Kissing balloons and kissing devices: transcatheter closure of multiple atrial septal defects on hypermobile atrial septum with two devices

Techniki *kissing balloons* i *kissing devices* – przezskórne zamknięcie wielu ubytków w hipermobilnej przegrodzie międzyprzedsionkowej za pomocą dwóch urządzeń

Zekeriya Küçükdurmaz[1], Hekim Karapinar[1], Mehmet Burhan Oflaz[2], İbrahim Gül[1], Ahmet Yılmaz[1]

[1]Cardiology Department, Medical School, Cumhuriyet University, Sivas, Turkey
[2]Pediatric Cardiology Department, Medical School, Cumhuriyet University, Sivas, Turkey

Postep Kardiol Inter 2012; 8, 4 (30): 357–359
DOI: 10.5114/pwki.2012.31920

Abstract

Endovascular treatment has become an accepted treatment modality for atrial septal defects (ASD) in adults. In multiple defects on a hypermobile atrial septum with atrial septal aneurysm (ASA), surgery used to be the treatment of choice, but transcatheter occlusion has emerged as a successful alternative in appropriate cases. We present a case with multiple ASDs treated with two ASD occluder devices.

Key words: multiple atrial septal defects, percutaneous closure

Streszczenie

Zabiegi śródnaczyniowe są akceptowalną metodą terapii ubytków w przegrodzie międzyprzedsionkowej (*atrial septal defect* – ASD) u dorosłych. Leczenie operacyjne jest terapią z wyboru w przypadku wielu ubytków w hipermobilnej przegrodzie międzyprzedsionkowej z towarzyszącym tętniakiem przegrody (*atrial septal aneurysm* – ASA), jednak w niektórych sytuacjach skuteczną alternatywę stanowi zamknięcie przezskórne. Przedstawiono przypadek chorej z wieloma ASD leczonymi za pomocą wszczepienia dwóch okluderów.

Słowa kluczowe: wiele ubytków w przegrodzie międzyprzedsionkowej, zamknięcie przezskórne

Introduction

Transcatheter closure with an appropriate device is accepted as the gold standard therapy for suitable secundum atrial septal defect (ASD) patients. Also it is an alternative to surgery in suitable ASD patients with multiple defects on a hypermobile septum with atrial septal aneurysm (ASA).

Herein we present a case with multiple ASD on a hypermobile septum with ASA successfully treated via transcatheter closure with two devices.

Case report

We diagnosed multiple ASDs with ASA via transthoracic echocardiography (TTE) in a 33-year-old woman who was admitted to our clinic with dyspnoea. Than we performed transoesophageal echocardiography (TEE) and revealed two ASDs. We decided to close them via the transcatheter approach. We decided to inflate sizing balloons in the ASDs near the mitral valve and aorta to stop the flow and to reveal whether an additional defect exists and also to perform optimal sizing because of the flail and aneurysmatic morphology of the septum. And we revealed a third ASD. We foresaw that this defect could be closed by the discs of the other two devices because of its median location with the other defects. First we placed a 16 mm Amplatzer ASD closure device onto the smaller defect near to the mitral valve then a 20 mm Amplatzer ASD closure device onto the defect near to the aorta. Colour Doppler

Corresponding author/*Adres do korespondencji:*
Dr. Zekeriya Küçükdurmaz, Cardiology Department, Medical School, Cumhuriyet University, Sivas, Turkey, tel.: 00905336122444, fax: 00903462191115, e-mail: trimesgites@hotmail.com
Praca wpłynęła: 6.08.2012, **przyjęta do druku:** 30.10.2012.

echocardiographic examination revealed only a minimal flow in the devices after liberalisation of the devices. No complications occurred. Everything was normal at the first year follow-up.

