

Problems that occurred during and after transcatheter closure of muscular ventricular septal defects in two patients

Problemy związane z przezcewnikowym zamykaniem mięśniowych ubytków międzykomorowych na przykładzie dwóch przypadków

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Abstract

Aim: A case of 2 children (8 and 11-year-old), in whom muscular ventricular septal defect (mVSD) (in echo 5 and 6 mm of diameter respectively) was closed interventionaly. Both had symptoms of significant left-right shunt.

Methods and results: In the first patient 6 mm Amplatzer Muscular VSD Occluder (MVSDO) was implanted from the arterial side. The reason were technical problems to cross VSD with delivery system from the venous side. In the second child (with inlet defect) 8 mm MSDO was applied. During both procedures no complications were observed. In the latter case 3 days after the procedure important tricuspid valve incompetence was noted. The implant was removed, VSD closed and damaged tricuspid valve reconstructed surgically.

Conclusion: During and after transcatheter closure of muscular ventricular septal defects unpredictable problems and complications can occur.

Key words: transcatheter closure of muscular ventricular septal defects

Streszczenie

Cel: Analiza przypadków 2 dzieci (w wieku 8 i 11 lat), u których ubytek mięśniowej części przegrody międzykomorowej (mVSD) (o średnicy odpowiednio 5 i 6 mm w badaniu echokardiograficznym) zamknięto interwencyjnie. Oboje dzieci miały objawy istotnego przecieku lewo-prawego.

Metody i wyniki: U pierwszego chorego wszczepiono 6-milimetrową zatyczkę Amplatzer Muscular VSD Occluder (MVSDO) z dościa tętniczego. Przyczyną były problemy techniczne z przeprowadzeniem systemu podawania przez VSD od strony żyłnej. W drugim przypadku (z ubytkiem w części napływowej) zastosowano zatyczkę MSDO 8 mm. W trakcie obu zabiegów nie obserwowano powikłań. W drugim przypadku 3 dni po zabiegu zarejestrowano istotną niedomykalność zastawki trójdzielnej. Implant usunięto, VSD zamknięto chirurgicznie i uszkodzoną zastawkę zrekonstruowano operacyjnie.

Wnioski: W trakcie zabiegu przezcewnikowego zamykania mVSD i po jego wykonaniu mogą wystąpić trudne do przewidzenia problemy i powikłania.

Słowa kluczowe: przezcewnikowe zamykanie mięśniowych ubytków międzykomorowych

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Introduction

Transcatheter closure of muscular ventricular septal defects (mVSD) is quite a complex interventional catheterization procedure. Various technical obstacles may be encountered while performing such a procedure. It is likely that complications following the procedure will be connected with new episodes of arrhythmia, late embolization, valvular regurgitation, etc.

Below are presented reports on the transcatheter closure of muscular ventricular septal defects during an intervention cardiology workshop which was held on 29-30 January 2009 at the National Institute of Cardiology in Sofia (Bulgaria) [1] and the problems which occurred during the procedures.

Case 1

A muscular ventricular septal defect was diagnosed in an 8-year-old girl with palpable tremor in the precordial area (thrill) with holosystolic murmur most audible at the left sternal margin. Echocardiography showed a 5 mm defect located in the medium segment of the septum (mid-muscular defect). Moreover, moderate enlargement of the left heart chambers was found (the left atrium and ventricle). Cardiac catheterization confirmed the presence of the muscular VSD (fig. 1. A), and Qp/Qs ratio was 1.7. An attempt was made to close the defect using a Muscular VSD Occluder (MVSDO) (AGA Med) applying a standard technique reported previously [2]. Briefly, according to these guidelines the defect is sounded from the left ventricular side. Subsequently, an arteriovenous loop is created from the guide wire and an implant is deployed transvenously. Implantation was performed via arterial access due to difficulties with transvenous insertion of the delivery system. The defect was closed using a 6 mm MVSDO (fig. 1. B, C). The procedure and postprocedural period were uncomplicated. Leakproof closure of the mVSD was obtained.

