

**ONE-STAGE PROCEDURE OF PULMONARY
VENTRICULOARTERIAL COMMUNICATION CLOSURE WITH
BALLOON ANGIOPLASTY OF RIGHT PULMONARY ARTERY
BRANCH STENOSIS AFTER FONTAN PROCEDURE**

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We present our first experience of interventional treatment of patient in early postoperative period after Fontan procedure. This paper describes indications and technique of one-stage closure of pulmonary ventriculoarterial communication with right pulmonary artery stenosis balloon angioplasty.

Key words: *Fontan procedure, early postoperative complications, ventriculoarterial pulmonary communication, pulmonary artery branch stenosis.*

In 1968 French surgeon F. Fontan performed first successful operation of right heart chambers cava vein bypassing in patient with tricuspid valve atresia. In 1971 in co-authorship with E. Baudet he published results of 4 procedures in other modifications that he has performed [1].

First of all, blood flow to the pulmonary artery in the Fontan circulation is a result of single ventricle pump function. Presence of venous hypertension seriously diminishes results of Fontan procedure. Pressure values in the right atrium vary between 12-18mmHg after this hemodynamic correction. Growth of mean pressure to 20mmHg in right atrium is unfavorable sign for long term prognosis.

Venous hypertension can occur due to anatomic (pulmonary vein stenosis, subaortic obstructions, atrial septum residual defects, etc.) and hemodynamic reasons (additional blood shunting to the pulmonary artery) [2]. Active therapeutic approach in this situation is directed for elimination of venous hypertension etiology; examples

are balloon angioplasty and shunt removal. The complication development risk remains very high if these precaution measures are not performed. Complications manifest in the late postoperational period with a rate reaching 15% [3,4]. Presence of these complications in the early postoperational period significantly prolong hospital stay and sometimes are leading to long-term disability[4].

Objective: to show effectiveness of transcatheter interventional treatment after Fontan procedure complications.

Material and methods. Extracardiac Fontan procedure with RPA plasty was performed in 8 year old patient with bodyweight of 20kg. She was diagnosed with single ventricle left type, tricuspid valve atresia, ventricular septum defect, pulmonary valve stenosis and right pulmonary artery stenosis.

Patient has had several sequential procedures prior Fontan: balloon atrioseptostomy in the neonatal period followed by right modified Blalock-Taussig shunt and consequent TCPC at the age of two years.

On the second postoperational day pleural (200ml/day) and abdominal chylous exudation (800ml/day) developed. Echocardiography and catheterization were performed to identify possible reasons for this complication. We have discovered functioning ventriculopulmonary connection with antegrade bloodflow (Fig. 1) and severe upper and lower right pulmonary artery branches stenoses (Fig. 3). Systolic pressure in inferior and superior vena cava reached 22 and 23mmHg respectively, mean gradient on stenosed pulmonary artery branches reached 3mmHg. According to received data our team made a decision for transcatheter closure of VAC and RPA stenosis balloon angioplasty.

Procedure was performed under general anesthesia and with mechanical ventilation. For successful procedure outcome we have chosen right internal jugular vein access in spite of two lower extremities vein thrombosis and desire to decrease quantity of catheter bends. Heparin was administered in 100units/kg dose. After guidewire placement in hypoplastic right ventricle across VAC measurement balloon was placed to determine VAC diameter. Our team has chosen PDA-R occluder for patent ductus arteriosus closure produced by PFM company. It is self-centering and self-deploying cylindrical device with a disk on the distal part of device. Proximal

pulmonary part of this device in our case was 2mm smaller. Device size was chosen to fit thinnest part of VAC for 2 additional mm. The thinnest VAC part was 8mm. Delivery system was consequently inserted through jugular vein and Glenn anastomosis and further to main pulmonary artery through VAC reaching end in the RVOT. After disk deployment and fixation in pulmonary artery valve we have performed reference angiography and TEE for assessment of occluder placement. Delivery system was detached after ascertaining correct occluder position (Fig. 2).

