

Cardiac hybrid imaging - an effective tool for predicting heart attacks

A recent study has evaluated the long-term prognostic value for cardiovascular outcomes of hybrid SPECT Perfusion imaging and Coronary CT Angiography [1]

Invasive coronary angiography (ICA) is considered the gold standard for determining the percent of stenosis due to plaque in a coronary artery. However, the degree of stenosis on ICA is not always an accurate predictor of heart attack risk because it gives no information on perfusion.

Cardiac hybrid imaging combining coronary CT angiography (CCTA) and SPECT myocardial perfusion imaging (MPI) has shown promise to address this issue but so far studies have been limited to short-term observations.

This article summarizes the result of a recent study of the long-term prognostic value of hybrid CCTA - SPECT MPI.

The results showed that cardiac hybrid imaging is an excellent long-term predictor of adverse cardiac events [1]

Coronary artery disease (CAD) remains a leading cause of morbidity and mortality worldwide. Invasive coronary angiography has long been seen as the reference standard for the assessment of CAD. However, the angiographic severity of coronary lesions is a poor predictor of their hemodynamic relevance [2]. While traditionally a coronary stenosis with a luminal narrowing of 50% or greater was considered to be hemodynamically relevant, it has been recognized that a large proportion of intermediate lesions have no hemodynamic impact, while lesions with luminal narrowing of less than 50% may cause ischemia as well. Two large randomized trials including patients with known CAD failed to demonstrate a prognostic benefit of revascularization compared with modern medical treatment if patients were not stratified by prior ischemia testing. The recent prospective randomized FAME trial [3] has shown that ischemia-driven revascularization based on fractional flow reserve measurements improves outcomes. Hence, current evidence-based guidelines

recommend myocardial ischemia testing prior to coronary revascularization [4].

Cardiac hybrid imaging combining anatomic and functional information by fusing coronary CT angiography and myocardial perfusion imaging (MPI) may provide a comprehensive noninvasive assessment of CAD.

So far, several studies have shown the incremental diagnostic value of fusion imaging over one imaging modality alone [5] as well as over the side-by-side analysis of coronary CT angiography and MPI images.

Thus, currently available prognostic data on cardiac hybrid imaging are encouraging but are limited to short-term observations; no long-term outcome data are available so far [6]. Therefore, the objective of the study conducted by a team from the University Hospital Zurich, Switzerland was to determine the value of cardiac hybrid imaging performed by combining SPECT-MPI with coronary CT angiography as a long-term predictor. [1].

METHODS & RESULTS

In the retrospective single-center study, the research team looked at 428 patients who underwent hybrid imaging. During a median follow-up of 6.8 years, a total of 160 major adverse cardiac events, including 45 deaths, were observed in the

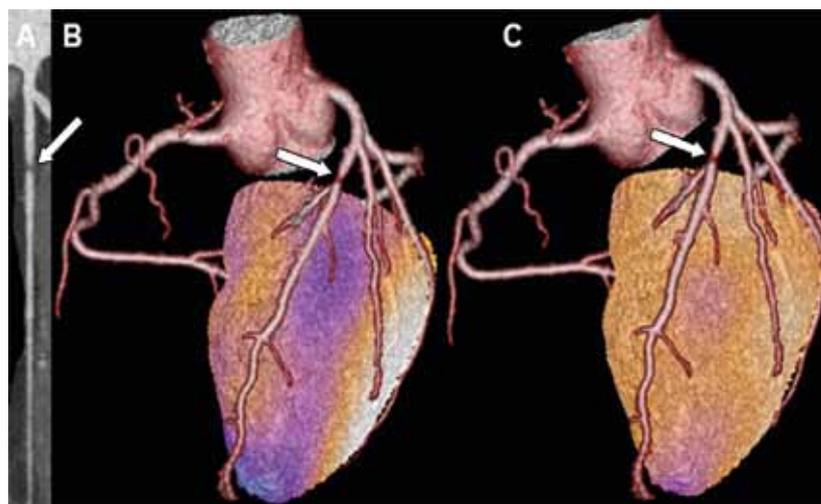
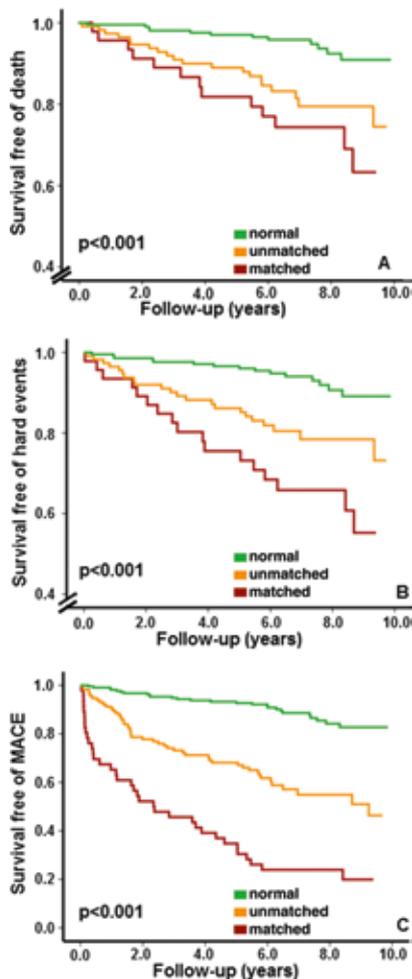


