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Letter to the Editor

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Chronotropic incompetence and peak VO_2 in paediatric heart transplant recipients: back to the basics

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To the Editor,

The gold standard method to assess cardiorespiratory fitness is by cardiopulmonary exercise test, in which peak oxygen consumption (VO_2) is directly measured. Peak VO_2 has been related to survival in health people and in subjects with cardiovascular diseases. According to Fick's equation, VO_2 is determined by cardiac output and peripheral oxygen extraction (VO_2=CO × [CaO_2 – CvO_2]). Cardiac output is represented by heart rate and systolic volume (cardiac output=heart rate × systolic volume). So, we can assume VO_2 as heart rate × systolic volume × peripheral O_2 extraction.

The study by Singh et al[1] assessed peak VO_2 in paediatric heart transplant recipients with previous diagnosis of congenital heart or cardiomyopathy. Interestingly, the authors did not find any difference in peak VO_2 between CHD and cardiomyopathy groups. However, the authors reported a significant difference in chronotropic response in favour of those transplanted for cardiomyopathy.[1] Chronotropic impairment can reflect cardiac reinnervation in heart transplant recipients and is a very important clinical variable.[2] Considering that peak VO_2 is represented by peak heart rate × peak systolic volume × peak peripheral O_2 extraction, we can try to understand the results found by Singh et al.

If we have the same peak VO_2 values for both groups (CHD and cardiomyopathy) and lower peak heart rate to CHD, we can assume that peak systolic volume or peak peripheral O_2 extraction are increased to balance the equation. Echocardiography and cardiac catheterisation did not show difference between the groups in the pilot study by Singh et al. But we need to keep in mind that these exams did not assess the heart under exercise stress (or at the peak effort). Considering the baseline and the fact that we are talking about healthy grafts, we would not expect any difference if echocardiography under exercise stress between groups. On the other hand, we have the peak peripheral O_2 extraction to explain the balanced equation for the same peak VO_2 in both groups. Peripheral O_2 extraction reflects the efficiency of the peripheral muscles to extract oxygen, which is directly associated with the level of physical activity. A previous study[3] that assessed adults' heart transplant recipients with less than 1-year follow-up and more than 10-year follow-up showed no difference in peak VO_2, despite the difference in chronotropic response during cardiopulmonary exercise testing. The authors highlighted the importance of assessing the muscle efficiency in oxygen extraction and the level of physical activity.

The study by Singh et al is very important to show the importance of assessing the peripheral oxygen extraction and the level of physical activity that, not always, are assessed. Maybe the explanation for the lack of difference in peak VO_2 between the groups of paediatric transplant recipients is not around the heart, but a little far from it.

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