

# Percutaneous balloon valvuloplasty because of bioprosthetic tricuspid valve stenosis

Przełskórna walwuloplastyka balonowa z powodu stenozy biologicznej zastawki trójdzielnej

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## Abstract

The durability of bioprosthetic valves is limited due to a process of mineralization and collagen degeneration over time. In a few years after surgery bioprosthesis dysfunction can occur and necessitate reimplantation. We would like to present a case of a patient with high risk of surgery, who underwent percutaneous balloon valvuloplasty of a stenotic tricuspid bioprosthesis.

**Key words:** balloon valvuloplasty, tricuspid bioprosthetic valve stenosis

## Streszczenie

Wadą biologicznych zastawek jest ich ograniczona wytrzymałość. W ciągu kilku lat od zabiegu chirurgicznego dochodzi do zwłóknienia i zwapnienia, a w konsekwencji – do istotnej wady bioprotezy. Opisujemy przypadek pacjentki z dużym ryzykiem przeprowadzenia klasycznej operacji, u której wykonano zabieg przełskórnej walwuloplastyki balonowej biologicznej zastawki trójdzielnej z powodu jej zwężenia.

**Słowa kluczowe:** przełskórna walwuloplastyka balonowa, zwężenie biologicznej zastawki trójdzielnej

## Introduction

Bioprosthetic valves are characterized by a low thrombosis and thromboembolism profile and limited durability. Although there is no need of anticoagulant therapy the process of calcification and fibrosis leads to dysfunction of the valve and the necessity of reoperation in a few years time [1]. This process can also affect the tricuspid bioprosthesis, although it is rather slow in this position. Balloon percutaneous valvuloplasty is an alternative option to surgical intervention in patients with high operative risk. This method may be considered controversial, but in this group of patients can improve haemodynamic parameters.

## Case report

A 70-year-old woman after implantation of mitral and tricuspid mechanical valves in 1985 and reimplantation due to infective endocarditis (IE) in 1995: Carpentier-Edwards

tricuspid bioprosthesis 29 mm and St. Jude Medical (SJM) 23 mm mitral mechanical valve, and then in 1996 re-implantation (SJM 25 mm) of a mitral mechanical valve because of endocarditis was admitted to the hospital with symptoms of right heart failure. A number of cardiac (VVI pacemaker implanted in 1995 because of second degree atrioventricular block, hypertension) and general medical problems (diabetes type 2 treated with diet, chronic kidney disease – stage 3, C-type hepatitis, spontaneous bleeding into the right occipital region a few months ago and ovarian cysts for further diagnosis) were noted in her history.

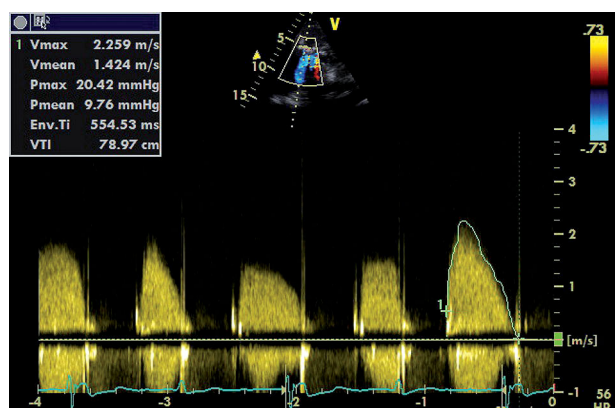
The echocardiography examination revealed limited mobility of biological tricuspid valve leaflets, a significant tricuspid inflow gradient (fig. 1) (maximum 20.4 mmHg, mean 9.8 mmHg), and slightly enlarged right ventricle cavity (3.4 cm) with a very enlarged right atrium (43 cm<sup>2</sup>) (fig. 2).

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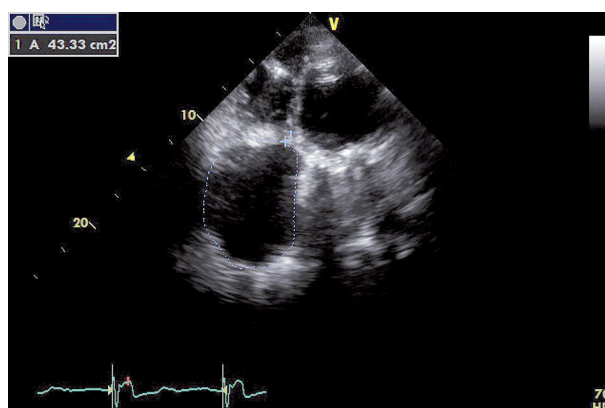
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**Fig. 1.** Transthoracic echocardiography, parasternal short-axis view. Assessment of pressure gradient across the tricuspid bioprosthesis

