Does a test impact on a patient's life many years from now?

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In this issue of the *journal*, Romera-Farina[1] et al examine the long-term risk associated with a normal stress myocardial perfusion SPECT in a relatively large cohort of patients followed for up to 12 years. The current report is similar to prior series in that it identifies cutpoint in time during follow-up at which a patient risk is altered.[2] This has been previously defined as the warranty period[2] or the duration of time whereby the patient's risk alters significantly from that observed during the early portion of follow-up. In the case of a patient with a normal stress myocardial perfusion scan, the expected risk over 2-3 years of follow-up is quite low.[3] In a recent meta-analysis, the annual cardiac event rate was 0.4% and 0.9% with stress myocardial perfusion PET and SPECT.[3] In both cases, the annual event rate was less than the conventionally quoted <1%; denoting exceedingly low risk status. But, this is average risk and we know that within that point estimate, there are patients with more extensive comorbidity, unable to exercise, or with coronary artery disease that have an expected cardiac event rate that is nearly double the $\sim 1\%\cdot year^{-1}$ in the setting of normal stress myocardial perfusion imaging.[3] We have also seen a higher risk status with patients who have severe coronary artery calcification in the setting of normal or low risk myocardial perfusion imaging scans.[4,5]

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Romera-Farina et al examined a novel approach whereby they examined the duration of follow-up whereby the patient remained low risk (i.e., <1% cardiac event rate·year^{-1}). Using this calculation, patients who underwent exercise testing with normal stress myocardial perfusion findings had a warranty period of ~3 years where their risk remained exceedingly low at <1%/year. As expected, patients unable to exercise requiring pharmacologic stress had a warranty period that was nearly half that of functionally capable patients. What is unclear from their analysis is the extent to which the temporal changes in risk status are the direct impact of the scan or just mirroring age-related increases in risk.

There is a well-established reduction in physical work capacity with age that has been consistently observed in the published literature.[6] Patients who exceed age-defined normative standards for exercise capacity have a better survival than those with diminished functional capabilities. Although the authors report in this series that patients achieving five or metabolic equivalents on their exercise capacity have a low rate of cardiac events often beyond 5 years of follow-up. Amazing as this statistic is, what would be informative is if we could incorporate the age-related normative standards for exercise capacity to understand if the presented statistic is indicative of a younger aged patient or uniquely categories the elite low risk status to all. The authors do present an adjusted analysis that includes age as a covariate but this may or may not be sufficient to discern low to high exercise capacity based on physiologically expected declines with age.

Moreover, although the authors report the survival analysis findings through 10 years of follow-up, importantly the mean follow-up was only 5 years. Thus, many of the latter findings represent data from a much smaller sample of patients. Statements focusing on the long-term implications of observed risk need to contextually-based within the constraints of the limited representation of patients in the latter follow-up time periods. The limitations of these statements include the

precision of estimates on the duration of time period for low risk status. Importantly, the longer the observational time period, the more competing risks, adequacy of treatment, compliance, and the progressive nature of atherosclerotic plaque are operational and impact on the warranty period analysis.

Despite the limitations of this report, the authors are to be lauded for providing us with one more prognostic series that clearly establishes stress myocardial perfusion imaging as an integral component of a patient management strategy. That is, a patient management strategy includes more than the index procedure but links the test with guidance on risk and targeted therapeutic intervention. Based on the current findings, less intensive management and eliminating the need for follow-up testing would be expected in the identified patients classified as low risk at least through 3 years of follow-up; and longer in the more functionally capable patient subsets. This data not only provides guidance as to the need for repeat testing but also defines a means to achieve cost efficiency by reducing unnecessary healthcare expenditures. This is yet but one more pearl of evidence linking stress myocardial perfusion imaging findings to optimally guiding care. The body of evidence within the field of nuclear cardiology continues to grow based on the hard work of groups such as that of Romera-Farina and colleagues and others. This immense evidence is far greater than for other modalities and continues to strengthen our understanding of the value of nuclear cardiology in patient-centered care.

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