How-to-do-it

The Sorin Freedom SOLO stentless aortic valve: easier implantation technique with potentially less risk of complications

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Abstract

Aortic valve replacement by bioprosthesis is increasingly being used. Among these, stentless bioprosthesis is becoming a valid choice due to its potential hemodynamic improvement. The Sorin Freedom SOLO stentless aortic valve (FS) (Sorin Biomedica Cardio, Saluggia, Italy) is widely used, with initial and midterm promising results. It is designed to be deployed in a straightforward manner in the supraaortic position with a single running suture due to its reproducible implantation technique. Few specific valve-related complications, such as transient thrombocytopenia or rare thrombotic events, are known. Our experience, after the implantation of 33 Freedom SOLO, suggests that using the classical implantation technique, the noncoronary sinus adopts a conformation that increases the difficulty of the implant. Besides, it could also be distorted increasing the risk of periprosthetic leakage and hypothetically becoming the origin of thrombus. We present an easy and safe variation in the implantation technique of the FS that decreases the technical difficulty of the implantation, reduces the risk of periprosthetic leakage, and may additionally reduce the risk of thrombosis.

Keywords: Aortic valve disease; Stentless valve; Implantation technique

1. Introduction

The Sorin Freedom SOLO stentless aortic valve (FS) is constructed from two bovine pericardial sheets without fabric reinforcement. Detoxified and stored in an aldehyde-free solution, it does not require rinsing prior to implant. Standard implantation technique is published elsewhere [1]. Anatomical remarks to be considered prior to its use are: tricuspid, rather symmetric conformation of aortic root; sinotubular junction <2 mm larger than aortic annulus [2]; and noncalcified aortic root. Technical landmarks include: transverse, high aortotomy; use of specific size that should tightly fit aortic annulus; use of three reference sutures above valve commissures; and application of three continuous strictly supra-annular 4/0 polypropylene sutures in a precise order: right, left, and noncoronary sinuses [3] (Fig. 1A).

After the initial learning curve, we feel comfortable and fully agree with the fact that it is an easy, user-friendly prosthesis to work with. However, after the implantation of 33 FS, we have noticed several technical issues that need to be stated. First, when we made a strictly transversal aortotomy, we found a tendency to stay slightly low in the intercoronary commissure and subtly high in the noncoronary sinus, which used to be the deepest one. Second, when commissural stay sutures are applied, it is easy to appreciate slight asymmetries, mainly a wider noncoronary sinus. Third, after tying the three 4/0 sutures, the prosthesis stays somewhat fixed inside the aortic root and expositions worsen. Fourth, for right-handed surgeons, suturing the right sinus is easier than the left one while for left-handed surgeons, the left sinus is easier. Last and of utmost importance, when addressing the noncoronary sinus (the worst exposed), conjunction of wider and deeper sinuses can make the suture line longer and in some instances create tension on the prosthetic pericardial rim; we also found a clear tendency to wrinkle medial portion of native sinus when suturing it.

Technical modifications advocated are as follows: first, aortotomy needs to be transversal to aortic root plane, not to patient sagital plane, staying well above the intercoronary commissure and gaining exposition to noncoronary sinus. Second, after applying the first stay suture above intercoronary commissure, we use sizer marks to choose the exact site of the other two, correcting it with sinus depth when necessary to achieve the same suture line length of three sinuses. Third, after passing the three 4/0 sutures at the midpoint of Valsalva sinuses and pericardial rim, we tie each
suture only when needed to gain mobilization. Fourth, and most important, we begin the suture in noncoronary sinus by applying only the first 2–3 stitches on each side; by doing this, we can assure tension-free seating of the prosthesis on a non-wrinkled aortic sinus under perfect exposure. Next we suture the right sinus, followed by the left sinus, and finally, the procedure is finished by completing the noncoronary sinus suture line (Fig. 1B).

2. Discussion

FS has been found to be easier to implant than any other stentless valve, with cross-clamp mean times similar to that of stented bioprosthesis (62 min vs 64 min in our institution).

The advantages of the stentless design are to provide a larger effective orifice area [1,2] and the possibility to implant larger sizes when compared with stented bioprostheses [1]. Main mistakes that could occur during valve implantation are inaccurate removal of the diseased valve, calcified aortic root, inaccurate sizing, and too small a suture bite in the aortic root and intra-annular seating [1].

In our experience with FS, we observed from the very beginning that when suturing noncoronary sinus, it was common to find some degree of discrepancy between the length of pericardial rim and that of aortic root. As a result, in some cases we were forced to make a V-shaped rather than the ideal U-shaped suture line to avoid excessive tension on the pericardial prosthetic rim. However, this would create folds in the midpoint of aortic sinus. Our single case of periprosthetic leakage, corrected intraoperatively, clearly originated at the bottom of one of these folds and prompted us to redefine the implantation technique. With the changes we propose, symmetry and a perfect apposition of prosthetic tissue in a tension-free, U-shaped, non-wrinkled sinus will be assured.

One can argue that we were undersizing prosthesis, but all of our cases showed >10 mm coaptation line and sizing up could leave excessive tissue and thus some gradient [4].

We also hypothesize that the above-mentioned folds left on noncoronary sinus can explain thrombotic events. Grubitzsch et al. [5] and Hilker et al. [6] reported thrombotic events with FS. Beholz and Konertz [7] reported it with one of its precursors, the Pericarbon Freedom valve. What these thrombosis cases have in common is that they all originated from the noncoronary sinus. Thus, it is not unrealistic to think that loss of smooth conformation of noncoronary sinus may be the origin of these events.

We suggest that our technical variation ensures suturing of noncoronary sinus, making implantation easier and probably safer. Further experience is required to confirm additional advantages.

References