**Ryc. 1.** Przezskłatkowe badanie echokardiograficzne, projekcja przymostkowa w osi krótkiej. Ocena gradientu ciśnień przez biologiczną zastawkę w ujściu trójdzielnym



**Fig. 2.** Transthoracic echocardiography, apical four-chamber view. Measurement of the right atrium area

**Ryc. 2.** Przezskłatkowe badanie echokardiograficzne, projekcja koniuszkowa czterojamowa. Pomiar pola powierzchni prawego przedsionka

Normal-sized left ventricle cavity (4.8 cm), preserved systolic function (EF 60%), and normal movements of the mitral mechanical valve with slightly elevated inflow gradients (maximum 25.6 mmHg, mean 6.9 mmHg), probably secondary to haemolytic anaemia, were also found. There were episodes of fever to 38.9°C with exacerbation of renal failure and hypotension during hospitalization. On the basis of clinical symptoms and laboratory tests (procalcitonin > 10 ng/ml, samples of blood cultures – *Klebsiella oxytoca*) sepsis was diagnosed. Antibiotic therapy was started and a tooth was removed – a suspected source of infection. The patient required intravenous infusion of dopamine, furosemide and dobutamine. Although the patient's general condition was stabilized, the symptoms of right heart failure persisted. Therefore balloon percutaneous valvuloplasty was planned.

The Inoue catheter was inserted through the right femoral vein. The balloon of the catheter was twice inflated to 25 mm and 27 mm (figs. 3 B, 3 C). 11 mmHg to 7 mmHg reduction of the average gradient through the tricuspid valve was achieved. The control echocardiography examination confirmed reduction of the tricuspid inflow gradient (maximum 10 mmHg, average 5.4 mmHg), without signs of regurgitation.

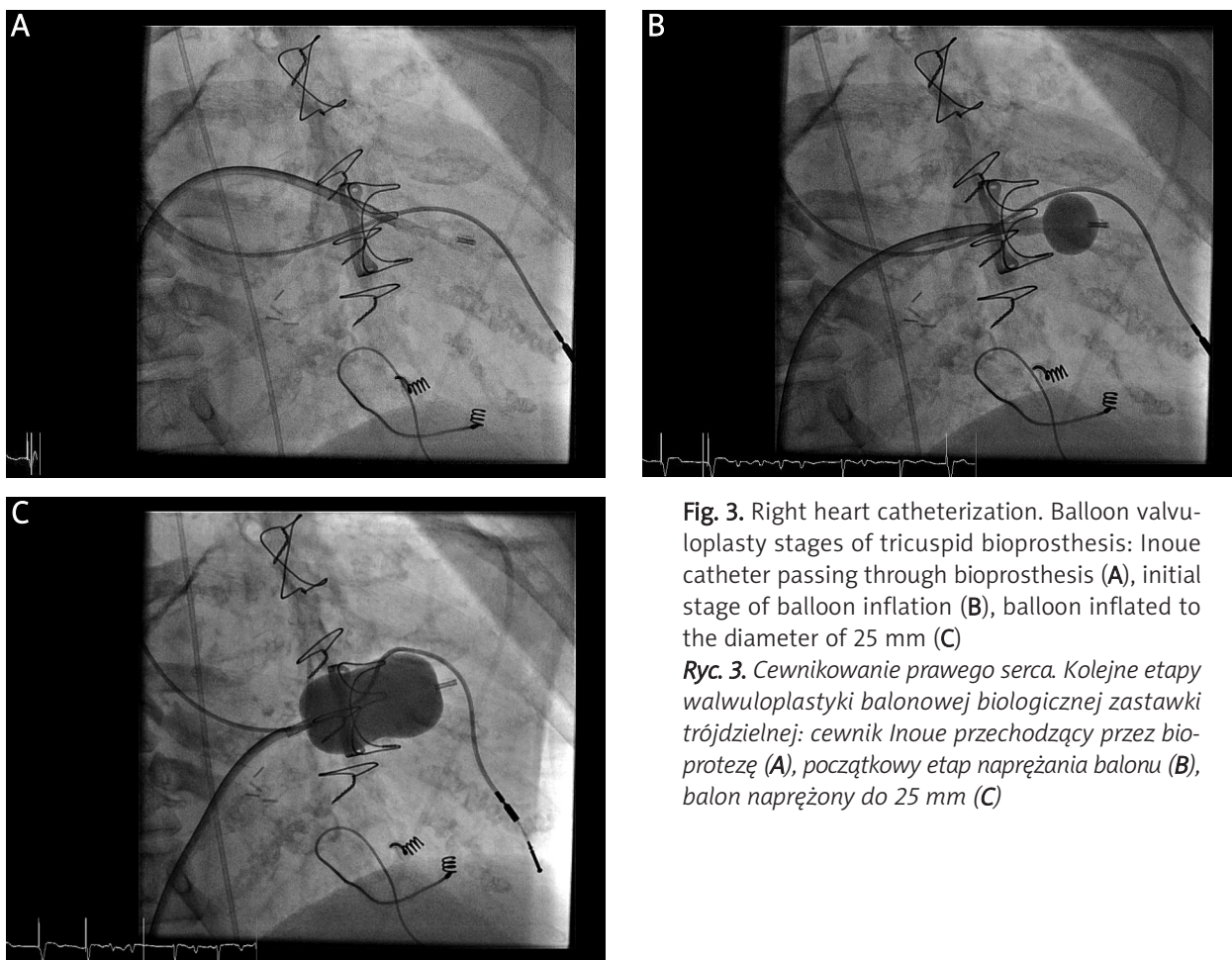
During hospitalization pharmacological therapy was optimized which allowed us to observe a gradual reduction of peripheral oedema and ascites. The patient was discharged with slight improvement of her general condition.

