

Fig 3. Surgical specimen: (A) together with two calcified thrombi found inside, and (B) a look inside the cyst.

fied. During surgery this large sack full of blood obstructed most of the atrium and could only be visualized in toto after incision and drainage of the blood. The sack was then removed together with the pedicle and part of the septum showing a tiny entrance into the saccular tumor from the left atrial side. Closure of the septum was performed by patch closure.

#### Analysis

Common diagnostic approaches were informative; however exact diagnosis could be made by the surgical procedure and histology only.

Echocardiography showed the highest specificity in the diagnosis, whereas the accuracy of the computed tomographic scan, coronary angiogram, and magnetic resonance imaging of the heart was low. The determinations of whether this finding was of congenital origin or whether it was acquired could not be clarified.

Our hypothesis is that a valve-like entrance in a layer of the septum secundum produced a gradually enlarg-

ing balloon-like structure filled with blood. Temporal occlusions of the entrance with subsequent thrombosis and reopening of the entrance producing several partially resorbed sequester gradually transformed into calcifications.

We conclude that this cystic formation was an aneurysmatic formation of part of the septum secundum with a pinhole opening. The blood cycling within this structure formed this gallbladder-like structure and the calcified thrombi within.

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## Left Common Carotid Artery as Inflow Site in Coronary Artery Bypass Grafting

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Porcelain aorta is associated to significantly increased risk of atheromatous embolization in patients who undergo cardiac surgery. We described three cases in which coronary artery bypass grafting was performed off-pump and the saphenous vein graft was anastomosed proximally to the left common carotid artery. This technique permitted avoidance of ascending aortic manipulation and reduce the risk of atheromatous embolization.

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Porcelain aorta is associated to significantly increased risk of atheromatous embolization in patients who undergo coronary artery bypass grafting [1]. Hence ascending aorta should not be manipulated in these cases.

Off-pump extra-anatomical coronary artery bypass grafts represent an alternative technique to avoid clamping of a severely atherosclerotic ascending aorta and reduce the rate of stroke [2]. Previous studies described the use of the great saphenous vein (GSV) graft from the axillary artery and from the right common carotid artery, as well as Y-grafts from the left internal thoracic artery, with a low rate of perioperative stroke [2–5].

We reported three cases in which coronary artery bypass grafting was performed by off-pump coronary artery bypass grafting and extra-anatomical conduits were anastomosed on the left common carotid artery (LCCA).

From January 1999 to January 2006, 3 patients (2 men and 1 woman) were referred for elective myocardial revascularization. The mean age was  $75.7 \pm 2.5$  years. The mean left ventricular ejection fraction was  $65.3\% \pm 7.5\%$ . The mean preoperative EuroSCORE was  $7.3 \pm 2.1$  (range, 5–9). Coronary angiogram revealed two-vessel coronary artery disease (not eligible to percutaneous intervention) in all patients. A chest roentgenogram documented a calcified ascending aorta and aortic arch. Doppler ultrasonography excluded hemodynamically significant stenoses of the extracranial carotid arteries.

Coronary artery bypass grafting was performed through a median sternotomy with the same off-pump technique in all 3 patients. The left internal thoracic artery and the GSV were harvested; we preferred not to harvest the right internal thoracic artery as patients had type-1 diabetes. The left internal thoracic artery had a small diameter and was not suitable for a Y-graft. Direct intraoperative evaluation confirmed a severe atherosclerotic disease of the ascending aorta involving the aortic arch and the innominate artery. A soft area was found on the anterior portion at the base of the LCCA, and this location was selected as the proximal arterial inflow site for the saphenous vein graft (Fig 1). Off-pump coronary artery bypass grafting was performed by means of a suction stabilizer device (Octopus, Medtronic, MN), deep pericardial traction stitches, and intracoronary shunts (Medtronic).

First, the in situ left internal thoracic artery was anastomosed to the left descending artery. After dissection of the proximal part of the LCCA, the GSV graft was proximally anastomosed to the LCCA using 6-0 Prolene running sutures (Ethicon, Somerville, NJ). This anastomosis was constructed using a partial occlusion clamp on the anterior portion of the LCCA and controlling the distal LCCA pulse through palpation to avoid cerebral ischemia. The distal end of the GSV graft was then anastomosed to the target coronary vessel. The procedure was complete without major technical difficulties in all 3 patients.

No perioperative complications occurred. The postoperative course was uneventful without deaths and neu-

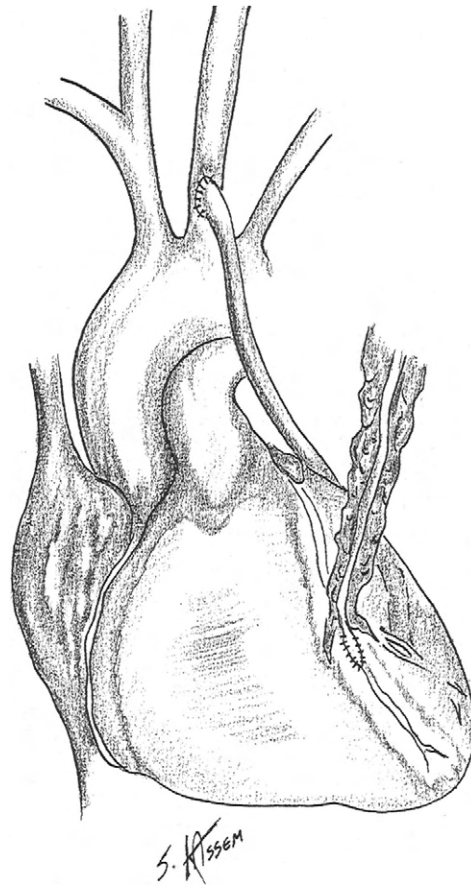


Fig 1. Illustration of the extra-anatomical off-pump coronary artery bypass grafting procedure performed. The in situ left internal thoracic artery was anastomosed to the left descending artery. The left common carotid artery was used as an arterial inflow site for the great saphenous vein graft.

