

## Surgery for Aortic Valve Endocarditis - Treatment Options for Aortic Abscess

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### Summary

**Background:** Patients with infective endocarditis show a large diversity of anatomical presentations, which has been a complicating factor for the surgical treatment of this condition, especially in those who develop abscesses in the aortic ring or intracardiac fistulae. For this reason, surgeons have been developing tactical options to repair it. There is consensus around the fact that the removal of infected tissue promotes radical cleaning, and that the outcome of the treatment has been improved by the manufacture of biological glues which facilitate the closure of abscesses and by the creation of new valve replacements.

**Objective:** To demonstrate yet one more treatment option for aortic abscess for selected cases: a valved conduit placed in infra-coronary position.

**Methods:** We employed the technique in three patients: in two of them we employed a valved conduit with a mechanical prosthesis and in one of them a valved conduit with a biological prosthesis. Two patients needed associated procedures such as replacement of mitral valve in one of them and tricuspid valvoplasty in the other. All cases involved reoperation of prostheses in aortic position.

**Results:** The progression during surgery and in the early postoperative period was satisfactory and the three patients were discharged from the Intensive Care Unit and were sent to hospital rooms. One of the patients progressed to death during hospital stay due to severe comorbidities which were present in the preoperative period, and which related to esophageal varices and hepatic involvement. The other two progressed well in the late postoperative period.

**Conclusion:** We believe that this option is yet one more alternative for the treatment of abscesses with great involvement of aortic ring structures and mitro-aortic continuity. (Arq Bras Cardiol 2008;91(2):65-69)

**Key words:** Endocarditis/surgery; thoracic surgery; aortic valve; abscess.

### Introduction

The surgical treatment of endocarditis has changed with the evolution of medicine in general and of heart surgery in particular. More accurate diagnosis and early therapy with more efficacious antibiotics have prevented the formation of abscesses, a major complication of surgical repair. At first, treatment entailed a reinforcement of the abscess site with stitches anchored in Teflon bars, which yielded poor results in the case of large abscesses. Other solutions were prosthesis implant in supra-coronary position and saphena grafts<sup>1</sup>, but in young people there were problems with graft durability, causing the ill site to be left without adequate treatment. Dacron was also used to close the abscesses and gave better results<sup>2</sup>. Based on this experience, bovine pericardium<sup>3</sup> was used to the same end, because of the ease of manipulating the

tissue and the possibility of using it in part of or in the whole ring, implanting the prosthesis with stitches. The technique presented good results. The biological glue facilitated the procedure and improved the results when it was employed to block the abscess space located between the patient's tissue and the pericardium.

The outcome was greatly improved when surgeons began to treat abscesses as oncologic surgeries, with ample resection of the infected tissue and laborious reconstructions which were also the most complete. The prostheses, biological and mechanical ones alike, contributed to the success of the procedures in the late postoperative period, thanks to their development and the creation of valve replacements with modern preparation, conservation and design.

The Ross procedure<sup>4</sup>, the use of autologous or heterologous homografts<sup>5</sup> and stentless prostheses<sup>6</sup> represented yet one more option in the arsenal used to surgically treat aortic ring abscesses.

Our objective in this paper is to present an option for treating this very serious disease by employing a valved conduit

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in infra-coronary position to repair it, implanting it as if it were a stentless prosthesis. The possibility of using a mechanical prosthesis in this conduit gives the cardiologist and the patient yet another choice, which does not require the reimplantation of coronary arteries or the use of saphena vein grafts.

Additionally, with this technique, we reduce the chance of postoperative bleeding, since the sutures remain inside the aorta.

## Method

Since January 2005, three patients with endocarditis have been operated to implant a valved conduit placed in infra-coronary position. A mechanical prosthesis was used in two of them, and a biological prosthesis was used in the other one.

The three patients had previously been operated on for the placement of prostheses.

The first one was operated on in 1994 to replace the aortic valve with a cagedball mechanical prosthesis associated with the enlargement of the aortic root. The patient was thirteen at the time. In January 2005, he presented with a picture of endocarditis in the prosthesis placed in aortic position with a large periprosthetic abscess. The prosthesis replacement was performed and the abscess was repaired using a valved conduit with a double-disc mechanical prosthesis. The tricuspid valve abscess was also repaired; the valve was maintained and the patient underwent valvoplasty (fig. 1 and 2).

