

## Less Is More, More the Merrier, or More From Less?



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Physicians deal with uncertainty all the time and chest pain in the emergency department (ED) is a typical example. Traditionally, coronary artery disease (CAD), pulmonary embolism (PE), and aortic dissection can present as chest pain, and the consequences of a missed diagnosis can be devastating, with the potential for rapid deterioration, and serious risk of morbidity and mortality. Moreover, because these conditions are also common causes of malpractice claims, an extra layer of concern and possible overinvestigation may be added. This has led to a computed tomography angiography (CTA) strategy—the triple rule out (TRO) or a single test for all 3 conditions—out of an abundance of caution.

Of course, CTA for a single diagnosis is routinely used in the ED. It is commonly used to exclude aortic dissection and CAD. It is often the first-line strategy to rule out pulmonary embolism (1,2), which is difficult to diagnose clinically and is often missed. Other tests for PE such as ventilation/perfusion scans are not robust and are diagnostic less than one-half of the time (2). This results in a low threshold for computed tomography (CT) evaluation but has a low positive yield with a very high negative predictive value (3). Overuse of CTA for PE in the ED is understandable but may be detrimental by picking up PEs that may not have immediate clinical relevance (1). An interesting paper (4) and the accompanying editorial (5) in this issue of *JACC* on TRO by CTA for chest pain ED evaluation raise broader questions about the appropriate amount of testing in this

setting. This multicenter study (4) strongly suggests that TRO should not be the standard of care because of the low diagnostic yield, additional contrast and radiation, as well as poorer image quality, echoing the conclusions of a meta-analysis (6).

There is ongoing concern about the overuse of medical technology and its adverse consequences, including avoidable harm, wasted time and resources, burgeoning cost, and possibly poorer outcomes. The *less is more* philosophy has very nicely highlighted these issues (7). A retrospective analysis of 421,774 insurance claims (8) extended the *less is more* approach to all ED noninvasive testing based on significantly higher odds of cardiac catheterization and revascularization procedures without improvement in clinical outcomes accompanying stress testing and CTA (8). The adverse event rate has been demonstrated to be only 0.18% in 11,230 patients admitted or sent to an observation unit after an ED chest pain visit with normal serial troponins and electrocardiogram, and it has been suggested that patients be discharged straight from the ED without further evaluation (9). There are some data showing that the use of CTA in pulmonary embolism may also be a strong example of the need for the *less is more* philosophy (10), and the Burris et al. (4) paper brings the same evidence into the chest pain syndrome in the ED.

What will be the evolution of diagnostic testing in the face of ever-increasing technology? It would seem that the weight of opinion in the future will favor the *less is more* philosophy, but that transition will depend only on the availability of high-quality outcome data. Shotgun testing—a single test screening for a number of potential diagnoses—will be less favored than testing based on high-quality “probability scores.” In addition, as medicine

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transitions from a volume-driven, fee-for-service paradigm to an accountable care outcomes approach with no reward (and possible financial disincentive) for additional testing, the use of noninvasive imaging is likely to decrease in general and, more specifically, in the ED where a larger percentage of unpaid care would render the economics more unfavorable. The introduction of high-sensitivity troponins into the ED paradigm might accelerate the decline of noninvasive testing by its promise of extraordinarily high negative predictive value for an acute coronary syndrome delivered within a dramatically shortened time frame (11), and noninvasive testing would likely be reserved for the as yet to be determined equivocal troponin range. Thus, unless further randomized, controlled trials yield better outcomes for the noninvasive testing strategy (a highly unlikely eventuality), the application of the “more the merrier” strategy of testing in the ED to patients in whom CAD or a related condition for chest pain is thought to be the greatest consideration appears unlikely.

However, it is not out of place to consider *more from less*. As Burris et al. (4) have demonstrated, the yield from TRO was overwhelmingly cardiac (15.2%) compared to aortic dissection (1.7%) and pulmonary embolism (1.1%). Even though dissection and embolism were very likely not the primary diagnoses, it is reasonable to anticipate similar findings in CTA in which they were the primary targets. History and physical exam remain notoriously inaccurate in distinguishing between cardiac, aortic, and pulmonary artery etiologies, and only ~10% of pulmonary embolism studies have positive findings (12). Exact numbers are not available for dissection studies, but it is likely to be even lower because there are

approximately just 2,000 new dissections reported annually (13). Thus, analysis of the coronary arteries (which are always in the field of view) would be ideal in pulmonary embolism and dissection studies, i.e., deriving more information from an indicated test. However, the need for electrocardiographic gating will increase the radiation dose and cannot be routinely advocated with the current technology. Nonetheless, ongoing and future CT technology developments, with radiation dose and contrast reductions, may enable a single gated acquisition protocol for scanning the entire chest with very low radiation without loss of quality—i.e., a TRO without the limitations of the Burris et al. (4) study. Other modalities are improving rapidly as well and cardiac magnetic resonance with angiography might provide the same benefits without radiation in selected patients.

Thus, in the current era of maximizing yield from available resources and avoiding unnecessary testing, the versatility and radiation sparing of future CT scanning technologies may provide invaluable coronary information from appropriately indicated dissection and pulmonary embolism studies without additional cost or harm. Of course, as in any medical decision making, outcome studies demonstrating the objective benefits of this approach will be required. We need to hear what you think; do you see an increasing role for CTA in the ED or do you think otherwise. Please write to us at [jaccimg@acc.org](mailto:jaccimg@acc.org).

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