Patent foramen ovale closure was indicated with intraoperative transesophageal echocardiography, and the presence of PFO associated with a lipomatous hypertrophy of interatrial septum was confirmed on the echocardiogram, with no other evident changes (Figure 1), with a large amount of microbubbles passing to the left atrium (LA). We guided the transseptal passage and confirmed the location of the guide catheter in the LA. We chose to measure the stretched balloon because the PFO opening increased in size after crossing the guidewire and sheath (Figure 2A). After inflating the balloon, its waist was measured when the shunt disappeared (approximate diameter of 14mm) (Figure 2B). The occlusive discs were released from the left and right atrial surfaces without complications, confirming the inclusion of all septal defect edges (ASD prosthesis number 15) (Figures 2C and D). We observed microbubbles passing through the center of the prosthesis, in addition to the absence of shunt through the interatrial septum, after total release of the prosthesis. In an outpatient reassessment conducted 1 year after the procedure, the patient was asymptomatic, with good functional capacity, NYHA class I, with no cardiovascular complaints in the period and no new episodes of TIA. A control echocardiogram showed the occlusive device in a well-positioned interatrial septum topography, without residual shunt.

Figure 1. Echocardiographic image of the lipomatous hypertrophy of the septum, before implantation of the occlusive prosthesis.

Figure 2. Procedure steps. (A) Echocardiography of the balloon stretched in the patent foramen ovale. (B) Image during the catheterization of the balloon stretched in the patent foramen ovale. (C) Side view of echocardiographic image of the implanted atrial septal defect prosthesis. (D) Image during the catheterization of the atrial septal defect prosthesis.

Case report 2

A 60-year-old male patient, with a 15-year history of ischemic stroke, reporting no comorbidities or use of medication at the time. He was thoroughly investigated for thrombophilia, but no alteration that contributed to the onset of stroke was found, and he had a carotid Doppler scan showing no significant obstructions. He was referred to our service after identification of a PFO, measuring 3.5mm in diameter and 10mm in length with reverse shunt (Figure 3) on the transesophageal echocardiography. He had epilepsy and dyslipidemia as comorbidities, denying HTN, smoking habit or DM. At the time, he was taking AAS 100mg, atorvastatin 40mg, gemfibrozil 900mg, sodium valproate and alprazolam. There were no changes on the 24-hour Holter monitoring. The RoPE score was 4. He had dyspnea on moderate exertion and was in NYHA functional class II. He underwent percutaneous closure of the PFO with the use of intraoperative transesophageal echocardiography, confirming the presence of PFO, associated with a lipomatous

hypertrophy of interatrial septum on the echocardiogram, without other evident changes. After the passage of the catheter, a large PFO opening was observed (Figure 4A), and the balloon was stretched at 12mm (Figure 4B). We chose to use an ASD prosthesis because of the lipomatous aspect and the large PFO opening. The discs were released from the left and right atrial surfaces, confirming the inclusion of all edges of the septal defect (Figure 4C). We observed an absence of pericardial effusion or shunt through the atrial septum after releasing the 14mm prosthesis (Figure 4D). Cardiac catheterization was performed right before the procedure, with no evidence of significant coronary lesions. He had a favorable clinical course, and was discharged with his usual medications, in addition to clopidogrel 75mg for 3 months, and instructions on the prevention of endocarditis. The patient was reassessed on an outpatient basis 2 months after the procedure, and was clinically stable, with good functional capacity, NYHA class I, and without any cardiovascular complaints.

Figure 3. Echocardiographic image of the lipomatous septum before implantation of the occlusive prosthesis.

RA: right atrium; LA: left atrium.

Figure 4. Procedure steps. (A) Echocardiography of the balloon stretched in the patent foramen ovale. (B) Image during the catheterization of the balloon stretched in the patent foramen ovale. (C) Side view of the echocardiographic image of the implanted atrial septal defect prosthesis. (D) Image during the catheterization of the implanted atrial septal defect prosthesis.

DISCUSSION

The presence of PFO may be implicated in the occurrence of ischemic stroke, especially when no other causal factor is identified. In young adults, the foramen ovale accounts for up to 40% of all cardioembolic strokes.¹

Lipomatous hypertrophy of the atrial septum, characterized by a thickness greater than 20mm, is an occasional finding, with reports of an approximate prevalence of 2% in the general population. Usually, the hypertrophy originates from the upper and/or lower region of the interatrial

septum, sparing the region of the foramen ovale, configuring the shape of a “dumbbell”. There are no reports indicating that the presence of a lipomatous septum is associated with a higher occurrence of PFO.⁶

Several aspects may be implicated in the success of the foramen ovale occlusion, such as the extension of the canal, the presence or absence of septal aneurysm and the choice of the device. The evaluation of the residual shunt is one way to evaluate the success of the procedure.⁷ This evaluation is often used to compare the efficacy of different devices and the occurrence of adverse events, such as thrombus formation and atrial fibrillation. Since the different devices currently used differ in efficacy and safety³ and in view of the different anatomical characteristics of each patient, it is reasonable to believe the customized choice of the device can impact on procedural success.² An alternative approach for PFO associated with lipomatous hypertrophy of the interatrial septum is based on the use of a dedicated device for the occlusion of ventricular septal defect (VSD), because this device has a longer waist (usually >7mm). Lin et al. reported two cases of successful use of VSD occlusive devices for treating PFO in a lipomatous atrial septum, with both individuals recovering well after the procedures, without any complications.⁵

The presence of lipomatous hypertrophy of the interatrial septum is a challenge for performing PFO occlusion, since the length of the central disc does not cover the entire thickness of the interatrial septum, preventing adequate coaptation of the lateral discs in the septum walls.⁵ This inadequate coaptation leads to persistence of the shunt, therefore the success of the occlusion and the desired protective effect against embolic events cannot be guaranteed.² The choice of prostheses with elongated central disc is more suitable for coaptation in a thick septum, allowing proper prosthetic fit and interrupting the interatrial flow.⁵

PFO closure with lipomatous hypertrophy of the atrial septum, when performed using standard occlusion devices for PFO closure, may lead to poor prosthesis positioning, with continuous blood flow deviation and residual shunt, and eventually, to prosthesis embolization.⁵ The characteristics of the ASD occluder, with various prosthesis waist diameter sizes, allow PFO closures guided by sizing balloon, with more appropriate occlusion and lower probability of residual shunt.

FINANCING SOURCE

None.

DECLARATION OF CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: GG and FHF; data collection: FHF and JBMS; data interpretation: GG and FHF; writing of the text: VEAF, PAFB and LVA; approval of the final version to be published: GG, FHF, JBMS, VEAF, PAFB and LVA.

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