The second patient was undergoing the second reoperation. In the first surgery in 1975, at 17, the patient had a biological prosthesis implanted in aortic position and underwent mitral commissurotomy. He was reoperated in 1979 and had the prosthesis placed in aortic position replaced with a Starr Edwards valve and a biological prosthesis placed in mitral position. Twenty seven years later, he developed endocarditis in the aortic prosthesis with a large abscess and communication with the left atrium. Since at the time of surgery the stentless prostheses which we had already used to repair abscesses were unavailable, and in view of our first experience with the valved conduit we decided to implant a Hemashield conduit, which was valved with a biological

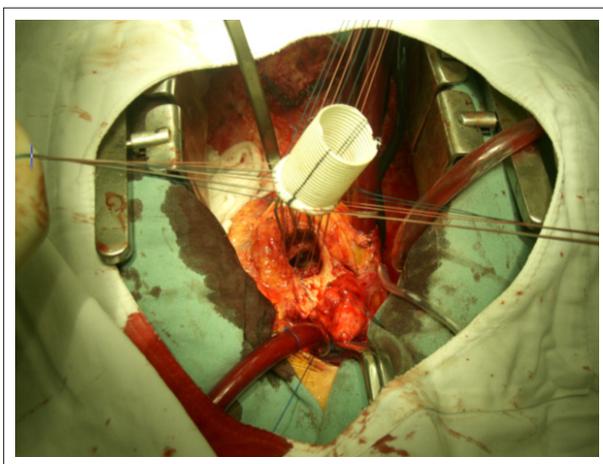


Figure 1 - Hemashield conduit with double-disc prosthesis being implanted.

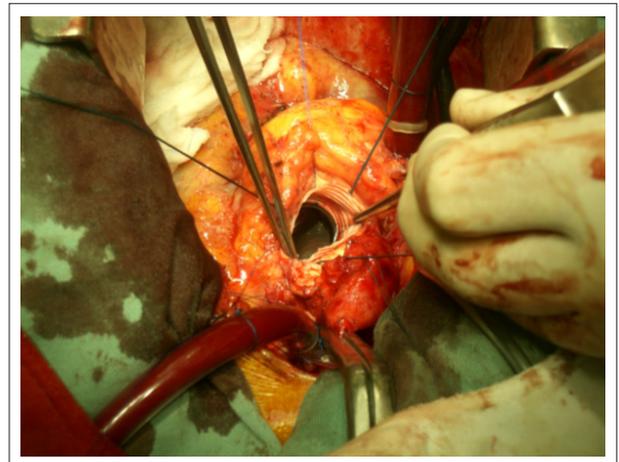


Figure 2 - Conduit totally implanted in the interior of the aorta and being sutured below the coronary ostia.

prosthesis. The prosthesis in mitral position was replaced with another biological prosthesis.

The third patient had been operated in 1986 because of endocarditis. At that time a ball-caged mechanical prosthesis was implanted, a Valsalva sinus aneurysm was repaired and the aortic root was enlarged with bovine pericardium. He was 17 at that time. He now presented with a large abscess in the periprosthetic region, and we employed a Hemashield valved conduit with a double-disc mechanical prosthesis.

The surgical procedure in all three cases was medial sternectomy. Pericardium adhesences were loosened with no incidents. Extracorporeal circulation was installed in the usual manner, with a cannula in the ascending aorta and two cannulae placed in the right atrium. A membrane oxygenator (Vital model) manufactured by Edwards was used.

The aortotomy performed was similar to the type we have been employing for the treatment of the aortic valve with no complications, that is, a transverse incision directed at the commissure between the left coronary and non-coronary leaflets or at the position it would have been before the valve replacement.

Myocardial protection was performed with antegrade hypothermal crystalloid cardioplegia in the coronary ostia. The patient was cooled to 32 degrees Celsius. Extracorporeal circulation and anoxia times were respectively 135–97, 120–90, and 90–70. No patient presented with atrioventricular block.

