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EDITORIAL COMMENT

Diagnosis of Pulmonary Arterial Hypertension in Adult Congenital Heart Disease

Still Room for Improvement*

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The tremendous advances achieved over the last decades in the treatment of congenital heart disease (CHD) in children have led to an ever-increasing number of adults with congenital heart disease (ACHD). While significant progress has been made, life expectancy of ACHD, in particular for those with more complex CHD, is still guarded compared to the general population.[1] The main reason for this finding is that a cure of the CHD is seldom achieved, while in the longer term, complications and sequela like heart failure or arrhythmias that require therapeutical interventions and are major causes of morbidity and mortality are common.[2,3] Pulmonary arterial hypertension (PAH) is one of the most impactful complications regarding morbidity and mortality in this patient group. While its association with uncorrected shunt defects like large ventricular septal defects has been well described and known for decades, its occurrence late in adulthood even after the successful closure of so-called simple shunt defects in childhood has recently become a focus of attention.[4] In the German National Register for Congenital Heart Defects a PAH prevalence of 3.0% was reported in patients with corrected simple lesions, and PAH was associated with significantly increased mortality.[4] Nevertheless, therapeutic options for PAH exist in the form of specific drug therapies like endothelin receptor antagonists, phosphodiesterase-5 inhibitors or prostacyclin receptor agonists to name a few.[5] However, early diagnosis is key to achieve the best possible outcome.[5] Unfortunately, it is well described that there is still a substantial time delay of up to more than 2 years until PAH is finally diagnosed in symptomatic patients.[5] This can be even more aggravated for patients with ACHD with corrected shunt defects due to the lack of awareness by treating clinicians as well as a substantial number of patients lost to follow-up. One reason for the latter is that in some CHD centers, children with corrected simple shunt defects were historically discharged from cardiac care due to the assumption that their CHD is cured. Therefore, there is a pressing need to optimize ways to identify patients with ACHD that develop PAH.

In this issue of *JACC: Advances*, Landzberg et al[6] report the results of the Quality Enhancement Research Initiative program in ACHD, a multicenter, observational, U.S.-based longitudinal program in 59 specialist ACHD centers which used a standardized approach for PAH screening in ACHD with repaired systemic-to-pulmonary arterial shunts considered at high risk of PAH. The criteria used for the definition of the high-risk population were partly based on data from the literature and partly on expert consensus. Treating clinicians were informed during data entry by pop-up reminders of patient-specific evidence-based recommendations for PAH detection. The main results of this study are that recording of transthoracic echocardiography parameters, that are required for the detection of PAH, improved during

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the study. Furthermore, around 40% of patients had at least 2 high-risk features for PAH on echocardiography. However, only 7% of patients underwent right heart catheterization, the gold standard for diagnosing and classifying pulmonary hypertension. This demonstrates a clear underutilization of right heart catheterization, especially taking into account that this is a high-risk cohort, which probably leads to missed opportunities in the treatment of this vulnerable patient population. Considering that these patients were recruited from specialized ACHD centers, it is reasonable to assume that ACHD patients under care in nonspecialized centers are even less often evaluated for the diagnosis of PAH. Interestingly, the main reason given by the treating clinicians in this study for not following the advice of the guidelines in the pop-up reminders was "I believe my management is appropriate."[6] This is worrisome. While without doubt after careful evaluation a deviation from the recommendations of the guidelines in individual cases must always be a valid option, it is well known that in general adherence to the guidelines improves patient outcomes in cardiovascular medicine. This has also been recently shown for the treatment of patients with ACHD.[7] Therefore, in clinical practice in most cases adherence to guideline recommendation is advisable.

The authors have to be commended for implementing an intuitive alert system to improve screening and early diagnosis of PAH in ACHD. In other at high-risk for PAH populations the implementation of diagnostic algorithms has already been evaluated. For example, in patients with systemic sclerosis PAH is a leading cause of death and early diagnosis is key but often missed. Therefore, specific algorithms for the early diagnosis like the DETECT algorithm were introduced.[8] These forms of diagnostic algorithms for the early diagnosis of PAH are essential and should be implemented in the electronic health records systems. However, given the financial and possible emotional cost associated with regular screening, a definition and stratification of high-risk groups would be desirable to avoid unnecessary investigations. Unfortunately, these high-risk groups for the development of PAH in association with ACHD are not fully defined yet. Although we have some parameters described in the literature which could be helpful and were also utilized by Landzberg et al,[6] these have not been validated as a screening tool. Therefore, we might miss cases of PAH in patients with ACHD, which were classified as low risk and were therefore not screened, leading to an even more pronounced delay until the diagnosis is made and possibly a worse outcome. In a future study, these patients should also be included in the alert system until we have valid criteria for the definition of high-risk groups.

As shown by Landzberg et al,[6] the only way to improve the early detection of PAH in ACHD and consequently the outcome of these patients is through education of the providers as well as the patients and by raising the awareness for this important and potentially devastating complication.

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