Mini Review

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Ross operation

Abstract

In the neonatal and childhood period aortic valve replacement is a rare operation, due to the moderate to bad long-term outcome. Therefore, aortic valve reconstruction or balloon dilation is the preferred method of choice. Reconstruction can be a commissurotomy, however, with a high recurrence rate of aortic stenosis. Valvar shaving, leaflet extensions and other procedures tend to show good short-term results, however, no long-term results are promising yet. If the indication has been set to replace the valve, then a biological or mechanical valve implantation is only useful once the patient has reached a certain age and weight. In very small children and neonates aortic valve replacement with either mechanical or biological valve is not very promising. Also in patients with a contra indication against coumarin derivates alternative operative procedures are used.

The Ross procedure, first done by Donald Ross in 1967, to replace the aortic valve in case of stenosis, regurgitation or endocarditis is a valuable alternative.1 The damaged aortic valve is replaced by an autograft, patient's own pulmonary valve, which behaves very well in the aorta position and demonstrates good long-term longevity and growth potential.2,3 Since the pulmonary graft is used in the aortic position, the pulmonary valve is replaced with a homograft or commercially available conduit in the right ventricular to pulmonary artery side. No coumarin derivates or other medication interfering with the clotting are needed. The optimal patients are small children, neonates and young women in childbearing age.

Keywords: aortic valve disease, ross operation, aortic valve dilation

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Examinations

Aortic valve disease can be determined with echocardiography and depending on the age of the patient a heart catheterization is necessary to exclude coronary artery disease. If a heart catheterization is done then exact measurements can be taken to evaluate the degree of stenosis or regurgitation. The size of the pulmonary autograft can also be measured.

Operation

The operation is done using the heart lung machine. The area between aorta and pulmonary artery stem is dissected and freed. Then after cardioplegia, the pulmonary autograft is harvested with some musculature from the right ventricle and some native tissue of the pulmonary artery stem. In the mean time the aorta has been opened and the condition has been inspected and both coronary have been isolated on buttons. After the diseased aortic valve has been excised, the autograft is put in place, either by inlay technique or as a free graft. The former sub coronary technique has been abandoned due to the technically more challenging aspect.

In the proximal part the autograft is sewn into place and distally connected to the native aortic tissue. Both coronaries are re-implanted into the autograft, without kinking and traction. If all of this is finished the aortic clamp, to prevent beating of the heart can be released and the implantation of the right ventricle to pulmonary artery graft can be done with beating heart. The most often used graft is a homograft, either pulmonary or aortic homograft. Currently, there are several of these right ventricles to pulmonary artery graft available, both biological as with other tissue. However, the search towards the holy grail, growth potential, is still ongoing.

Complication and risks

In the hands of experienced surgeons the operative risk of this procedure is slightly higher than with a normal valve replacement with either mechanical or biological valve.[4] The operation is more demanding for the surgeon and the patient due to longer ischemic time for the heart and the fact that one valve disease is repaired by a two valve procedure (aortic and pulmonary valve, which is a general argument used by non-believers). The normal complications that also can occur during a normal aortic valve replacement like atrioventricular block, bleeding etc. are in the same range with the Ross procedure. Other complications and risks that can occur are small to moderate aortic regurgitation due to pulling or mismatching of the autograft and in the long run calcification. Graft versus host reactions is rare with the use of homograft's, due to the conservation procedure. The grafts are frozen to-130 or-150degrees Celsius with nitric oxide and lose their immunological competence. All homograft's are tested on hepatitis and HIV. The disadvantage is the shortage of donor organs and there for the shortage of homograft's. From the substitutes of homograft's are various variants of which the jugular vein of the cow is the most promising (this is called Contegra^{R}, Medtronic Inc).

Up until now the short-term and long-term results of this conduit are similar to homograft.[5] Then some more conduits exist with an artificial conduit from several materials. What they have in common is the biological valve inside. The disadvantages of these conduits are the stiffness of the conduits and the same disadvantages as a biological valve has, i.e. poorer long-term survival and calcification.

Post-surgery treatment and control

A yearly control at the cardiologist or pedi-cardiologist should be

done. The main importance is the echocardiographic evaluation of the valve and the conduit. Very rare further interventions are needed.

Summary

The Ross procedure can be an alternative for an aortic valve replacement. Instead of mechanical or biological valves this procedure can be used in selective cases. Depending on age, growth and in older girls/younger women pregnancy possibilities there could be a good indication. Although the long-term results in children are very promising, this is a procedure that should be performed only by experienced surgeons. One should not forget that this procedure is more time consuming and has slightly higher risks. Another limiting factor is the availability of homograft's, which allows us to select the right patient's group, although newer conduits are very promising.

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Conflict of interest

The author declares no conflict of interest.

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