Case 2

In the other child, an 11-year-old boy (physical examination and echocardiographic findings similar to the case above), the defect was located in the muscular

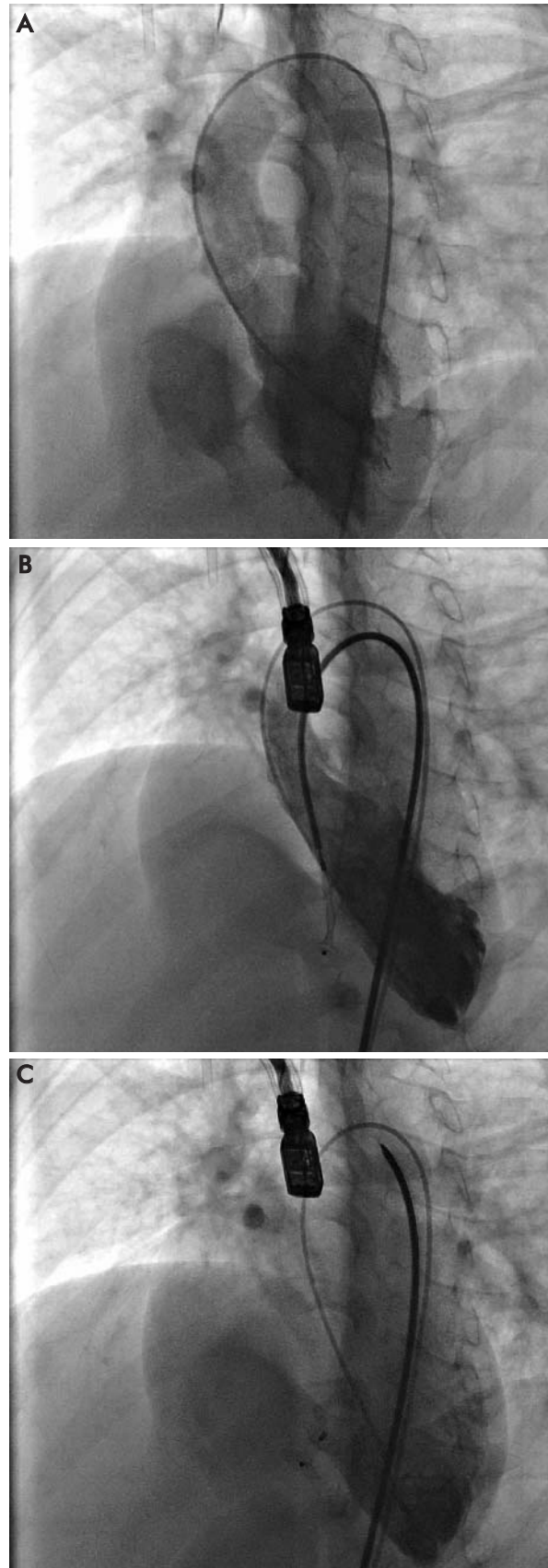
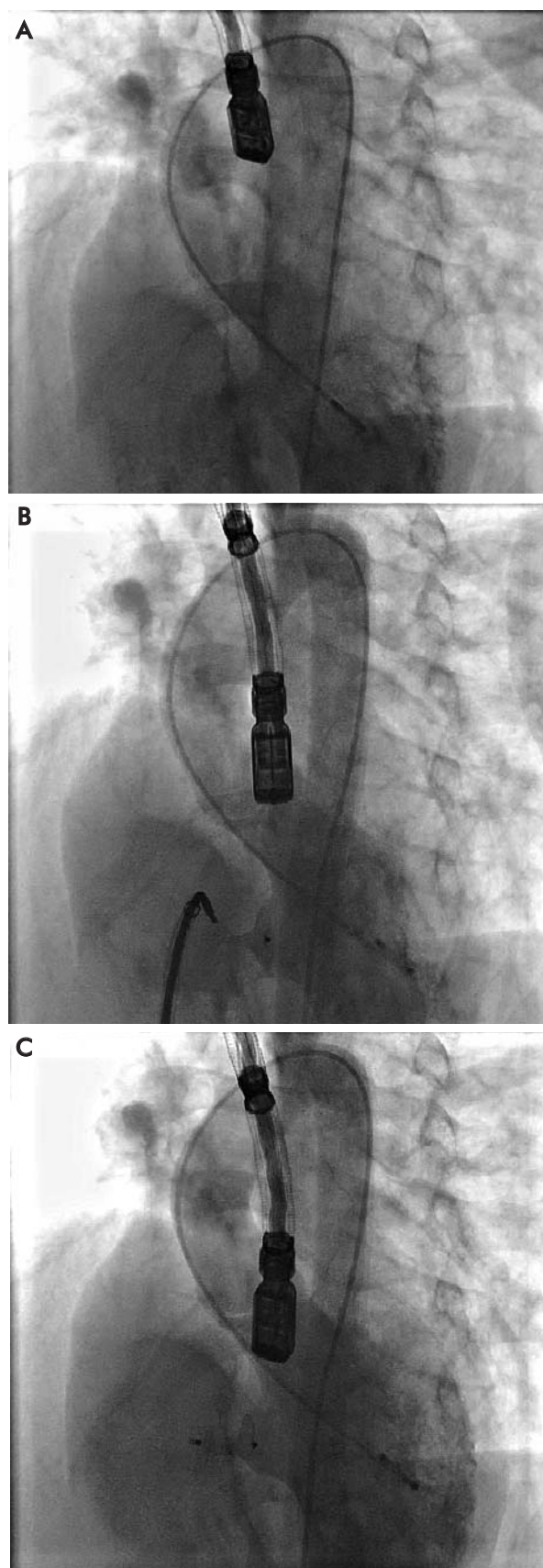


