

Tackling the overuse of imaging for pulmonary embolism

By Simon Deblois and Carl Chartrand-Lefebvre

The number of imaging examinations carried out in Emergency Departments in cases of suspected pulmonary embolism (PE) is increasing steadily, without a corresponding increase in the number of confirmed diagnoses. These trends suggest an unnecessary overuse of imaging.

This article summarizes the conclusions of a recently published paper analyzing the possible approaches that could be implemented to tackle the issue of imaging overuse in PE.

The combined implementation of Clinical Decision Support and Performance Feedback Reports is more effective than mainly educational or policy interventions in reducing such overuse of imaging for PE. However, an approach including all four types of interventions, together with provider-led imaging stewardship, may be even more efficient.

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INTRODUCTION

The use of imaging in the diagnostic work-up for pulmonary embolism (PE) has risen markedly since the introduction of computed tomography pulmonary angiography (CTPA) in the 1990s [1-3]. A significant increase in the probability of having a diagnosis of pulmonary embolism in Emergency Departments was observed from 2001 to 2010, likely because of an increased access to CTPA [4]. A study conducted in the emergency department of an American teaching hospital from 2004 to 2009 has shown a significant increase in the use of CTPA without a corresponding significant increase in diagnostic yield (i.e. the number of positive exams/number of exams ordered for PE) [5].

“.. Overuse of imaging for PE can be associated with the use of imaging techniques (CTPA or ventilation/perfusion, V/Q) when a patient is at low risk of PE as determined by a validated CDR...”

Overuse of health care refers to the use of a service in the absence of a clear medical basis for its use, when the risk of harms exceeds the likely benefits or when the incremental costs do not provide proportional benefits [6]. Clinical guidelines recommend using a validated clinical decision rule (CDR) — for example, Wells, PERC, Charlotte or Geneva — in combination with D-dimer testing to estimate the probability of a patient being at risk of acute pulmonary embolism [7-15]. Systematic reviews have demonstrated that the choice of a CDR and D-dimer test should depend on both prevalence and characteristics of the clinical setting [16, 17].

Moreover, it has been demonstrated in two other systematic reviews that the application of a validated CDR in combination with D-dimer can contribute to reducing inappropriate use of imaging for

PE, although the heterogeneity of the study designs did not allow the pooling of results [18, 19].

Overuse of imaging for PE can be associated with the use of imaging techniques (CTPA or ventilation/perfusion, V/Q) when a patient is at low risk of PE (determined by a validated CDR) and in whom D-dimer testing was not carried out or its result was negative [20].

In their recent systematic review including 17 studies, Deblois *et al.* identified four main types of interventions intended to promote the use of CDRs and improve the appropriateness of imaging use in the diagnostic workup of pulmonary embolism.

These are: electronic clinical decision support (CDS; performance and feedback reports (PFRs); educational interventions and finally the establishment and application of policy directives [19]. Fifteen of these studies were conducted in the Emergency Department and eight assessed CDS interventions [19]. Thirteen studies were conducted in the United States, three in Australia and one in Spain. The main type of CDS appraised was a software application embedded into the electronic health record of the clinical setting.

One experimental study whose design included a comparative control group evaluated an intervention combining CDS and Performance and Feedback Reports (PFR) [21]. PFRs are quarterly reports sent electronically to emergency physicians, comparing their individual statistics and performance with those of an anonymous group of emergency physicians (use, yield, and adherence to clinical guidelines) [21]. Other studies evaluated educational and policy interventions. In most studies, a “before-and-after” design was used, with retrospective data collection.

The main results generated by this systematic review are summarized below, along with other key results. The implications of the current evidence for the development of interventions aimed at reducing the overuse of imaging for PE will then be discussed.

EFFICACY

The volume of imaging and diagnostic yield are two indicators commonly used to appraise the efficacy of interventions aiming at reducing overuse [18,19,22]. In their systematic review pertaining to interventions

aimed at reducing the overuse of imaging for PE, Deblois *et al.* observed at baseline a volume of imaging per 1000 admissions that varied from 2.6 to 26.5, and a diagnostic yield that varied from 4.7 to 31% [19]. Therefore, baseline values show important variation from one implementation setting to the other.

The implementation of an electronic CDS was associated with a modest decrease in use, or the volume of imaging following intervention, ranging between 8.3% and 25.4%. A rise in diagnostic yield between 3.4% and 4.4% was observed, as well as a rise in appropriate ordering ranging from 18% to 19%. However, the impact on diagnostic yield was mixed, since a significant result was observed in only three out of

six studies. The combined implementation of an electronic CDS with PFRs was associated with a significant increase of 8.8% in appropriate ordering.

The implementation of educational and policy interventions yielded mixed results. However, it is difficult to compare results and draw conclusions, since

there is much heterogeneity in study designs and intervention characteristics.

SAFETY

There is only limited evidence on the safety of the various intervention approaches that were evaluated. No adverse events related to possible complications or missed diagnoses were noted by Deblois *et al.* upon appraisal of the 17 studies they reviewed [19]. Further research is needed to confirm the safety of CDS and PFRs, as well as educational and policy interventions.

ECONOMIC ASPECTS, FACILITATORS AND BARRIERS

Evidence regarding the economic impact of the implementation of interventions aimed at reducing the overuse of pulmonary embolism, as well as facilitators and barriers, is limited. Among the studies assessed by Deblois *et al.*, only one dealt with economic aspects; Kline *et al.* (2014) found a significant decrease in charges and estimated costs for medical care within 90 days of initial ED visit [23]. The same review included only one study assessing the reasons given by users for not adhering to CDS recommendations [24]. The explanations most often given to explain non-adherence to CDS recommendations were the time needed to access and use the application and a preference for intuitive judgement [24]. Further research is also needed to confirm the economic impact, facilitators and barriers associated with the implementation of CDS and PFRs, educational and policy interventions.

“... The explanations most often given to explain non-adherence to CDS recommendations were the time needed to access and use the application and a preference for intuitive judgement...”

IMPLICATIONS FOR THE DEVELOPMENT OF INTERVENTIONS AIMED AT REDUCING THE OVERUSE OF IMAGING FOR PE

The evidence tends to demonstrate that interventions based on validated clinical decision rules are an appropriate way to tackle the overuse of imaging for pulmonary embolism. In this respect, the combined implementation of a CDS and PFRs is more effective than solely educational interventions and policies, though the evidence is limited [19]. Comparative studies of high quality would strengthen the evidence concerning the relative efficacy, safety and economic impact of the interventions appraised, especially when various types are combined [19].

A combination of interventions that may include not only CDS and PFRs but also well-designed educational interventions and policies, may well be even more efficient than single interventions. Moreover, implementing a well-thought out combination of interventions would be coherent with the perception of some observers who have stressed the need for increased provider-led imaging stewardship to reduce inappropriate imaging [25, 26]. Provider-led imaging stewardship involves the participation of physician champions to lead change-management efforts and invest into the implementation of process interventions to curb inappropriate use, making imaging specialists responsible for executing interventions which satisfy appropriateness criteria [25]. This approach also includes implementing interventions such as CDS to ensure systematic evaluation of appropriateness at the time of ordering and encouraging dialogue between referring physicians and imaging experts [25]. Moreover, it involves implementing performance and feedback interventions, informing referring physicians about their imaging use rates compared to that of their peers, as well as educational interventions [25, 27, 28].

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