

Original

# Combined percutaneous treatment of structural and congenital heart defects

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ARTICLE INFO

*Article history:*

Received 6 November 2014

Accepted 13 January 2015

*Keywords:*

Heart septal defects

Cardiac catheterization

Protheses and implants

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*Palavras-chave:*

Defeitos dos septos cardíacos

Cateterismo cardíaco

Próteses e implantes

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ABSTRACT

**Background:** Multiple congenital defects are traditionally corrected surgically, but nowadays can be treated percutaneously. There are few reports in the literature attesting to its efficacy and safety. We aimed to describe an experience with combined procedures to treat different congenital and structural defects, in a single therapeutic session.

**Methods:** Since 2007, different defects were treated in a single treatment session. All were selected by echocardiography. The procedures were performed using traditional techniques already described for each defect.

**Results:** Ten patients were treated, five males, aged 1-67 years, weighting 11-90 kilograms. The most prevalent isolated defect was patent ductus arteriosus (PDA, n = 5), followed by ostium secundum atrial septal defects (osASD, n = 4) and ventricular septal defects (VSD, n = 4). The most common combinations were VSD with PDA (n = 2) and VSD with osASD (n = 2). Two pulmonary valve stenosis were dilated with osASD and patent foramen ovale (PFO), and one aortic coarctation with PDA. Additionally, a left atrial appendage with PFO was occluded and an aortopulmonary fistula with PDA was embolized. All procedures were successful. The mean follow-up was 31 ± 28.1 months, with only two complications. There were no deaths.

**Conclusions:** The small number of reported cases showed that the combined procedures were safe and effective and can be reproduced by experienced operators in specialized centers and may be considered as the first therapeutic option in these patients.

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## Procedimentos percutâneos combinados em defeitos estruturais e congênitos

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RESUMO

**Introdução:** Defeitos congênitos múltiplos são tradicionalmente corrigidos cirurgicamente, mas, atualmente, podem ser tratados percutaneamente. Existem poucos relatos na literatura atestando sua eficácia e segurança. Objetivamos descrever uma experiência com a realização de procedimentos combinados para tratar diferentes defeitos, congênitos e estruturais, numa mesma sessão terapêutica.

**Métodos:** Desde 2007, foram tratados, numa mesma sessão terapêutica, diferentes defeitos. Todos foram selecionados por ecocardiograma. Os procedimentos foram realizados segundo as técnicas tradicionais já descritas para cada defeito encontrado.

**Resultados:** Foram tratados dez pacientes, cinco do sexo masculino, com idades de 1 a 67 anos, e pesos de 11 a 90 kg. O defeito mais prevalente de forma isolada foi a persistência do canal arterial (PCA, n = 5), seguido da comunicação interatrial *ostium secundum* (CIA OS, n = 4) e da comunicação interventricular (CIV, n = 4). As combinações mais frequentes foram CIV com PCA (n = 2) e CIV com CIA OS (n = 2). Foram dilatadas duas estenoses valvares pulmonares, com CIA OS e com forame oval patente (FOP), e uma coarctação de aorta com PCA. Adicionalmente, foi ocluído um apêndice atrial esquerdo com FOP e foi embolizada uma fístula aortopulmonar com PCA. Todos os procedimentos foram bem-sucedidos. O tempo médio de seguimento foi de 31 ± 28,1 meses, havendo apenas duas complicações. Não houve nenhum óbito.

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DOI of original article: <http://dx.doi.org/10.1016/j.rbc.2015.01.004>

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Peer Review under the responsibility of Sociedade Brasileira de Hemodinâmica e Cardiologia Intervencionista.

**Conclusões:** A pequena série de casos relatada mostrou que os procedimentos combinados foram seguros e eficazes, podendo ser reproduzidos por operadores experientes em centros especializados, podendo vir a se constituir como primeira opção terapêutica para esses pacientes.

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## Introduction

Percutaneous intervention is currently the therapeutic modality of choice for most simple congenital heart diseases, as well as for some structural defects, with similar results and sometimes even advantage over conventional surgery.<sup>1,2</sup>

Multiple congenital defects are traditionally corrected through surgical techniques. Although the feasibility of percutaneous intervention for different defects in the same procedure has been described in some case reports, its efficacy and safety have not been consistently evaluated.<sup>3-6</sup>

In this article, the authors analyze their experience with combined procedures performed for treatment of different defects, both congenital and structural, and discuss technical aspects and indications. Finally, some comments are offered on the effectiveness and safety of the procedures performed.