Fig. 1. Left ventriculography in 8-year-old girl with mid muscular ventricular septal defect (LAO 40° Cran 40°). **A** – before closure – visible left-right shunt through VSD, **B** – during implantation of 6 mm MVSDO from arterial side (visible opened disc in right ventricle), **C** – MVSDO in correct position after releasing from the delivery system

Ryc. 1. Wentrykulografia lewostronna u 8-letniej dziewczynki z mięśniowym ubytkiem międzykomorowym – VSD (projekcja LAO 40° Cran 30°). **A** – przed zamknięciem – widoczny lewo-prawy przeciek przez VSD, **B** – w trakcie implantacji 6-milimetrowego MVSDO drogą odtętniczą (otwarty dysk w prawej komorze), **C** – po uwolnieniu implantu z systemu transportującego



inlet section of the interventricular septum beneath the tricuspid valve leaflet (Fig. 2. A). In this case at the insistent request of the organizers, the decision was made to conditionally perform the procedure considering the risk of development of iatrogenic arrhythmias (AV block), or tricuspid insufficiency. It was postulated that in the case of presence of the above-mentioned complications the procedure would be discontinued. During cardiac catheterization Qp/Qs ratio was 2.0. The procedure course was free of complications. Transvenously an 8 mm MVSDO was inserted (fig. 2. B). The location of occluder discs was correct. The MVSDO opened on both sides of the interventricular septum caused neither arrhythmias nor tricuspid insufficiency. The decision was made to deploy the occluder (fig. 2. C). The direct course of the procedure was free of complications; on the first postprocedural day a leakproof occlusion of the mVSD was confirmed. Three days after implantation, the child experienced a sudden episode of fainting. In the ECG, an incomplete left bundle branch block was observed (without AV block), and echocardiography showed significant tricuspid insufficiency. On the same day the occluder was removed, and cardiac surgery was performed, resulting in closure of the VSD and reconstruction of the tricuspid valve (the surgeon found that tricuspid tendinous chords were partially cut (fig. 3).