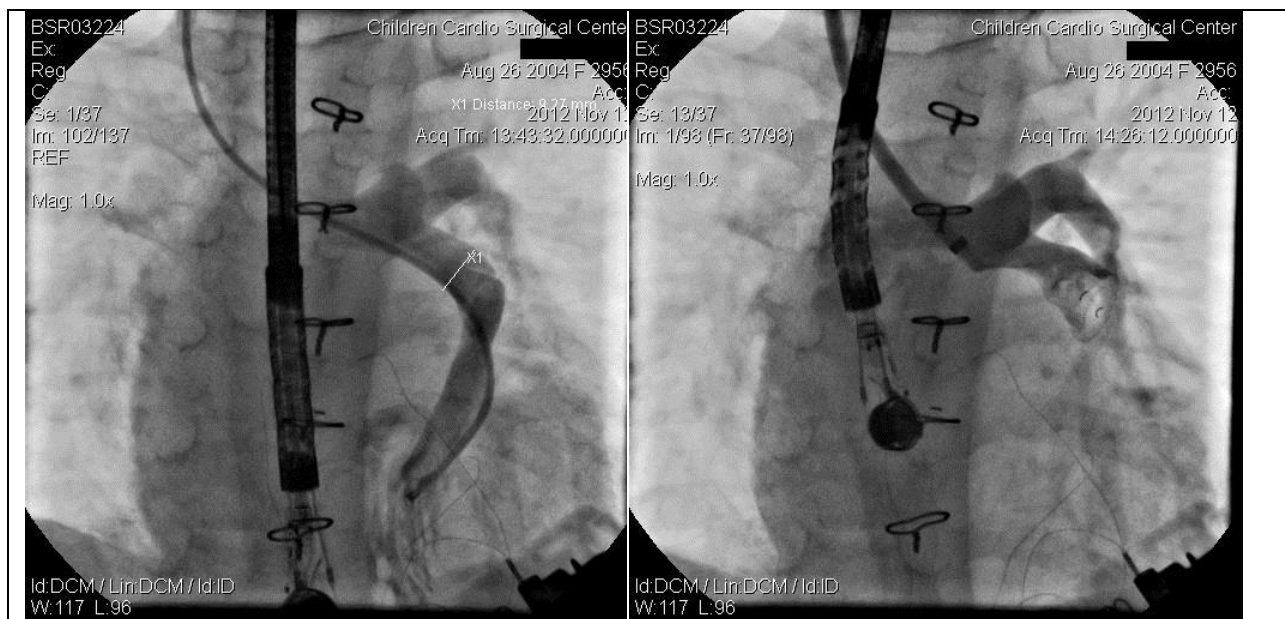


Fig. 1

Ventriculopulmonary communication (VAC).

Fig. 2

Pulmonary artery angiography: fixed occluder, absence of shunts through VAC.

Next stage of the procedure was right upper and lower pulmonary artery branches balloon angioplasty. Two guidewires were crossed through stenosed vessels. Using double balloon technic angioplasty was performed. Success of procedure was confirmed angiography and by absence of gradients on those vessels (Fig. 4). Directly measured pressure in SVC, IVC and pulmonary arteries decreased to 17mmHg.

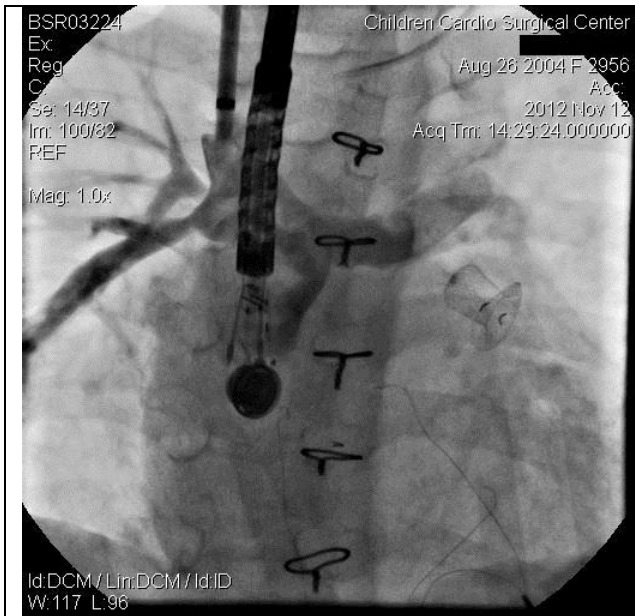


Fig. 3

Glenn anastomosis angiography:
 right pulmonary artery branch stenoses.