## Methods

The medical records of all patients who underwent percutaneous procedures to treat various heart defects in a single therapeutic session were retrospectively analyzed. Cases of more than one device implanted for treating the same type of anatomical defect and cases in which an atrial septal defect and patent foramen ovale (PFO) were occluded during the same procedure were excluded from this analysis.

### Procedures

All procedures were performed under general anesthesia and orotracheal intubation after at least an 8 hour fasting. The patients underwent right and left heart catheterization by femoral puncture. Relevant angiograms were performed in each case.

Heparin was administered at doses of 100 IU/kg in children and of 5,000-10,000 IU in adults after a venous access was obtained and a transesophageal sheath was introduced. Antimicrobial prophylaxis with cefazolin (50 mg/kg in children or 2 g in adults) was routinely administered.

As a general rule, procedures regarded as more complex, time-consuming, or laborious were performed first, followed by those considered simpler or technically less demanding. In the case of association with valvar stenosis, these conditions were addressed first.

All occlusive procedures and all dilations were performed according to standard techniques, detailed elsewhere.<sup>2,7-11</sup> Occlusive procedures were monitored by transesophageal echocardiography (TEE), in addition to fluoroscopy.

All patients were followed-up in the intensive care unit after the procedure and were discharged after undergoing a control transthoracic echocardiography (TTE) 24 hours after the index procedure.

### Follow-up

Patients undergoing ostium secundum atrial septal defect (osASD), PFO, ventricular septal defect (VSD), and left atrial appendage (LAA) occlusions were instructed to use acetylsalicylic acid (3-5

mg/kg/day in children or 200 mg/day in adults) for 6 months, in addition to 75 mg of clopidogrel bisulfate in adults for 3 months in cases with this indication. In patients whose procedure involved only stenting, antiplatelet therapy with acetylsalicylic acid was recommended for 6 months. All patients were instructed to observe the prophylactic recommendations for infective endocarditis for a period of 6 months, when necessary.

Clinical follow-up was performed at 1, 3, 6, and 12 months after the procedure, and annually thereafter. Image monitoring with TTE was performed in visits at 1, 3, and 12 months, and annually thereafter; at the 6 month visit, TEE was performed for evaluation of the procedure outcome.

In addition to clinical examinations and routine echocardiograms, stents were angiographically evaluated after 6 months.

## Results

Since 2007, 982 patients were submitted to interventional procedures; in 10 patients (1.0%), two different defects were treated in the same session. Five patients were male, with age ranging from 1 to 67 years ( $14 \pm 24.3$  years), and with weight ranging from 11 to 90 kg ( $50 \pm 26.9$  kg).

Table 1 shows demographic data of these ten patients included in this study, as well as combinations of the structural defects treated. Globally, 20 congenital and structural defects were treated, with patent ductus arteriosus (PDA) the most prevalent ( $n = 5$ ) in isolation, followed by osASD ( $n = 4$ ) and VSD ( $n = 4$ ). The most common combinations were VSD with PDA ( $n = 2$ ) and VSD with osASD ( $n = 2$ ).

Of the 20 procedures performed in these ten patients, a combination of two procedures of occlusion was performed in the majority of cases ( $n = 7$ ). In two cases, balloon pulmonary valvuloplasty (BPV) was performed in combination with PFO ( $n = 1$ ) and osASD ( $n = 1$ ) occlusion. In another patient with aortic coarctation (AoC) and PDA, AoC was treated with balloon dilation and with the implantation of a polytetrafluoroethylene (PTFE)-coated stent, positioned so as to also occlude the ductus arteriosus origin. A variety of devices with different characteristics and from different suppliers were used to conduct these procedures (Table 2).

**Table 1**  
Demographics and structural defects.

Nº	ID	Gender	Age (years)	Weight (kg)	Defects
1	JAA	M	57	90	PVS + PFO
2	GCO	M	1	11	PDA + aortopulmonary collaterals
3	BMOA	F	14	50	Perimembranous VSD + osASD
4	LCMM	F	35	59	Multiple muscular VSDs + PDA
5	GOR	F	29	56	PDA + osASD
6	JKVSG	M	3	14	PVS + osASD
7	JMFV	M	4	15	Perimembranous VSD + PDA
8	SMGQ	F	67	65	Chronic AF with stroke + PFO
9	GGR	M	10	42	Perimembranous VSD + osASD
10	IVM	F	7	24	AoC + PDA

ID: patient identification; M: male; PVS: pulmonary valve stenosis; PFO: patent foramen ovale; PDA: patent ductus arteriosus; F: female; VSD: ventricular septal defect; osASD: ostium secundum atrial septal defect; AF: atrial fibrillation; AoC: aortic coarctation.

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