Discussion

Our own experience published recently indicates the technical difficulty of those procedures [4]. They should be performed only where clearly indicated (i.e., Qp/Qs ratio > 1.5 and enlargement of the left heart chambers – as it was in the discussed children). The number of patients meeting those criteria is not high. It was also supported by the European Registry on transcatheter closure of VSD. It includes data on 119 subjects with muscular VSD (including 83 with mid-muscular, 250 with perimembranous, 16 with multiple and 45 with residual post-surgical mVSD (total of 430 patients). The authors highlighted that tricuspid regurgitation was observed in the periprocedural period in 27 (6.3%) patients, not defining the affected group of defects. They mentioned that in no cases did tricuspid

Fig. 2. Left ventriculography in 11-year-old boy with inlet muscular ventricular septal defect (LAO 40° Cran 40°). **A** – before closure – visible left-right shunt through VSD, **B** – during transvenous implantation of 8 mm MVSDO (visible opened disc in left ventricle), **C** – MVSDO in correct position after releasing from the delivery system

Ryc. 2. Wentrykulografia lewostronna (LAO 40° Cran 40°) u 11-letniego chłopca z napływowym mięśniowym ubytkiem międzykomorowym. **A** – przed zabiegiem widoczny lewo-prawy przeciek przez mięśniowy ubytek międzykomorowy, **B** – w trakcie odzylnej implantacji (widoczny otwarty dysk w świetle lewej komory), **C** – po uwolnieniu 8-milimetrowego MVSDO z systemu transportującego

regurgitation require treatment. One of the patients reported by Waight et al. [5], in whom the mVSD was closed with an MVSDO (similarly to the case presented in this case report), required further tricuspid reconstruction and removal of the implant due to iatrogenic tricuspid regurgitation. According to the opinion of Dr. Kurt Amplatz, the designer of the MVSDO (oral report), cutting of the tricuspid tendinous chords by the MVSDO is practically unpreventable, and this complication results from the specific anatomy of their attachment site. According to the AGA Med complication register (oral report – Dr. Amplatz), one more similar complication occurred in another European site. Our experience confirms the higher risk when closing interventricular septal defects located more to the inlet area of the IVS.

Conclusion

During the transcatheter closure of mVSD and after the procedure unpredictable problems and complications may result.

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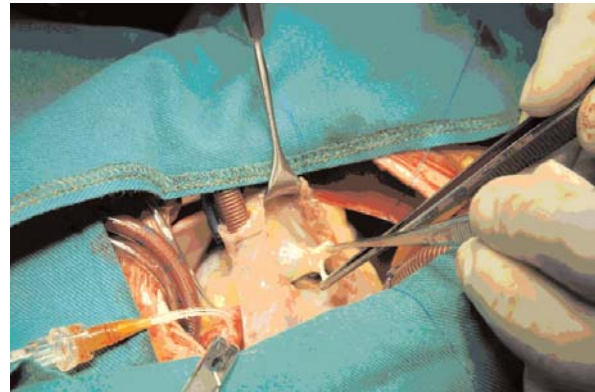


Fig 3. Cut chordae tendinosae of tricuspid valve during surgical removal of the device and reconstruction of the valve

Ryc. 3. Obraz przeciętych nici ścięgnistych zastawki trójdzielnnej podczas zabiegu chirurgicznego usunięcia implantu i rekonstrukcji zastawki

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Komentarz/Commentary

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The development of massive tricuspid insufficiency is exceedingly rare and to our best knowledge we have only heard of one other instance occurring in Belgium. The occurrence obviously depends on the anatomy which one can not determine prior to the insertion of a device. Consequently, this complication is unavoidable and fortunately exceedingly rare.