The three patients progressed well in the immediate postoperative period, were extubated and sent to their hospital rooms. Patient number two presented with upper digestive hemorrhage and was resented to the Intensive Care Unit. The endoscopy showed hemorrhagic gastritis and esophageal varices which underwent sclerosis. He progressed to hepatic encephalopathy and died 26 days after the surgery. The patient had hepatic cirrhosis, type I diabetes and a previous history of upper digestive hemorrhage due to esophageal varices. The indication of surgery to treat endocarditis was due to the severity of the case from the cardiological point of view and in view of the stabilization of the hepatic picture at the time of indication.

The other two patients progressed well and were discharged from hospital, with the echocardiogram showing a good result postoperatively, with no signs of endocarditis recurrence. Both have been oligosymptomatic so far, one with a 24-month follow up and the other with a 17-month follow up.

## Discussion

Endocarditis has been considered for many years as a disease difficult to diagnose and challenging to treat, especially as regards aortic ring abscesses.

The Duke<sup>7</sup> criteria have helped to define the diagnosis and are largely recommended when there is suspicion of disease. They echocardiogram to analyze endocardial involvement and consider major and minor criteria the diagnosis is considered definitive in the presence of two major criteria, or of one major and three minor criteria, or even five minor criteria. It is also possible to have one major and one minor, or three minor criteria.

Numerous consensus<sup>8</sup> have tried to define how to diagnose and treat this disease which, if left untreated, may lead to serious complications and high mortality.

According to the consensus of the European Society of Cardiology<sup>9</sup>, three echocardiographic findings are considered of major importance in patients with suspected infective endocarditis, that is, the presence of an echodense mass, which is mobile, in the valve, in the mural endocardium or in a previously implanted prosthesis; the presence of abscesses or fistulas; or a new leakage through a prosthesis, especially if implanted a long time ago.

Despite all this care, the occurrence of aortic abscesses continues to be one of the most serious complications faced by cardiovascular surgeons, and requires a wide range of possible surgical procedures to correct it.

Surgeons have long focused on treating infective endocarditis and its major complication, the abscesses, especially those in the aortic ring, using surgical alternatives to correct it.

The first reports emphasized the cleaning of the site with reinforcement in the placement of stitches to implant the prosthesis. The placement of the prosthesis in the ascending aorta outside the valve ring was championed by Danielson<sup>1</sup> in 1974, and endorsed by Reitz<sup>10</sup> in 1981. The use of Dacron to close the wound was described by Bailey et al in 1982<sup>2</sup>.

Many of these ideas are still taken into consideration today when the surgical approach is selected. In 2005, Al-Attar et al<sup>11</sup> published the technique that consists of the translocation of the aortic valve. They placed the prosthesis in the supra-coronary position using saphena vein or artificial grafts for revascularization. The difference between this and Danielson's technique lies in the placement of the prosthesis in supra-coronary position, the revascularization being performed as close as possible to the coronary ostium. The abscess site is treated according to the situation found. After thorough cleaning of the site, if the abscess is small, a plication is performed and if it is large or if there are multiple abscesses, it is treated with Dacron or equine pericardium. The mean time of anoxia was 138 minutes.

We believe that, with the option that we have been using, surgery becomes easier and faster, with the use of the conduit itself to close the abscesses with no need to treat the coronary network with saphena vein grafts which can present problems in the long run. In the group of 21 patients of the Nawwar series, published by Nottin et al<sup>12</sup>, one of them had problems with the anastomosis of Gore-Tex and had to be reoperated for new revascularization.

In 1985<sup>13</sup> we reported on the repair of a large abscess with large resections, cleaning of all infected tissues and use of bovine pericardium preserved in glutaraldehyde in part or in the whole ring to close the mitro-aortic discontinuity in case of large abscesses, thus preserving the mitral valve.

Gunai et al<sup>14</sup> in 2005 reported on a similar technique, with the reconstruction of the mitro-aortic continuity and preservation of the mitral valve in case of mitro-aortic discontinuity.

The need for double replacement in these cases makes the procedure more difficult, according to Oliveira et al<sup>15</sup>: they consider the surgery to reconstruct the fibrous skeleton of the heart with double replacement of valves in patients with complex valvular diseases very challenging but necessary when no other alternative procedure is possible.

David<sup>3</sup> used autologous pericardium in small abscesses and bovine pericardium preserved in glutaraldehyde for large defects.

