Editorial

The ideal substitute for tricuspid valve replacement in patients with congenital heart disease: an unsolved dilemma

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In a recent paper, Burri and colleagues (1) addressed the complex theme of bioprosthesis durability in patients with congenital heart disease (CHD) operated of tricuspid valve replacement (TVR). The authors reviewed a consecutive series of 51 patients (mean age 32 years) affected by CHD (mainly Ebstein disease) operated over a 25 years period of TVR with a bioprosthesis. The main results of the study are the following: (I) TVR in patients with CHD can be accomplished with acceptable early mortality (30-day mortality rate was 8%) and with good late survival (5 and 10 years survival rate were 80%); (II) structural valve deterioration (SVD) is a significant problem, with a 10-year freedom from prosthesis dysfunction of only 58%. Younger age and smaller valve size (in the context of patient-prosthesis mismatch) result the strongest independent predictors of SVD; (III) SVD does not always translate into valve re-replacement, as 10-year freedom from reoperation was 81%; (IV) however reoperation were quite common in the follow-up period (13 patients) with SVD occurring faster after the reoperation in respect to the first time operation.

In patients with acquired valve disease (AVD), TVR remains a major surgical intervention with a considerable reported risk of mortality (7–22%), and a high incidence of prosthesis-related complications (14–34%), which results in a high number of reoperations (10–22%) during a follow-up of 5–9 years (2,3). Reasons for these disappointing results greatly depend on the population characteristics, as it has been demonstrated that age, preoperative congestive heart failure and redo operation are major determinants of early and long-term mortality (4).

Data on TVR in patients with CHD are scarce, and seem to report conflicting results. The only large series of congenital patients with tricuspid valve prostheses are that of the Mayo Clinic who succeeded in collecting a huge amount of data mainly related to Ebstein's disease (5,6). In patients with CHD, results are more favourable, as shown by studies on patients with Ebstein anomaly in whom 5- and 10-year survivals of 88–93% and 85–93%, respectively, are reported with the use of bioprostheses (6). However results of TVR in small children (age <6 years) are disappointing as well, and children <1 year of age had markedly worse outcomes than the older group of children with a 64% hospital mortality (7). This difference in survival between acquired and congenital TVRs might well be due to differences in preoperative status and age at implantation.

The good long-term survival in congenital patients undergoing TVR made them more prone to valve-related complications, such valve thrombosis in mechanical prostheses and SVD in bioprostheses. In patients with CHD and TVR, long-term valve related complication rate is higher as 50% during a mean follow-up of 15 years. This value is significantly higher compared to the long-term TVR complication rates of 10–34% (8) reported in studies describing patients with AVD. Many authors have advocated the use of bioprostheses in the tricuspid position based on the concept that low pressure and low stress in the right

heart seem to provide higher valve durability compared with valves located in systemic circulation (9). However, this concept, which is partially true in patients with AVD, does not apply in patients with CHD undergoing TVR. Van Slooten and colleagues (10) reported a incidence of bioprosthetic valve deterioration of 4.2% patient/year in a consecutive series of 20 patients with CHD which is significantly higher of the incidence (1.7% patient/year) reported by Rizzoli *et al.* in a meta-analysis of 11 studies of patients with AVD (11). Two factors are major determinants of early bioprostheses failure in this subgroup of patients: younger age at implantation and smaller size of implanted prosthesis. In the paper from Burri and colleagues (1), the durability of the bioprosthesis was almost similar to patients with AVD in patients over 16 years of age, but reoperation and dysfunction significantly increased in patients below 16 years of age. This is in line with studies that investigate the use of bioprostheses in other positions in younger patients: Shinkawa and colleagues (12) reported a rate of freedom from prosthesis dysfunction of 74% after 5 years and of 33% after 10 years for bioprosthesis in the pulmonary position, with earlier dysfunction in younger patients. Reoperation is a major issue during tricuspid prosthetic valve selection at first surgery. Given the younger age, and the higher rate of vale-related dysfunction, many patients with CHD and a tricuspid bioprosthesis required a second, third or even a fourth prosthesis lifelong. This is a major issue in this subgroup of patients, because operative risk increase with the number of reintervention but also the durability of the second or third bioprosthesis is significantly lower than the durability of the first bioprosthesis. What are the alternatives to replacement of the TV with a bioprosthesis? The use of mechanical prosthesis in the tricuspid position has neither improved the outcome in patients with AVD (2), nor in patients with CHD. Brown and colleagues (5) compared patients with Ebstein's anomaly undergoing bioprosthetic and mechanical TV implantation. Freedom from reoperation was similar after 20 years, but overall survival was better when using a bioprosthetic valve. The major issue against the use of a mechanical valve in the right heart is the higher rate of valve thrombosis compared with left heart implants. The high rate of tricuspid valve thrombosis, especially in young population seemed to be entirely related to inadequate anticoagulation. Young people are thought to be less compliant with anticoagulation therapy because of life phase, lifestyle and the tendency to deny the potential implications of poor compliance. The growing enthusiasm for transcatheter valve replacement is forcing many surgeons to implant an increasing number of bioprostheses, even in young patients, on the basis that SVD will be addressed in the future percutaneously. Despite the experience with tricuspid valve-in-valve replacement is limited (13), the evolving feasibility of transcatheter technique will open a new clinical scenario in the near future for these high-risk patients. In conclusion, TVR in patients with CHD remains a challenging procedure, with increased operative mortality and a high incidence of valve-related complications at follow-up. Because current options for TVR in patients with a CHD remain unsatisfactory, all efforts should be made to repair the native valve whenever possible. More recent repair techniques enable reconstruction in an increasing percent of patients with Ebstein's anomaly, even after a previously failed repair (14). If the valve should be replaced in young patients, bioprostheses seem to be the most reasonable option. Percutaneous valve-in-valve technique could be useful to manage bioprosthesis dysfunction until adulthood is reached, when a reintervention with a mechanical valve should be a more definitive strategy.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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