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Congenital heart disease plus infective endocarditis: complexity squared, but what is the outcome?

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Improved diagnosis and treatment options have significantly enhanced the life expectancy of patients with congenital heart disease (CHD). Because patients are now surviving well into adulthood, they might face other challenges. Previous research has shown that CHD patients are more vulnerable to infective endocarditis (IE) than the general population. However, data on long-term outcomes after IE in adult CHD (ACHD) patients are scarce. Therefore, Verzelloni Sef *et al.* [1] conducted a single-centre study to investigate this issue. First of all, we want to compliment the authors with their long-term follow-up, as well as their comprehensive data collection and analysis.

In their ACHD population, that resembles the complexity of patient load in a tertiary centre, the first notable finding is that the 1-year mortality rate reported by Verzelloni Sef *et al.* is considerably lower than the mortality reported in a previous international substudy from the EURO-ENDO registry [2] (7.3% vs 12.9%, respectively). Several reasons for this discrepancy come to mind. First, patients in the cohort of Verzelloni Sef *et al.* were considerably younger (mean age 36 vs 44.8 years). This emphasizes that age as a predictor for mortality weighs heavy in this complex patient population, which is also stated by the authors. Therefore, we suggest that clinical decision-making in ACHD IE patients should be made in light of the life expectancy per cardiac anomaly. Second, differences in bacterial causative agents may account for variances in mortality rates in IE. Verzelloni Sef *et al.* observed considerably less IE by *viridans Streptococci* than EURO-ENDO (5.7% vs 16.5%). Moreover, *Enterococcal* species, another virulent microorganism in IE, was the causative agent in only 3 cases in their cohort. There was no significant difference in the prevalence of *Staphylococcal* infections (16.5% vs 17.5%). For optimal IE treatment, it is essential to consider the wide variety of clinical manifestations and characteristics for different bacterial causative agents, such as the ability to abscess formation, peripheral embolization and responsiveness to antibiotic treatment.

One of the main results by Verzelloni Sef *et al.* is that patients with prosthetic heart valves are at risk for adverse events. This stresses the importance for early detection of prosthetic valve endocarditis (PVE) and subsequent initiation of treatment. Since conventional two-dimensional echocardiography is often inconclusive in PVE, there should be a low threshold to perform additional anatomical and functional imaging when PVE is possible. Anatomical imaging includes ECG-triggered multidetector-row computed tomography and provides additional value in detecting vegetations, cardiac abscesses and pseudoaneurysms. Functional imaging on the other hand includes 18-fluorine-fluorodesoxyglucose positron emission tomography with low-dose computed tomography, which has a high specificity for perianular extension in PVE [3].

We support the author's statement that in moderate and complex ACHD, there is a higher threshold for performing (redo) surgery. Mediastinal adhesions caused by previous (staged) surgeries as well as prolonged cardiopulmonary bypass- and aortic cross-clamp times significantly increase operative risk [4]. In addition, overall increased risk for postoperative haemodynamic instability in IE patients should be taken account [5].

The satisfactory results for conservative treatment found by Verzelloni Sef *et al.* in patients with PVE and/or moderate and complex ACHD IE highlights the importance for further research on indications for surgery in this specific subgroup. However, we want to emphasize that renouncement of indicated surgical treatment in CHD patients with IE is an independent risk factor for all-cause mortality [2]. Lastly, the relatively low prevalence of cardiac abscesses (11.9%), which is regarded to be an independent risk factor for mortality, may suggest limited extensiveness of IE in their cohort and may have resulted in lower mortality rates. We believe that close (personal) follow-up in patients with (complex) CHD can result in earlier detection and initiation of IE treatment. As stated in the guideline from the European Society of Cardiology, all CHD patients need to be educated about IE symptoms and the importance of obtaining blood cultures before starting antibiotic therapy [6].

Interestingly, Verzelloni *et al.* found less IE cases with pulmonary homograft as opposed to prosthetic pulmonary valve. This is in line with previous research, where surgical treatment with homograft conduits has good long-term results and low rates of

endocarditis [7]. Subsequently, this raises the question whether homografts should not be more frequently implanted in ACHD patients with valvular disease, for example in those with a predisposition for IE (e.g. immunocompromised patients). However, more research is needed on this topic.

While we acknowledge the importance of the authors' research question regarding the long-term prognosis after IE treatment in CHD patients, it is key to keep in mind that the variations in long-term survival found in this study are also based on the inherent life expectancy associated with different congenital anomalies. Therefore, we find it debatable to what extent mortality beyond 1 year after successful IE treatment can be solely attributed to the IE episode. Nevertheless, we are delighted to see satisfactory long-term outcomes in ACHD patients with IE.

We believe that the organization of care around CHD IE cases, at least in part, has resulted in satisfactory (long) term mortality rates of this vulnerable and growing population. As recommended by the European Society of Cardiology guideline, clinical decisions by Verzelloni Sef *et al.* were all reviewed by a multidisciplinary team in their tertiary CHD hospital, whereas EURO-ENDO reported no information on the presence or composition of IE teams in EURO-ENDO and cases were retrieved from a wide range of academic and non-academic hospitals [8].

Taken together, the study by Verzelloni *et al.* provides important real-world data on IE in ACHD patients, with satisfactory long-term results. We must however be careful in extrapolating the results to all CHD patients, given the heterogeneity of congenital anomalies. Moreover, IE remains an important clinical problem in this high-risk population, and we encourage ACHD specialists to perform more research on this topic.

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