The use of pericardium, especially in the treatment of more localized abscesses has not yet been abandoned and we use it whenever necessary. Kim et al<sup>16</sup> described the successful use of autologous pericardium to treat an aortic abscess with pseudo-aneurysm of non-coronary Valsalva sinus. We believe that the involvement of the non-coronary sinus isolatedly is the best option for the repair using pericardium, whether autologous or preserved bovine pericardium.

Choussat et al<sup>17</sup>, in 233 cases of abscesses, with 185 aortic abscesses in their series, preferred to employ mechanical prosthesis, and indicate this valve replacement for both the involvement of native valves and in infected prostheses. They adopt the same procedure when the mitral valve is involved.

Gaudino et al<sup>18</sup> have also employed mechanical prostheses in their twenty patients and concluded that their study cannot support the use of homografts as replacements of choice in endocarditis.

Pomerantzeff et al<sup>19</sup> prefer to use biological prostheses and indeed have used this type of prosthesis in most of the sixty eight cases of abscesses in aortic position that they have operated.

As time went by and new valve replacements emerged, other therapeutic options became available, and the use of homografts or stentless prostheses has been proposed.

Aortic homografts were employed by David<sup>20,21</sup>, and the mitral valve of these grafts can be used to repair defects in the left ventricular outflow tract.

Yankah et al<sup>22</sup> published the result of 17 years of studies of the reconstruction of the aortic root in patients with periannular abscess, using criopreserved aortic homografts. Operative mortality was 9.3% for elective surgeries and 14.3% for emergency surgeries. In the 17-year follow-up, late mortality was 7.3%. Thirty patients were reoperated, eleven of

them due to residual or recurring infection and periprosthetic leakage. The authors concluded that the use of cryopreserved homografts provides good resistance to infection.

However, the use of homografts has been questioned in the repair of large abscesses. Ritter et al<sup>23</sup> described abscess persistence after repair with aortic homograft. Joyce et al<sup>24</sup> reported on a fistula between the left ventricle and the right atrium after the use of aortic homograft. Infection persistence was reported by Bauernschmitt et al<sup>25</sup> when aortic homograft was used.

Homograft is preferred by many groups<sup>5,26,27</sup>. Niwaya et al<sup>28</sup> used both homograft and the Ross procedure and considered that the choice of prosthesis and operative technique depends on the site anatomy, comorbidity factors and surgeon preference.

We agree with Niwaya's assertion, and have employed this tactic in our department. We always perform ample resection, and choose the valve replacement or the form of reconstruction of the defect at the time of surgery, taking into account the characteristics of the patient and the anatomy of the site. We have used pericardium to close the abscess, with both biological and mechanical prostheses, and we prefer the double disc mechanical prosthesis for the aortic position. We later used stentless prostheses, and now prefer the valved conduit in infra-coronary position in those cases where we think this technique can be used.

The use of prosthetic material to repair these abscesses has been questioned, but Hagl et al<sup>29</sup> advocated for its use and showed results that are comparable with those for biological material.

Gontijo et al<sup>6</sup> used stentless porcine prostheses in fourteen cases of endocarditis, with no recurrence of infection, and considered this prosthesis an excellent replacement for patients with ring lesions. Santini et al<sup>30</sup> reported good results on a first experience with this type of prosthesis.

Borbuga et al<sup>31</sup> performed ample annular resection in five cases of aortic abscesses and reconstructed the site with pericardium, implanting a stentless prosthesis and replacing

the whole of the aortic root.

Whatever the valve replacement employed, all of the infected tissue should be resected and the site should be carefully cleaned.

We have used biological glue in all of our patients to close the cavities.

The option we used in the last cases was the valved conduit in infra-coronary position. Since cardiologists and patients prefer mechanical prostheses, we decided to opt for this operative tactic. As with all abscess surgeries, we perform ample resection of all the infected tissue and clean the site. We then make separate stitches below the site affected and implant the valved conduit (Hemashield with double disc mechanical prosthesis). Biological glue is placed in the abscess site and the ring is treated with iodine. The prosthesis support is infiltrated with antibiotics. The upper part of the conduit is sutured below the coronary ostia just as we do with stentless prostheses.

## Conclusion

We believe that this is yet another option in our arsenal to treat this severe disease, but more time is required for us to assess the future behavior of the conduit in infra-coronary position, and the technical difficulties that will come up if the prosthesis or conduit need to be changed.

## Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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There were no external funding sources for this study.

## Study Association

This study is not associated with any graduation program.

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