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Importance of Pretest Probability for Calculating Positive Predictive Value

LETTER TO THE EDITOR

To the Editor,

We read the article by Erol et al[1] titled "Agreement Between Transthoracic Echocardiography and Computed Tomography Pulmonary Angiography (CTPA) for Detection of Right Ventricular Dysfunction in Pulmonary Embolism" with great interest. Pulmonary embolism is an important clinical condition, and many prognostic indexes such as PESI (pulmonary embolism severity index) are frequently used.[2] We agree that right ventricular dysfunction is very important and understand why it has a special place in predicting prognosis in pulmonary embolism. The CTPA can provide important prognostic information in pulmonary embolism[3] and its agreement with transthoracic echocardiography deserves attention. However, we have some concerns about the article.

Our first concern is about the calculation of the PPV for predicting adverse outcomes. The PPV is defined as "the ratio of patients truly diagnosed as positive to all those who had positive test results."[4] In order to calculate PPV, Bayesian theory should be used; the pretest probability (*P*) should be added to the formula: PPV = [(Sensitivity) × (*P*)] / [Sensitivity x (*P*) + (1 − specificity) x (1 − *P*)]. The authors reported that the presence of right ventricular dysfunction on transthoracic echocardiography has a positive predictive value (PPV) of 93%, which is very high. Similarly, computed tomography pulmonary angiography has a PPV of 94%. If pretest probability is not used, the PPV data of a study cannot be extrapolated to the general population, and the data remains limited only to the study sample. The authors didn't mention the pretest probability in the text; therefore, it seems that they haven't considered it. If they had considered it, using the numbers given in the study, we can calculate from the above formula that the pretest probability of adverse outcomes should have been about 0.88 (88%).

Assuming that the adverse event rate in pulmonary embolism is 3%, and the sensitivity and specificity of RV dysfunction in TTE for predicting adverse events are 100% and 43%, respectively, as stated in this study (by the way, 8 patients constitute 3% compared to 258 patients; we could not understand why it was mentioned as 4% in the study), the numbers of true positive, true negative, false positive, and false negative are expected to be 8, 107, 143, and 0, respectively. Accordingly, while a total of 151 patients had RV dysfunction with echo, only 8 developed adverse events, indicating a PPV of 5.1% (8 out of 151) as opposed to the 93% written in the article. This value of 5.1% PPV is calculated without taking pretest probability into account. Even if pretest probability is not used, the calculated PPV is much lower than the value reported in the article. Moreover, calculating PPV without considering pretest probability may lead to misinterpretations and should not be used. The author's clarification of the method of calculating the PPV would be helpful for the readers of the journal.

Our second concern is about the rate of patent foramen ovale (PFO) in this study. Although PFO may have positive effects in pulmonary hypertension,[5] the study by Konstantinides[6] suggests that PFO is a predictor of adverse outcome in pulmonary embolism, indicating a paradoxal outcome. Therefore, it is reasonable to try to understand whether PFO is present in patients with pulmonary

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embolism. Erol et al reported that PFO is present in only 10 patients (3.9%), while PFO was diagnosed in 48 patients (35%) in the study by Konstantinides et al. This rate is higher than the prevalence of PFO in the general population (20%),[7] suggesting that PFO itself may predispose individuals to thromboembolism. Our concern is that the detection of PFO is very difficult if contrast echocardiography is not used. Konstantinides et al used contrast echocardiography to detect PFO, while Erol et al have not mentioned the use of contrast echocardiography in their study. The reason for the large difference in PFO rate may be the lack of contrast use. It would have been better if the authors had addressed how they diagnosed PFO and how this might impact the diagnosis of PFO. In addition, it would be better if they had mentioned about whether they had a diagnosis of PFO by CTPA.

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