

Total cavopulmonary with extracardiac conduit without cardiopulmonary bypass

Cavopulmonar total com tubo extracardiaco sem circulação extracorporea

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PATIENT CHARACTERIZATION

A male child aged 4 years and 5 months, born in Salvador, Bahia. The patient was diagnosed with a complex heart disease with univentricular physiology with following features: main ventricle: the left ventricle; significant pulmonary valve and subvalvar stenosis, partial anomalous connection of right superior pulmonary veins to the superior vena cava, and a wide ostium-secundum-type interatrial communication without previous surgical treatment.

The patient underwent total cavopulmonary operation (Fontan type operation) using crimped bovine pericardium extracardiac conduit (size 21) without cardiopulmonary bypass (CPB) support.

DESCRIBING THE TECHNIQUE

The video starts showing the Hospital de Base de São José do Rio Preto (a Teaching Hospital) where the operation was performed.

The following procedures were performed: indication of the median sternotomy incision site, opening of subcutaneous tissue using an electric scalpel, thymus resection, anterior opening of the pericardial sac, and detailed analysis of the structures involved in the procedure: superior vena cava (SVC), right atrium (RA), right pulmonary artery (RPA), left and right brachiocephalic veins (innominate veins) (L/RBV), and inferior vena cava (IVC).

Aortic traction, dissection of superior pulmonary veins (RSPV) of right lung opening into the SVC, dissection of

RPA, presentation of the dissected azygos vein and right superior pulmonary veins, spatial observation of the RPA to choose the best site to perform the anastomoses, and extensive dissection of the IVC were all performed.

A bursa was surgically-created in the right atrial appendage using 5-0 polypropylene thread sutures; a tourniquet was passed through the RA thread; heparin, in bolus of 4 mg/kg was administered directly into the RA, trying to avoid air embolism. A bursa was also surgically-created in the brachiocephalic vein using a 6-0 monofilament polydioxanone suture, where we can see the exposure of RPA sutured with a 5-0 polypropylene thread which was previously fixed to the aorta lateral wall, exerting traction upon it. An incision using No. 11 scalpel blade was made in the brachiocephalic vein to introduce a metal tip 14G cannula, then, the tourniquet was settled and firmly attached to the cannula and the air was withdrawn from the cannula; the other extremity of the cannula was inserted into the RA after the atrial appendage was incised; the residual air was then withdrawn from the cannula using a syringe; the tourniquet was settled and the cannula was fixed.

A demonstration of the blood course from the brachiocephalic vein towards RA after SVC cross-clamping was performed.

A ligature and section of the azygos vein were performed by passing 5-0 polypropylene threads proximally and distally to it.

Distal and proximal cross-clamping of the SVC was performed, which, at the time, was higher than usual due to the presence of an anomalous connection of the right

TO WATCH THE VIDEO –VISIT THE RBCCV WEBSITE AT http://www.rbccv.org.br/video/Cavopulmonar_total.asp

CONFLICT OF INTEREST STATEMENT: The authors declare that they have conflict of interests; Braille Biomédica® provided all the material used and supplied the video images of the operation, presenting its commercial products.

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superior pulmonary veins; SVC was completely removed. The remnant distal pedicle (stump) was tied to the right superior pulmonary veins using a 6-0 polypropylene thread suture. Then, the superior surface of the right pulmonary artery was cross-clamped, incised using No. 11 scalpel blade, and widened with the iris scissors. SVC was anastomosed to RPA using 6-0 monofilament polydioxanone suture thread, placed on the posterior surface of SVC, adjusting to the RPA. One must avoid the presence of adventitial tissue into the internal surface of the suture, minimizing the risk of thrombus formation.

After all the procedures described above, the anastomosis was completed and the clamps were removed. The final aspect of the superior vena cava anastomosed directly to the RPA is called superior bidirectional cavopulmonary anastomosis or bidirectional Glenn anastomosis [1,2].

Afterwards, the following procedures were undertaken: a) removal of RA cannula, blood level and central venous pressure (CVP) were analyzed; in the present situation, the CVP is equal to the arterial pulmonary pressure; b) removal of the brachiocephalic vein cannula, leaving a small deliberate bleeding in order to prevent the presence of adventitial tissue into the brachiocephalic vein and thrombus formation; and c) the brachiocephalic vein was sewn using 7-0 monofilament polydioxanone suture threads; the presence of suture underlying stenoses was not noticed.

The cardiac monitor was entirely visible allowing us to verify, among others signs and variables, a significant improvement of the peripheral saturation to 96%, and CVP of 10, suggesting the need to adjust the volume of blood in order to proceed with the procedure.

A crimped bovine pericardium conduit (size 21) was analyzed regarding its extensibility and flexibility; a bevel incision increasing the area to be sutured to the pulmonary artery, and positioning of the tube were performed.

Cross-clamping of RPA inferior surface was performed as central as possible, allowing the functionality of the bidirectional Glenn anastomosis previously performed. Incision and widening similarly to that previously achieved to anastomose SVC was performed.

Then, we preceded the anastomosis of the crimped bovine pericardium to the right pulmonary artery using 6-0 polypropylene suture thread; clamps were removed avoiding the interruption of blood flow through the conduit, allowing free blood flow throughout the right pulmonary artery; at that moment, the blood flow is coming from the superior vena cava and the pulmonary trunk.

A tube with the necessary length to reach the inferior vena cava appropriately was sectioned. The inferior wall of the right atrium was retracted; a surgically-created bursa on the anterior surface of IVC was sewn using 6-0 monofilament polydioxanone suture thread, as distal as possible after dissection along the diaphragm. A longitudinal incision using No. 11 scalpel blade was made in order to avoid local stenosis.

A larger diameter cannula was inserted to drain the superior territory with an end connected to the right atrium, at the same site previously used.

A demonstration of the route followed by the blood after IVC cross-clamping was performed.

Cross-clamping proximal and distal to the right atrium close to IVC and excision of IVC were performed. Pulmonary ventilation and heart rhythm were observed. The proximal pedicle (stump) was sewn close to the RA with 5-0 polypropylene suture thread. On that point, specially, it is extremely important the interaction with the anesthetist to attain inotropic support, if necessary, and to have mechanical ventilation interrupted from time to time.

After completion of the anastomosis, the air inside the tube was withdrawn, as well as the clamp. The cannula between the right atrium and the inferior vena cava was also removed.

A final demonstration of the routes followed by the blood and the final aspect of the operation concluding the extracardiac conduit total cavopulmonary connection (Fontan-type operation) without CPB support was performed [3,6].

The cannula system developed at the Braile Biomédica® to perform this type of operation was presented to the audience.

We emphasize that the pulmonary trunk was ligated posteriorly, interrupting the antegrade blood flow completely, however, the procedure is not presented on the video.

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