After 2 weeks the patient was readmitted to hospital with a plan of removal of a second suspected infected tooth and to assess the general condition. On the day of admission the patient presented again symptoms of right

heart failure – oedema of lower limbs and slight ascites. During the hospitalization the renal function worsened to anuria. There was also bleeding into the retroperitoneal space and the patient was transferred to the Intensive Care Department, where, despite intensive therapy, she died after a few days.

## Discussion

In case of inability to carry out an effective valvuloplasty of the tricuspid valve, implantation of a biological valve is the treatment of choice [2]. Implantation of a mechanical prosthesis in this position carries a high risk of thrombosis. Despite the continuous modification of biological valves, their limited durability is still an unsolved problem. Within a few years after the surgery the process of fibrosis, calcification, and damage to fibrocollagen structures is initiated. It leads in turn to restriction of mobility or tear of leaflets and consequently to functional dysfunction. Risk factors of biological valves' earlier degeneration are: younger age of patients, hypercholesterolaemia, hyperparathyroidism and chronic renal failure. Healthy patients, in good clinical condition, are mostly qualified for surgical valve replacement. There are difficulties in determining further treatment in patients with high surgical risk. In this group of patients, the method likely to bring significant improvement with less periprocedural risk is balloon valvuloplasty of the stenotic bioprosthesis. Its application is uncertain due to stiffness and reduced leaflet mobility. However, the data available in the literature indicate significant reduction in haemodynamic parameters after balloon valvuloplasty of stenotic biological valves and consequently improvement of the patient's clinical condition [3-5].



**Fig. 3.** Right heart catheterization. Balloon valvuloplasty stages of tricuspid bioprosthesis: Inoue catheter passing through bioprosthesis (A), initial stage of balloon inflation (B), balloon inflated to the diameter of 25 mm (C)

**Ryc. 3.** Cewnikowanie prawego serca. Kolejne etapy walwuloplastyki balonowej biologicznej zastawki trójdzielnej: cewnik Inoue przechodzący przez bioprotezę (A), początkowy etap naprężania balonu (B), balon naprężony do 25 mm (C)

There is a lack of data on long-term effects of the procedure [6].

In our case we decided to widen the stenotic mitral Carpentier-Edwards valve by the percutaneous method because of the severe clinical condition of the patient, numerous medical problems, including a history of recent sepsis, and associated high risk of surgery. An Inoue catheter is usually used for mitral valve commissurotomy, but can also be used in other valves, for widening the orifice of the inferior vena cava, balloon pericardiectomy [7], or valvulotomy of a stenotic tricuspid bioprosthesis [3]. In this patient, the balloon was inflated twice but only a small reduction in pressure gradient through the tricuspid valve was obtained. The reasons for deterioration of the patient's general condition during the re-hospitalization are not certain. There was exacerbation of renal failure and retroperitoneal bleeding, which led to death. An autopsy examination was not performed. In the differential final diagnosis there was a possibility of ovarian malignancy taken into account and the patient's cachexia may have been linked to both heart failure and neoplastic disease.

In recent years the number of biological valves implanted worldwide is increasing significantly. It is associated with a better survival rate of the population, improvement

of the quality and availability of cardiological diagnostics, as well as a reduction in perioperative mortality. In the coming years these bioprostheses will be subject to destruction and the dilemma of replacement or repair of stenotic valves in elderly patients will become commonplace for interventional cardiologists. Implementation of low-invasive techniques such as percutaneous balloon valvuloplasty, which are relatively safe, appears to be a promising technique in this group of patients. Nowadays, the limited experience in such procedures prevents clarification of the indications and contraindications for this kind of treatment. Further clinical experience and long-term follow-up of patients are necessary to determine the significance of balloon valvuloplasty in the treatment of tricuspid valve stenosis.

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