rological events. The mean in-hospital stay was  $10 \pm 2$  days. At follow-up, no residual myocardial ischemia was identified by ergometric and nuclear stress testing in all 3 patients.

### Comment

Porcelain aorta still remains a challenge for the cardiac surgeon as it increases the risk of atheromatous embolism during manipulation. The reliable strategy potentially able to eliminate the risk of embolism induced by aortic manipulation is the avoidance of cardiopulmonary bypass and aortic cross-clamping. This approach can include complete arterial revascularization with in situ grafts, left internal thoracic artery grafts associated to multiple arterial grafting in a “T” or “Y” configuration and extra-anatomical bypass conduits to avoid proximal anastomoses on the ascending aorta.

Several arteries have been reported as the inflow site for extra-anatomical coronary artery bypass grafting [2–5]. In these 3 patients, we believed it was unsafe to use “T” or “Y” grafts on the left internal thoracic artery

graft, as its small diameter was unfit for GSV diameter. All inflow sites except the carotid arteries had atheromatous disease. The GSV proximal anastomoses to the right common carotid artery were already described in off-pump coronary artery bypass grafting performed with the no-touch aorta approach [5], but this approach needs an additional incision and graft tunnelling into the chest and has an increased risk of graft kinking or twisting.

The LCCA as an inflow site has not been as extensively reported. The LCCA does not need an additional neck incision, and the surgical field is limited to the chest. However, surgical exposition of the LCCA is generally more difficult and its partial clamping can lead to a suboptimal cerebral perfusion, as its diameter is smaller than the innominate artery. On these bases, we believe that the use of the LCCA as an inflow site should be reserved to selected patients with severe atherosclerotic disease localized to the ascending aorta and innominate artery in which partial clamping does not alter cerebral perfusion.

In our limited experience, off-pump coronary artery bypass grafting with the LCCA as an arterial inflow is a safe and reliable technique to reduce the risk of atheromatous embolism in selected patients with porcelain aorta.

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## Stage I Palliation for Interrupted "Right" Aortic Arch Associated With Mitral Atresia

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**A 2.6 kg female with the diagnosis of type "B" interruption of the "right" aortic arch and mitral atresia underwent stage I palliation with translocation and anastomosis**

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of the distal right carotid artery to the descending aorta. The distal main pulmonary artery was anastomosed to the under surface of the neo-aortic arch. A modified Blalock-Taussig shunt was constructed between the left side innominate artery and the left pulmonary artery. The child awaits stage II palliation.

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**P**atients with complex univentricular cardiac anatomy and an interrupted aortic arch present a unique therapeutic challenge in attempting palliative surgical care. Interrupted aortic arch will generally present with a large posteriorly malaligned ventricular septal defect and occasionally mild to moderate stenosis of the left side structures. Mitral atresia occurs in less than 2% of patients with interrupted aortic arch and has an associated operative mortality of greater than 60% [1]. Initial repair requires establishment of aortic arch continuity in combination with stage I single ventricle palliation. Reconstruction of the aortic arch should include use of the native tissue to provide ample opportunity for growth while avoiding compression of vital structures. Use of the carotid artery to establish aortic continuity in a two-ventricle repair of interrupted aortic arch has been reported with good mid-term results and low neurologic complications [2, 3]. We believe that the use of a carotid artery in conjunction with a stage I single ventricle palliation has not been previously reported.

The patient being reported is a 2.6 kg female with a prior in utero diagnosis of hypoplastic left heart syndrome. The transthoracic echocardiogram demonstrated mitral atresia, severe hypoplasia of the left ventricle, and a hypoplastic ascending aorta measuring 3 mm. There was a moderate sized perimembranous ventricular septal defect. The main pulmonary artery measured 11 mm and the right-sided ductus arteriosus was in continuity with a right-sided descending aorta. The right aortic arch was not well visualized, but the morphology of the great vessels was consistent with an interrupted aortic arch. The situs on the child was ambiguous with dextrocardia. There were bilateral superior venae cavae. The left-sided inferior vena cava was interrupted with continuation to the left-sided superior vena cava.

Cardiac cauterization established the diagnosis of a type "B" interruption of a right-sided aortic arch. The first branch of the aortic arch was a left innominate artery. This was followed by the right carotid artery. Blood flow to the descending aorta was provided by the ductus arteriosus (Fig 1). There was antegrade flow across the aortic annulus.

The patient was taken to the operating room on day 8 of life. The arch anatomy was as described by catheterization. The ascending aorta was found to be 4 mm in diameter. The ductus arteriosus inserted onto the descending aorta at the origin of the right subclavian artery.

A 3.0 modified Blalock-Taussig shunt was fashioned between a left innominate artery and the left pulmonary