Discussion

Percutaneous therapy is primarily recommended for suitable patients in secundum ASD patients. Major limitations of percutaneous therapy are total septum insufficiency (relatively large defect compared to the total septum diameter) and insufficiency of the inferior and/or posterior rims [1]. Existence of multiple defects and aneurysmatic septum are factors that might also make the intervention more difficult. Number and size of the defects, inter-defect distances and elasticity of the rims are also important parameters in multiple defects [2-4]. Swiss cheese like ASDs may be closed with an "Amplatzer cribriform septal occluder device". But multiple device use might be considered in the case of multiple large defects with increased inter-defect distances. In this situation total septal length and sufficient rim existence for each defect are important [2-5]. We revealed two defects echocardiographically but flow patterns led us to suspect additional defects. We stopped the flow of the two defects with sizing balloons and revealed an additional defect. We decided to close two defects with two devices because of their properties but foresaw that the third defect could be closed using the discs of the devices because of the frail structure of the aneurysm and insufficiency of the total septum.

Floppy and aneurysmatic septum is another restriction for percutaneous closure. Sizing balloon measurement is

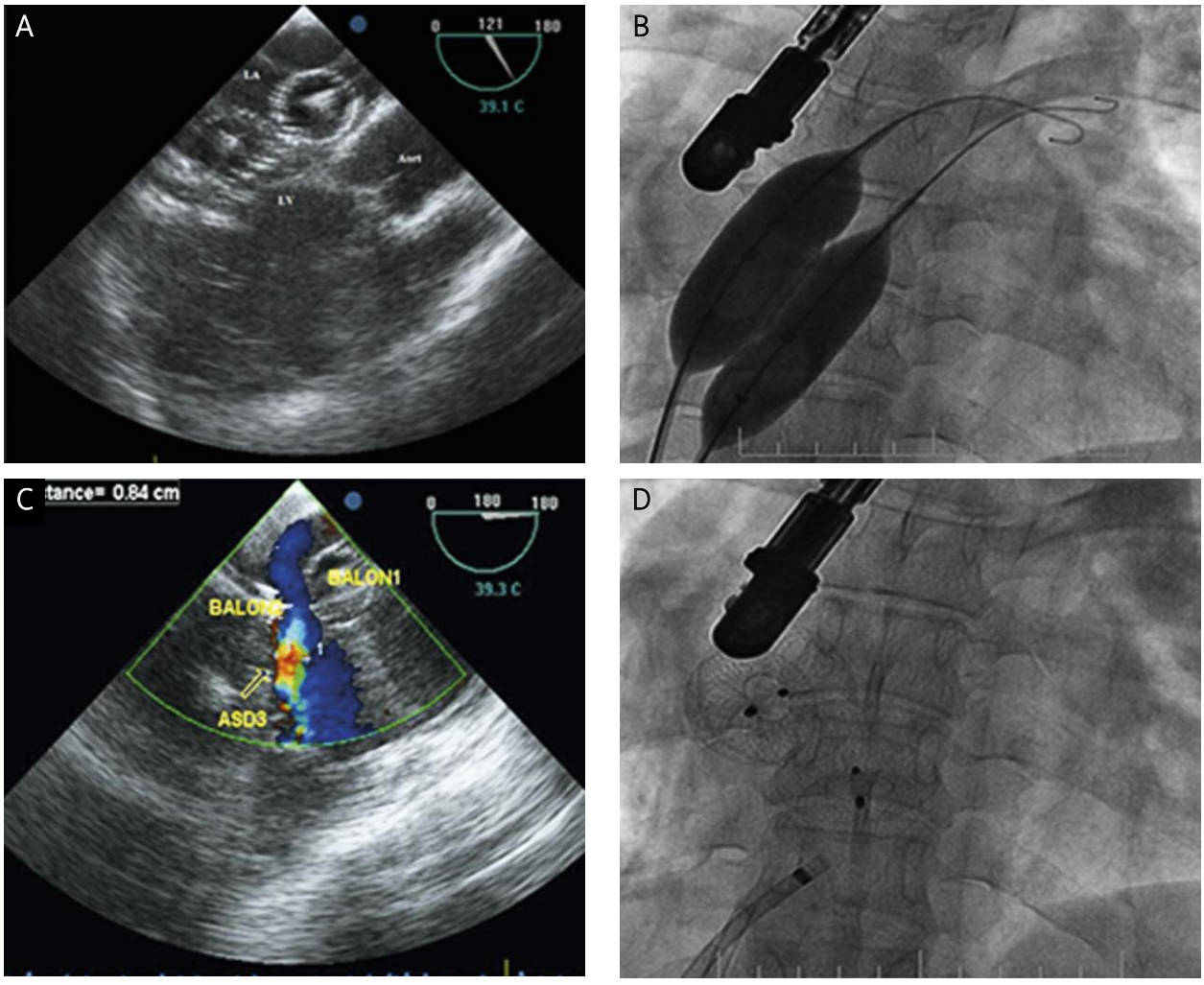

Fig. 1. A – Echocardiographic images of the defects during balloon sizing. **B** – Fluoroscopic images of the defects during balloon sizing. **C** – Echocardiographic image of the third defect during the stop-flow of the other two defects. **D** – Fluoroscopic images of the devices after deployment

