

Too Much of a Good Thing: Appropriate CTPA Use in the Diagnosis of PE

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There is abundant evidence that the use of computed tomography pulmonary angiography (CTPA) is increasing in emergency departments and more patients are being diagnosed with pulmonary embolism (PE).^{1,2} The increasing availability and resolution of CTPA technology since the late 1990s has led some to suggest that PE is now being overdiagnosed, which is supported by decreasing PE case-fatality rates and the detection of small, subsegmental clots that do not result in any meaningful right-ventricular dysfunction.^{3,4} Indeed, recent guidelines allow that not all small PEs require anticoagulation therapy.⁵ Beyond overdiagnosis, there are potential patient-level harms associated with the liberal use of CTPA imaging, including the consequences of radiation and intravenous contrast exposure.^{4,6} At the societal level, excess CTPA use contributes to the growing costs of healthcare.^{2,7}

Despite the above concerns, CTPA remains the diagnostic test of choice for PE. There are multiple approaches that are suggested to appropriately use CTPA in the workup of suspected PE, the most common of which is endorsed by best practice publications and combines a clinical score (eg, Well's score) with D-dimer testing, reserving CTPA for those patients with high clinical risk and/or positive D-dimer.^{8,9} Despite the professional recommendation, studies have shown that the use of PE diagnostic algorithms in clinical practice is suboptimal, resulting in much practice variation and contributing to the overuse of CTPA.^{10,11} In this issue, as a means of clarifying what measures improve adherence with recommended best practices, Deblois and colleagues¹² perform a systematic review of the published interventions that have attempted to reduce CTPA imaging in the diagnosis of PE.

Deblois and colleagues are to be commended for summarizing what is unfortunately a very heterogeneous literature, the limitations of which precluded a formal meta-analysis. The authors report that most of the 17 reviewed studies incorporated either electronic clinical decision support (CDS; usually imbedded into a computerized physician order entry) tools or educational interventions in a retrospective, before-and-after design; only 3 studies were experimental and included a control group. Most of the studies included efficacy, with a few

evaluating safety. There was little available evidence regarding cost-effectiveness or barriers to implementation. The most studied approach, CDS, was associated with a decrease in the use of CTPA of between 8.3% and 25.4% along with an increase in PE diagnostic yield of between 3.3% and 4.4%. Likewise, the appropriate use of CTPA (consistent with best practice recommendations) increased with CDS intervention from 18% to 19%. The addition of individual performance feedback seemed to enhance the impact of CDS, although this finding was limited to one investigation. Conversely, educational interventions to improve physician adherence to best practice approaches were less effective than CDS, with only 1 study describing a significant decrease in CTPA use or increase in diagnostic yield. Although safety data were limited, in aggregate, the reported studies did not suggest any increase in mortality with interventions to reduce CTPA use.

As discussed by the authors, CDS was the most studied and most effective intervention to improve appropriate CTPA use, albeit modest in its impact. The lack of contextual details about what factors made CDS effective or not effective makes it difficult to make general recommendations. One cited study did include physician reasons for not embracing CDS, which are not surprising in nature and reflect concerns about impaired efficiency and preference for native clinical judgement over that of electronic tools.

Moving forward, CDS, perhaps coupled with performance feedback, seems to offer the best hope of reducing inappropriate CTPA use. The growing use of electronic medical records, which is accelerated in the United States by the meaningful use provisions of the Health Information Technology for Economic and Clinical Health Act of 2009, implies that CDS tools are going to be implemented across the spectrum of diagnoses, including that of PE.¹³ The goals of CDS interventions, namely improved patient safety, quality, and cost-effectiveness, are more likely to be achieved if those studying and designing these electronic tools understand the day-to-day practice of clinical medicine. As summarized by Bates and colleagues¹⁴ in the "Ten Commandments for Effective Clinical Decision Support," CDS interventions will be successful in changing physician behavior and promoting the right test or treatment only if they seamlessly fit into the clinical workflow, have no impact on (or improve upon) physician efficiency, and minimize the need for additional information from the user. As suggested by Deblois et al.,¹² future studies of CDS interventions that aim to align CTPA use with recommended best practices should incorporate more rigorous methodological quality, include safety and cost-effectiveness outcomes, and, perhaps most

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importantly, attempt to understand the environmental and organizational factors that contribute to CDS tool effectiveness.

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