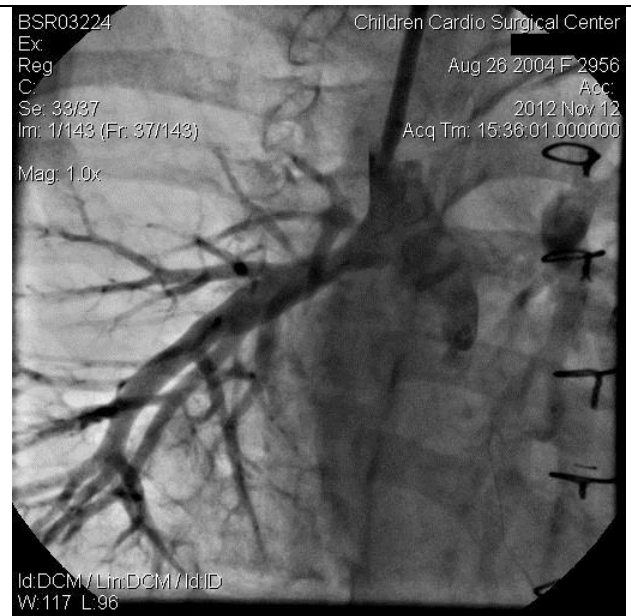


Fig. 4

Glenn anastomosis angiography:
 balloon angioplasty results.

Chylous exudation decreased sharply on the second day after procedure to 450ml/day and disappeared on the 9th day. Child was discharged on the 16th day from hospital in satisfactory condition.

Results and discussions. Development of described complications after Fontan procedure in the early postoperational period indicated on acute anatomic and hemodynamic problems that needed diagnostics by catheterization for right therapeutic option selection [3,4].

Many complications after Fontan procedure can be resolved by interventional treatment methods (pulmonary artery branch stenoses dilatation and stenting, cava-pulmonary anastomosis and intracardiac tunnel stenoses elimination, MAPCAs embolization, closure of connection between right ventricle and main pulmonary artery).

Conclusions

1. Severe early postoperational period after Fontan procedure can be caused by anatomic and hemodynamic reasons.
2. In such case angiographic examination is necessary for obtaining accurate diagnostic data. Additionally effective interventional treatment can be offered for solving causes of these complications.

Literature.

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ОДНОСТАДІЙНЕ ЗАКРИТТЯ ВЕНТРИКУЛО-АРТЕРІАЛЬНОЇ ЛЕГЕНЕВОЇ КОМУНІКАЦІЇ І БАЛОННОЇ ДИЛАТАЦІЇ СТЕНОЗУ ПРАВОЇ ГІЛКИ ЛЕГЕНЕВОЇ АРТЕРІЇ ПІСЛЯ ОПЕРАЦІЇ ФОНТЕНА

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Ми представляємо наш перший досвід ендovasкулярного лікування пацієнта в ранньому післяопераційному періоді операції Фонтена. У статті описано показання і методика проведення одностадійного закриття вентрикуло-артеріальної легеневої комунікації з балонною ангіопластиком стенозу правої гілки легеневої артерії.

Ключові слова: операція Фонтена, ранні післяопераційні ускладнення, вентрикуло-артеріальна легенева комунікація, стеноз гілки легеневої артерії.

ОДНОМОМЕНТНОЕ ЗАКРЫТИЕ ВЕНТРИКУЛО- АРТЕРИАЛЬНОЙ ЛЕГОЧНОЙ КОММУНИКАЦИИ И БАЛЛОННОЙ ДИЛАТАЦИИ СТЕНОЗА ПРАВОЙ ВЕТВИ ЛЕГОЧНОЙ АРТЕРИИ ПОСЛЕ ОПЕРАЦИИ ФОНТЕНА

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В статье изложен первый опыт интервенционного вмешательства в раннем послеоперационном периоде операции Фонтена. Описаны показания и методика проведения одномоментного закрытия вентрикуло-артериальной легочной коммуникации (ВЛК) с баллонной ангиопластикой стеноза правой ветви легочной артерии (ПВЛА).

Ключевые слова: операция Фонтена, ранние послеоперационные осложнения, вентрикуло-артериальная легочная коммуникация, стеноз ветви легочной артерии.