Figure 1. Example images in a patient with a matched cardiac hybrid finding (arrows). A, Multiplanar contrast material-enhanced coronary CT angiography reconstruction shows a stenosis of the proximal left anterior descending artery in a 62-year old man. B, C, Cardiac hybrid SPECT/coronary CT angiography images show a matched perfusion defect (arrow) in the territory served by the left anterior descending artery at, B, stress; this defect was reversible at, C, rest, indicating a stress-induced anterior ischemia.. Images from [1] courtesy of *Radiology*, RSNA.



Kaplan-Meier survival curves show prognostic value of cardiac hybrid imaging. Cardiac hybrid imaging findings predict, A, all-cause death, B, “hard events” (all-cause death and nonfatal myocardial infarction), and, C, major adverse cardiac events (MACEs) (hard events, unstable angina requiring hospitalization, and coronary revascularization). Matched (findings) = stenosis of 50% or greater (at coronary CT angiography) with ischemia (at SPECT) in subtended territory, unmatched (findings) = coronary CT angiography and/or SPECT findings in unrelated territories. Image from [1] courtesy of *Radiology*, RSNA.

final study population. Patients with matched findings—stenosis of 50 percent or more on CCTA with evidence of ischemia on SPECT in the area of the heart to which the blocked vessel was supplying blood—had more than five times the risk of adverse events than those with normal findings. Patients with unmatched findings, or evidence of ischemia but not in the area of the heart being fed by the stenotic artery, had three times the risk. Major adverse cardiac event rates were 21.8 percent for matched findings and

9.0 percent for unmatched—considerably higher than the 2.4 percent rate for normal findings.

The results show that cardiac hybrid imaging is an excellent long-term predictor of adverse cardiac events in patients evaluated for coronary artery disease. Study coauthor Dr P A. Kaufmann, Professor of Nuclear Medicine, and director of cardiac imaging at University Hospital Zurich said that hybrid imaging findings could help guide treatment decisions, such as whether or not a patient should have a revascularization procedure such as bypass or angioplasty.

“In patients with multiple lesions or complex coronary anatomy, it is, in many cases, very difficult to correctly identify the culprit lesion,” he said. “In a previous multicenter trial, with hybrid imaging we were able to see that about one in five patients should be revascularized in another coronary artery than originally planned. The present study now documents the prognostic importance of the comprehensive assessment provided by hybrid imaging.”

The study supports CCTA use for an initial, noninvasive evaluation of patients with known or suspected stable coronary artery disease. No additional imaging would be necessary if the results were normal. If a lesion is evident, then clinicians could employ a nuclear scan to assess ischemia and take advantage of both modalities by fusing the results together to make a hybrid image.

“The strategy of direct referral to invasive coronary angiography without noninvasive imaging is obsolete,” Dr. Kaufmann said. “Even after documenting coronary artery disease with coronary CT angiography, we need further noninvasive evaluation before deciding upon revascularization versus medication.”

CONCLUSION

Cardiac hybrid imaging combining CT coronary angiography with SPECT-MPI allows anatomic and functional assessment of CAD at the same time. Patients with a normal fusion myocardial perfusion SPECT/coronary CT angiography examination have an excellent prognosis at long-term follow-up. Cardiovascular outcomes are worse in patients

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with matched abnormalities at SPECT/CT angiography compared with patients with unmatched abnormalities. According to the researchers, their study is the first to expand the proven predictive short-term value of cardiac hybrid imaging over a long-term period.

In summary, in patients evaluated for coronary artery disease, cardiac hybrid imaging is an excellent long-term predictor of adverse cardiac events. A matched hybrid finding is associated with a high annual cardiac event rate.

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