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Assessment of acute pulmonary embolism outcome in hospital through Tricuspid Annular Plane Systolic Excursion versus Pulmonary Embolism Severity Index score

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ABSTRACT

Background: In-hospital mortality of acute pulmonary embolism ranging from 0 to 50%, depending upon hemodynamic status and right ventricular dysfunction. RV enlargement, in normotensive PE patients is considered as a predictor of poor clinical outcome, even in initially stable patients.

Aim of the study: Evaluations of Tricuspid Annular Plane Systolic Excursion (TAPSE) as the prognostic tool for prediction of in hospital mortality in relation to the Pulmonary Embolism Severity Index (PESI) clinical risk score.

Patients and methods: This study was carried out in Dallah hospital Riyadh – Saudi Arabia including 50 patients diagnosed with APE. Those patients classified into three groups, Group I (20 patients) hemodynamically unstable, Group II (15 patients) hemodynamically stable with RV dysfunction and Group III (15 patients) hemodynamically stable with normal RV function. For all included patients TAPSE was measured, PESI risk score was calculated and recorded in the 1st day, 3rd day and 7th day of admission.

Results: Receiver operating characteristic (ROC) curve analysis of TAPSE determine that 14 mm was the optimal cutoff value (AUC) 0.994, $p < 0.001$ and for PESI determine that 124 points was the optimal cutoff value (AUC) 0.983, $p < 0.001$.

Conclusion: TAPSE and PESI can be used as a good prognostic tool in acute PE during hospital course and TAPSE has higher accuracy than PESI in mortality prediction. TAPSE value ≤ 14 mm can be used in judgment of thrombolytic therapy decision in hemodynamically stable APE patients.

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Introduction

According to hemodynamic status and right ventricular (RV) function of patients, acute Pulmonary Embolism (APE) can be divided into massive, submassive or mild. Massive PE is associated with systemic hypotension or cardiogenic shock, while submassive PE has only RV dysfunction without hypotension, and mild PE has neither systemic hypotension nor RV dysfunction [1].

RV dysfunction playing a crucial role in hemodynamic instability, as acute increase in right ventricular (RV) afterload leading to ventricular strain and dilatation that can proceed to ventricular

failure with cardiac arrest and death if not treated at the proper time [2].

In-hospital mortality rate of acute pulmonary embolism ranging from 5% or less to 25–50%, in mild and massive PE, while submassive PE associated mortality rate of 3–15% [3].

In initially normotensive APE patients poor clinical outcome is considered if RV dysfunction associated with injury [4] or enlargement even in initially stable patients [5].

Tricuspid Annular Plane Systolic Excursion (TAPSE) is one of global RV function parameters that describe apex-to-base shortening [6]. TAPSE can be measured easily by M-Mode echocardiography and showed excellent correlation with RVEF [7].

The Pulmonary Embolism Severity Index (PESI) was designed by Aujesky et al. in 2005, which comprises 11 frequently available clinical parameters with variable prognostic power [8]. On the basis of the PESI score, each patient is classified into one of five classes (I–V), with 30-day mortality ranging from 1.1% to 24.5%.

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Patients in classes I (less than 65 points) and II (66–85 points) are considered as low-risk and classes III (86–105 points), class IV (106–125 points) –V more than 125 points) are at high-risk.

Although The PESI used as a clinical prognostic model for patients with APE is a well validated and highly reliable [9] there was no available follow up study comparing PESI and echocardiographic criteria for detection of in hospital mortality to our knowledge.

Aim of the study

Our aim from this study is to evaluate the prognostic value of Tricuspid Annular Plane Systolic Excursion (TAPSE) as simple echocardiographic parameter for prediction of in hospital mortality in relation to the Pulmonary Embolism Severity Index (PESI) clinical risk score.

Patients and methods

This study was carried out in Dallah hospital Riyadh – Saudi Arabia including 50 patients diagnosed with APE, from December 2015 to December 2016. APE was confirmed by contrast-enhanced multidetector computed tomography or V/Q scan if CT pulmonary angiography is contraindicated.

Consent: the study was approved by institutional ethical committee, informed written consent was obtained from each patient including clause for using images and data for research purposes.

All patient admitted to our hospital with confirmed diagnosis of APE was enrolled in this study. The diagnosis of APE was confirmed by contrast-enhanced multidetector computed tomography or V/Q scan if CT pulmonary angiography is contraindicated.

