The unanswered questions in the field of surgical treatment of bicuspid aortic valve (BAV)-associated aortopathy [1] periodically come in the limelight of the cardiac surgical literature. One of those questions is in the title of the paper by Vendramin et al. [2], published in this issue of the EJCTS: ‘should aortic root replacement be mandatory in the treatment of BAV disease and ascending aortic aneurysm?’

In 2000, Sundt et al. [3] addressed this question in a retrospective series of BAV patients undergoing separate valve and aorta \( (n = 27) \) or composite aortic root \( (n = 18) \) replacement. The cut-off diameter to replace an aorta with BAV disease was 40 mm in that experience, but the criteria to choose between either technique were not specified. Observing no aortic complications in a mean follow-up of 5 years, they concluded that separate valve and graft replacement is a safe option, ‘at least in selected cases’ (i.e. when coronary ostia displacement is not significant or when concomitant procedures have to be performed).

In 2011, Park et al. [4] published a larger series, of 153 patients, in which the BAV had been replaced along with the ascending aorta but leaving the native root in place: again the choice of the procedure was by the operating surgeon and not by strict diameter criteria. No patient receiving separate replacement required reoperation for aortic root dilatation in a median follow-up time of 3.3 years.

On the other hand, in 2007 Etz et al. reported a hospital mortality of 2.9%, no aortic reoperation over a mean follow-up of 5.9 years and survival similar to the age-matched general population, in a series of Bentall operations [5]. In that series indications included dysfunctional BAV with ascending dilatation exceeding 40–45 mm.

All the above-mentioned studies share the same retrospective nature and its inherent limitations. First of all, the undefined or inconsistent criteria for the choice of the procedure (separate versus composite replacement) make it impossible to draw a general conclusion on whether one should be more or less aggressive in the treatment of the bicuspid aortic root. Even in Vendramin’s study, where the criteria were indeed disclosed (i.e. separate replacement if the root was <45 mm, otherwise Bentall) the outcomes of the two different procedures were actually evaluated in remarkably different patient profiles. Patients receiving Bentall operation were more often male and had more than twice the prevalence of aortic regurgitation compared with the other group and significantly greater aortic diameters not only at the root level, but also at the ascending level, notwithstanding their significantly younger age. Recently, we have observed that the anatomic-clinical form of BAV aortopathy characterized by these features, namely the ‘root phenotype’, accounting for \( \sim 20\% \) of aortic dilatations with BAV [6], is associated with faster growth of the ascending aorta over time [7]. Lately, evidences are accumulating that the root phenotype may be a marker of earlier-onset, more severe and more progressive aortopathy [7, 8]; thus, in their experience Vendramin et al. have likely performed the more radical procedure in the group in which the worst pathology was concentrated. This could confirm a hypothesis that as long as the root phenotype is excluded, BAV aortopathy is safely and effectively treated by supracoronary replacement [3, 7].

The Bentall procedure is a low-risk operation in patients who present at a relatively young age with very few comorbidities if any. However, there is no doubt that separate valve and ascending replacement implies shorter operative times, no risk related to coronary ostia manipulation and—an argument that might be particularly relevant in a young patient population, with a longer
follow-up time ahead—easier and more straightforward reoperation in case of valve-related complications requiring redo AVR [2, 4]. It is important to distinguish between what can be done with a perception of surgical safety and what is really the wisest choice for the individual patient: which proportion of BAV patients who are today treated by composite valve and root replacement would fare well in the long term even if treated by separate replacement, without experiencing root dilatation and need for reoperation? This is a clinically important question to address; nevertheless, comparisons between clinically (and probably pathogenetically) different patient populations treated by different techniques will not help. The most frequent form of dilatation associated with BAV is the ‘ascending phenotype’, characterized by greater dimensions at the supracoronary tract compared with the sinuses [6]; therefore, the most common dilemma we are faced with is how to manage a root measuring between 40 and 45 mm, when both the valve and an ascending aneurysm must be resected. To answer this question, retrospective and/or prospective comparisons between the two techniques in object should be performed in a phenotypically homogeneous population (ascending phenotype patients) [8]. The type of cusp fusion and of valve dysfunction and more importantly the pattern of aortic dimensions [7] represent useful elements for BAV population stratification, that should be no longer overlooked in studies of surgical outcomes [1, 7, 9]. In turn, large well-designed studies could identify further criteria for risk stratification by assessing the determinants of the relevant outcomes, for example, within the root phenotype sub-population. Thus, a second question arises: which outcome measures should be considered? Sudden death, in the absence of an autopsy and in patients receiving also additional procedures, for example, coronary artery bypass grafting [2], cannot be considered univocally related to aortic complications. Both natural history studies and surgical follow-up reports have shown that the incidence of ‘aortic events’ can be very low in BAV patients, so that only by following thousands of patients for at least 10–15 years, a statistically robust comparison between different techniques could be performed [1]. In smaller samples and shorter periods of observation, the yearly growth rate of the residual aortic root after separate replacement could be a valid surrogate outcome, to identify patient subsets at higher risk [7].

Given the complexity of the disease, there probably cannot be one single (and simple) answer to the question whether to replace the BAV root, also because other considerations could enter the decision: for example, earlier indications to root replacement have been suggested in the setting of purely regurgitant BAV amenable by valve repair, to ensure stabilization of valve function restoration [10]. Multiple centres must join their efforts and series together, to ultimately draw sound criteria for personalization of management of BAV aortopathy [1].

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REFERENCES