Rev Port Cardiol. 2013;32(1):15–17

Revista Portuguesa de
Cardiologia
Portuguese Journal of Cardiology
www.revportcardiol.org

EDITORIAL COMMENT

Prognostic value of imaging methods in acute pulmonary embolism☆

Valor prognóstico dos métodos de imagem na embolia pulmonar aguda

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Available online 23 December 2012

Introduction

Pulmonary embolism (PE) is the third most common cause of acute cardiovascular disease after myocardial infarction and stroke. Prompt diagnosis, risk stratification and treatment of patients with PE can reduce the associated mortality.

Developments in imaging technology in recent years have led to changes in approaches to PE, one of the most significant being the replacement of conventional pulmonary angiography as the gold standard for diagnosis of PE by multidetector computed tomography (MDCT) angiography, whose superiority is acknowledged in the most recent European Society of Cardiology (ESC) guidelines on PE.[1]

MDCT has rapidly become the most widely used exam to confirm the diagnosis of acute PE, as well as to identify signs of right ventricular (RV) dysfunction, or to provide alternative diagnoses.

While the role of MDCT in diagnosis of acute PE is well established, its value in establishing the prognosis of these patients is still the subject of considerable research.

Prognostic value of different imaging methods

A significant number of studies in recent years have investigated imaging methods able to diagnose acute PE and to help establish its prognosis. Different methods have significantly different strengths and weaknesses in this regard; for example, transthoracic echocardiography has relatively low diagnostic value due to its low sensitivity, but is able to identify patients with RV dysfunction and hence has good prognostic value.

A recent review article by Burns and Haramati analyzed the various imaging methods used in the diagnosis of acute PE and their prognostic value.[2] Several parameters have been assessed to determine the prognostic value of each method under study. These studies add to the evidence that signs of RV dysfunction on MDTC are a strong predictor of mortality following acute PE, and MDTC is thus a valid alternative to transthoracic echocardiography in diagnosing RV dysfunction and can also assess other parameters that influence prognosis.

Heyer et al. analyzed the prognostic value of various MDTC parameters following acute PE and found that pulmonary obstruction index, venous contrast reflux, and the presence of pulmonary infarction correlated with the need for intensive care, that venous contrast reflux was associated with need for mechanical ventilation and length of stay in the intensive care unit, that the presence of pleural effusion was associated with total length of hospital stay, and that the ratio between right and left ventricular diameters (RV/LV ratio) correlated with mortality.[3]

Attina et al. examined the application of a new pulmonary artery obstruction score in the prognostic evaluation of acute PE and compared it with clinical and hemodynamic parameters.[4] Similarly, Nakada et al. studied the relation

☆ Please cite this article as: Ferreira D. Valor prognóstico dos métodos de imagem na embolia pulmonar aguda. Rev Port Cardiol. 2012. http://dx.doi.org/10.1016/j.repc.2012.10.003.

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between pulmonary embolus volume quantified by MDCT and clinical status and events during follow-up in patients with acute PE.[5]

Bauer et al., assessing pulmonary blood volume determined by dual energy MDCT and its correlation with other parameters of established prognostic value, concluded that it correlates with RV overload and appeared to have prognostic value in this pilot study.

The prognostic value of various MDCT parameters has also been compared with those of other imaging methods including transthoracic echocardiography[6] and magnetic resonance imaging,[7] as well as with laboratory assessment of troponin levels.[8]

The parameters studied are obviously important in any analysis of the prognostic value of different imaging methods, but it is also essential when interpreting the results to consider differences in the populations involved in these studies. Results will vary depending on whether all patients with suspected PE have been included or only those in whom it is confirmed; likewise, a study of all patients with confirmed PE cannot be compared to one analyzing only those at intermediate or high risk.

Another relevant factor in the analysis and interpretation of the results is the type of treatment, such as whether thrombolysis was used.

In the current issue of the *Journal*, Baptista et al. present an interesting analysis of parameters obtained from MDCT pulmonary angiography to determine the medium-term prognostic impact of various radiological indices (RV/LV ratio, arterial obstruction index, pulmonary artery-to-aorta diameter ratio and azygos vein diameter) in intermediate- to high-risk PE patients, most of whom were treated by thrombolysis, in a mean follow-up of 33 months.[9]

Of the variables studied, only the RV/LV ratio had predictive value, the ratio being significantly higher in patients who died (1.6±0.5 vs. 1.9±0.4, p=0.046). Patients with an RV/LV ratio $\geq$1.8 had 11-fold higher medium-term mortality (3.8% vs. 38.8%, p<0.001).

These results, which are similar to those in the literature,[10,11] lead the authors to conclude that RV/LV ratio obtained by MDCT can predict poorer outcomes following acute PE.

The fact that only intermediate- to high-risk patients according to the criteria of the ESC guidelines were included is of clinical significance, since most studies also include low-risk patients; this reduces the prognostic value of MDCT, as stated by the authors.

Although the study was retrospective, the authors took care to ensure that the MDCT data were reviewed by two radiologists who were blinded to patient outcomes. Significant inter-observer variability has been reported, related to the experience of the operators, which underlines the need for rigor in the analysis of parameters obtained by this method, which should always be carried out by more than one observer, in clinical practice as well as in research studies. Costantino et al. assessed this variability and recommended that a negative MDCT scan in a case of high suspicion of acute PE should be re-examined by a more experienced observer.[12]

Conclusion

The study by Baptista et al.[9] is further evidence that MDCT parameters, particularly those relating to RV dysfunction and especially the RV/LV ratio, have prognostic value in patients with acute PE. This imaging modality thus appears able to confirm or exclude a diagnosis of PE and simultaneously to identify patients with poorer prognosis, thereby helping in decisions concerning the best treatment for individual patients.

Conflicts of interest

Daniel Ferreira was a member of the Steering Committee of the EMEP Portugal (Estudo Multicêntrico de Embolia Pulmonar) and ARTE (Avaliação do Risco de Tromboembolismo Venoso) registries, and was an investigator for the PEITHO study and the RIETE registry. He has received fees for consulting and for participating in scientific meetings in the field of antithrombotic therapy from Sanofi, GlaxoSmith-Kline, and Boehringer Ingelheim.

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