All patients, underwent full medical history, physical examination, CT pulmonary angiography, Echocardiography, ECG and laboratory tests (D-Dimer, ABG, CBC, Kidney and liver function tests). PESI clinical risk score was assessed for all patient.

Exclusion criteria

Patients who received thrombolytic therapy before initial echocardiography study, with known cor pulmonale, chronic thromboembolic disease and patients died with 24 h of admission or patients refused enrollment in the study were excluded.

Those patients classified into three groups, Group I (20 patients) hemodynamically unstable (blood pressure <90 mmHg and/or Cardiogenic shock), Group II (15 patients) hemodynamically stable with RV dysfunction and Group III (15 patients) hemodynamically stable with normal RV function. For all included patients daily follow up was done with special consideration to parameters of PESI risk score and results were calculated and recorded in the 1st day, 3rd day of admission and 3rd PESI score calculated at day 7 of admission.

PESI clinical risk score calculation

Age per years, Male Sex (+10), History of Cancer (+30), History of Heart Failure (+10), Chronic Lung Disease (+10), Pulse ≥ 110 bpm (+20), Systolic B.P <100 mmHg (+30), Respiratory Rate ≥ 30 RR/min (+20), Temperature $< 36^\circ\text{C}$ (+20), Altered mental status, *(+60), Arterial oxygen saturation $< 90\%$ (+20)

*(disorientation, lethargy, stupor or coma).

Echocardiography

Transthoracic echocardiography to do routine assessment of RVD was done and interpreted according to a standardized proto-

col by experienced physician using an Echocardiography system (GE Medical Systems, Vivid 7, Norway), as soon as possible after admission. All examinations were recorded digitally. In the parasternal long-axis view both RV and LV diastolic diameters were measured. LV and RV diastolic diameters were measured in the apical 4-chamber view, during late diastole at the level of the mitral and tricuspid valve tips (defined by the electrocardiogram R-wave), EF of the left ventricular was done by Simpson's method. At peak systole (defined as the end of the T wave in the ECG) and in apical four chamber view by placement of M-mode cursor in the tricuspid annulus, TAPSE is the amount of longitudinal motion of the tricuspid annulus [10].

Echocardiography study was performed in the 1st day, 3rd and 7th day of admission.

PE treatment

Group I 13 patients received thrombolytic therapy, 4 refused the lytic therapy and three patients with contraindications to lytic therapy referred for surgical embolectomy.

Group II and group III patients in addition to the 4 patients who refused lytic therapy from group I were treated with subcutaneous low molecular weight heparin or I.V heparin infusion.

During Hospital course the condition of 4 patients from group II deteriorate and showed signs of haemodynamic instability which necessitate thrombolytic therapy administration.

Surgical embolectomy

Three cases from Group I were transferred for surgical embolectomy according to guidelines on emergency bases.

Surgical embolectomy was indicated according to American Heart Association (AHA) guideline which included a central or para-central (sub) massive embolism with one of the following situations: cardio-respiratory arrest, thrombus in the right heart, large patent foramen ovale (PFO), failure to respond to thrombolytic therapy, and absolute contraindications for thrombolytic therapy [11] (see Fig. 1).

Operative data

CT angiography showed central pulmonary embolism with large thrombus and there were extension in the right pulmonary artery in two of them, the third case had saddle shaped thrombus (Fig. 2).

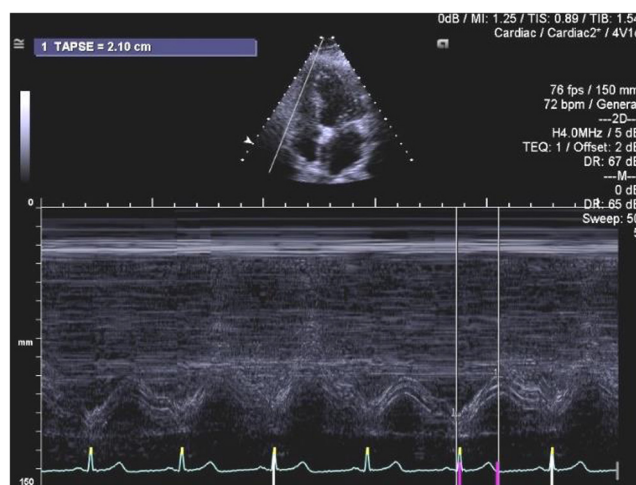


Fig. 1. Method of TAPSE measurement.

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