Can Advanced Healthcare Technology Save Money?

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In this issue of Circulation: Cardiovascular Quality and Outcomes, Hulten et al found that coronary computed tomographic angiography (CTA) may reduce hospital costs if emergency department (ED) patients with chest pain who are at low/intermediate risk of obstructive coronary artery disease (CAD) underwent coronary CTA.1 Thus potentially saving hospitalization costs in patients with negative test results who could be promptly discharged from the ED. National hospitalization costs for noncardiac chest pain are not trivial. As an example, in 2011, the Centers for Medicare and Medicaid Services paid hospitals $526 million for hospitalizations classified into the chest pain diagnosis-related group (ie, patients who were ultimately found to have neither an acute myocardial infarction nor other acute coronary syndromes as the cause of their chest pain). A reduction in the frequency of such hospitalizations may result in substantial cost savings.

Using sophisticated economic modeling techniques with detailed hospital cost data obtained from patients in the Rule Out Myocardial Infarction Using Computer Assisted Tomography (ROMICAT) trial, Hulten et al1 compared the actual costs of clinical care incurred by patients in the trial with the hypothetical costs these patients might have incurred if coronary CTA results were available to the patients’ clinicians (ie, patients who were designed to predict mortality and other adverse clinical events rather than the presence of obstructive CAD. Even if both a valid clinical decision rule for calculating the pretest probability of obstructive CAD and evidence-based clinical guidelines for appropriate ED use of coronary CTA existed, the evidence supporting the effectiveness of clinical decision rules in reducing US national healthcare expenditures is scant, and guidelines for the appropriate use of cardiac imaging are often not followed.7

Another challenge in reducing healthcare costs through the widespread use of coronary CTA in the ED is the absence of a well-defined clinical risk threshold below which coronary CTA would be deemed inappropriate. Hulten et al illustrated the difficulty of safely excluding the presence of obstructive CAD in any patient enrolled in the ROMICAT study using clinical data typically available to ED clinicians,1 and the authors remind their readers that the risk of litigation for inappropriate hospital discharge of patients with chest pain is not trivial. In light of these facts, if coronary CTA were to become a routine component of ED chest pain evaluation, it is easy to envision practice patterns evolving to the point where essentially all ED patients with any chest symptoms, no matter how unlikely to be caused by myocardial ischemia, undergo obligatory coronary CTA before ED discharge. Facing the imperative to practice defensive medicine under the perceived threat of litigation, and with advanced imaging technology readily available, many ED clinicians might be tempted to expand the pool of patients selected for coronary CTA to include numerous patients who would never have met the strict entry criteria of the ROMICAT trial (ie, chest pain with a constellation of clinical risk factors sufficiently worrisome to warrant hospitalization for rule-out myocardial infarction).8

Undoubtedly, the new costs generated from widespread overuse of coronary CTA among extremely low-risk patients would overwhelm any cost savings produced from reduced hospitalizations of patients at higher risk. Hence, for this technology to reduce national healthcare spending, in addition to the establishment of 30% obstructive CAD risk as the ceiling for appropriate coronary CTA use, a testing floor risk of obstructive CAD also must be clearly established and rigorously followed.

These implementation challenges notwithstanding, the results of the analysis by Hulten et al remain persuasive that there exists a sweet spot of pretest clinical probability for which coronary CTA may not only improve patients’ quality of life by

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facilitating safe discharge from the ED but also save substantial healthcare dollars by reducing unnecessary hospitalizations. But how might emergency care diagnostic protocols be organized to consistently reap the economic benefit? One alternative would be to use less costly but informative diagnostic tests in advance of the decision to use coronary CTA. For example, the coronary calcium score can provide useful risk stratification information with a much lower radiation dose,\textsuperscript{9} and lower cost, than coronary CTA. Reducing expenditures from chest pain hospitalizations may ultimately require the development of novel low-cost diagnostic tests for myocardial ischemia (eg, new biochemical markers, bioelectric indicators, or low-cost imaging modalities) to supplement and improve the predictive accuracy of the currently available routine ED tests. Coronary CTA may still retain a role in these diagnostic pathways, but that role would be carefully circumscribed.

It is also clear that expanding clinicians’ diagnostic options entails increasingly complicated clinical decision making. Integrating multiple sources of clinical data into an accurate assessment of pretest clinical probability is a nontrivial exercise even for expert clinicians.\textsuperscript{10} The development of artificial intelligence/clinical decision support that processes clinical data in real time and provides physicians with an unbiased and accurate assessment of the pretest probability of myocardial ischemia (envison IBM’s Watson as a physician’s assistant) in a timely fashion might be needed to guide these complex decisions. However, such advanced decision-support technology has not yet been developed for widespread clinical use nor is it likely that such technology would be rapidly and universally adopted by US emergency medicine physicians and their hospitals even if it did exist. As is the case for all high-cost diagnostic testing, clinicians must be adequately incentivized at the point of care to use technology appropriately, avoiding the twin pitfalls of overuse in settings where the diagnosis is exceedingly rare, as well as overuse in settings where the diagnosis is not in doubt.

Hospitals face mounting pressure to rein in rising healthcare costs. Reimbursement mechanisms such as those incorporated in Centers for Medicare and Medicaid Services contracts with Accountable Care Organizations,\textsuperscript{11} as well as widely anticipated bundled payments for episodes of care,\textsuperscript{12} raise the stakes for healthcare systems to find effective ways to reduce costs for common clinical conditions. Coronary CTA may be a rare example of a cost-reducing technology when used wisely, yet limiting its use to situations where it provides diagnostic value at reasonable cost may prove infeasible in many practice settings. If coronary CTA becomes widely available in US emergency departments, cost savings will only be realized if the thousands of patients with chest pain that is either too unlikely, or too likely, to be caused by myocardial ischemia do not undergo coronary CTA. This is a narrow path not often followed by clinicians using new medical technology,\textsuperscript{13} and even potentially cost-saving technologies can quickly become contributors to the national problem of rising healthcare costs.

**Disclosures**

None.

**References**


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