***Ryc. 1. A** – Obrazy echokardiograficzne ubytków podczas ich pomiarów za pomocą balonu. **B** – Obrazy fluoroskopowe ubytków podczas ich pomiarów za pomocą balonu. **C** – Obraz echokardiograficzny trzeciego ubytku po zatrzymaniu przepływu przez pozostałe dwa ubytki. **D** – Obraz fluoroskopowy urządzeń po ich wszczepieniu*

an important aspect for floppy septums because oval fossa might be like a flep and multiple defects might exist on this type of septum [1]. Balloon sizing may give us the exact size of the defect and precisely help us not to miss any other defects [5]. We observed the defects to be larger than the 2D and Doppler echocardiographic measurements and found a third defect by balloon sizing in our case. Also we measured the distance between the third defect and the other defects and foresaw that the third defect would be closed by the discs of the other two devices. Balloon sizing gave us the additional information that the device on the second defect close to the mitral valve would not touch the valve. However, we placed the biggest device also to take care of the floppy and aneurysmatic septum. After these evaluations, we freed the two devices overlapping on and closing the third defect and they became a bit further away by deviating the septum towards the right atrium. Colour Doppler showed the partially closed third defect and the residual flow. Previous studies found that residual flow existed after the closure of multiple defects without any hemodynamic strain and they observed that they disappeared in the follow-up [2-5]. The lack of ability to demonstrate the after-placing situation on the septum before freeing the devices is a restriction for the Amplatzer device. This restriction is important for closure of ASDs and PFOs on floppy and aneurysmatic septums and new developments of the devices should be performed with regard to this aspect.

Another difficulty in the closure of aneurysmatic septums is the detection of the total septal sufficiency. As happened in our case, the sum of the device dimensions is greater than the total septum, but this did not cause any problem because of the placement of the devices into the aneurysm so the total septum was enough.

Aneurysmatic septum was defined as a risk factor for thrombus formation and thrombus formation was observed after the closure with different devices in 1.2% of cases [6, 7]. In addition to septal aneurysm, atrial fibrillation and left ventricular dysfunction were also defined as risk factors for thrombus formation [6, 7]. We prescribed dual antiplatelet therapy to our patient and observed no thrombus in the 1st, 6th and 12th month follow-ups.

Awad *et al.* observed full closure in 15 cases (45.4%), haemodynamically insignificant shunt in 9 cases (27.3%) and haemodynamically significant shunt only in 1 case (3%) in their percutaneous multiple-defect closure case series and they reported no shunt in their long-term follow-ups. The device was percutaneously retrieved because of asymptomatic pulmonary embolisation at the 24th hour. Aortic and left atrial erosion and hence pericardial effusion was observed in a patient with angina and dizziness and the device was retrieved and the defect was closed surgically; it was observed that the device was endothelised [1]. Bramlet *et al*. evaluated 15 paediatric patients after closure with multiple devices. In 5 patients (36%) shunt was observed at the 24th hour but in only 1 patient (7%) at the first month follow-up and this shunt was found to be closed at the 7th month. Device erosion or embolisation was observed in no cases. One patient was lost at the 30th day but all 3 devices were found to be intact; 200 ml of serous pericardial fluid was found but no finding for myocardial inflammation or erosion was observed [4]. Both studies emphasised that percutaneous closure of multiple ASDs was safe and effective based on the case selection [1, 4].

In conclusion, our experience of this case showed that multiple defects on an aneurysmatic and floppy septum might be closed by a careful evaluation of the patient and choosing suitable materials. If the total septum and the rims are sufficient, percutaneous closure may be an alternative therapy.

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