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ORIGINAL RESEARCH

Role of Clot Burden Score for Assessment of Right Ventricular Dysfunction in Patients with Acute Pulmonary Embolism

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Abstract

Background: Pulmonary embolism (PE) is a critical cardiovascular and pulmonary derangement and third most common cause of cardiovascular death. PE is a “great masquerader” because of non-specific presentation. In patients with suspected pulmonary embolism (PE) CT-pulmonary angiography (CTPA) is frequently performed and its relationship with Qanadli score (QS/clot burden score) assists the clinicians in early diagnosis and management. Our study highlights to determine the correlation between Q-score and parameters of right ventricular dysfunction (RVD) on CTPA in patients with acute pulmonary embolism.

Materials and Methods: A prospective observational study done on 100 patients with radiologically confirmed diagnosis of PE in department of radiodiagnosis at SMS Medical College, Jaipur, rajasthan during one year period. Total of hundred (100) patients with radiologically confirmed diagnosis of PE were included whose clinical details, Q-score and RVD parameters [Right ventricle/left ventricle diameter (RV/LV) ratio, interventricular septum morphology, Superior vena cava (SVC) diameter, Azygos vein diameter, pulmonary artery/aorta diameter (PA/Ao) ratio and IVC reflux were recorded. Correlation between Q-Score and RVD parameters were determined, and logistic regression analysis was applied to assess Q-score as a predictor of RV-dysfunction.

Results: A strong positive correlation was found between Q-score and RV/LV ratio, bowing of interventricular septum ($r>0.7$, $p<0.05$). Positive correlation between Q-score and PA/Ao ratio, SVC diameter, azygos vein diameter was also there after gender and age-based stratification. No significant correlation was found between Q-score and IVC reflux. ROC curve for QS showed a cut-off of 15 to precisely predict RVD.

Conclusion: Qanadli score (QS) ≥15 correlates well with indicators of right ventricular dysfunction of CTPA in patients with acute pulmonary embolism and confers a poor prognosis with higher Q-scores.
Keywords: Pulmonary Embolism, CTPA, RV Dysfunction, Qanadli Score/Q-Score, Clot Burden Score.

Introduction

Pulmonary embolism is the partial/complete obstruction of central or peripheral pulmonary arteries by thrombi.[1] It is third most common cause of cardiovascular death after MI and STROKE and account for 2-7% hospital deaths worldwide.[2] Due to vague clinical presentation, it remains a diagnostic challenge for clinicians and radiologists.[2] Annual Incidence of cases in Indian population is 23-69 cases per 1 lakh population with mortality of 11% within 2 weeks of diagnosis.[3]

Incidence of pulmonary embolism is rising because of various predisposing risk factors. Major risk factor for venous thromboembolism include dyslipidemia (43.3%), smoking (30%), immobilization due to recent trauma or surgery (26.7%), cancers (6.7%) mainly ovarian, pancreatic and lung cancers, hypertension (13.3%) and diabetes (10%).[3-5] Diagnostic algorithms are needed to assist clinical assessment and optimize the use of diagnostic tests especially in an emergency setting.[5,6]

Diagnostic algorithms and guidelines based on clinical probability combined with D- dimer-test and various imaging methods {echocardiography, compression ultrasonography of the deep veins of the lower limbs, invasive catheter pulmonary angiography, ventilation–perfusion (V/Q) scintigraphy, CTPA and Magnetic resonance pulmonary angiography (MRPA)}support the correct diagnosis.[7] CTPA is the diagnostic technique widely used due to its convenience, speed, sensitivity and its ability in visualizing clots and excluding other diagnoses.[8]

The main advantage of MDCT (multidetector computed tomography) is quick data acquisition and 3D reconstruction protocol. Short scanning time reduces artifacts by cardiac and respiratory motion, facilitating imaging of adjacent vessels.

Pulmonary embolism causes rapid increase in pulmonary vascular resistance that leads to right ventricular dysfunction (RVD) subsequently causing heart failure and death. Patients with PE having RVD have greater mortality rate than those without, despite being stable clinically.[9] Hence rapid risk stratification is important in selecting the appropriate treatment in these patients who may benefit from thrombolysis or embolectomy in addition to anticoagulation. Since CTPA can assess heart and its chambers, its prognostic value is enhanced by evaluation of the right ventricle.[10]

Quantification of pulmonary artery obstruction index using the scoring system of Qanadli et al[11] is an important variable in assessing the severity of PE. This index can be defined as the number of segmental arteries that are blocked and corrected by a factor of one for partial obstruction ortwo for completely obstructive PE. The highest possible score is 40 with this scoring system and the percentage of vascular obstruction is calculated by dividing the patient's score on the maximum total score (40) and multiplying the result by 100.[12]

Significant incidental vascular findings can also be detected on CTPA like aortic and coronary artery calcification, pulmonary artery dilatation and aortic aneurysms which warrant recognition and provide an alternative diagnosis.[13] CTPA has proven itself as the first imaging test because of its high negative predictive value for PE with high clinical probability or elevated D-dimer level. Hence CTPA is recommended in all patients with clinical suspicion of PE. CTPA has entirely taken over invasive catheter pulmonary

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angiography and V/Q scintigraphy as first line imaging tool in diagnosis of PE.[14] Our current study was to find out the correlation between an Qanadli score (QS) and parameters of right ventricular dysfunction (RVD) on CT pulmonary angiography in patients with acute pulmonary embolism.

Materials and methods

This prospective observational study was carried out on 100 patients with radiologically confirmed diagnosis of PE in department of radiodiagnosis at SMS Medical College, Jaipur, rajasthan during one year period after approval from institutional ethical committee.

Inclusion Criteria

- Patients suspected to have pulmonary embolism on the basis of history and clinical examination/x-ray/echo/doppler.
- Those who gave written and informed consent to be included in study.

Exclusion Criteria

- Patients with renal impairment (serum creatinine>1.5mg/dl), pre-existing chronic lung disorders and heart diseases which can increase the after load to right ventricle.
- High risk patient with BP<90mm of Hg, pulse rate >100/min., respiratory rate>25/ min., Po2>60.
- Clinically suspected patients with acute pulmonary embolism negative on computed tomography imaging.

Methodology

All 100 patients after complete clinical work-up {vitals, ECG, Echocardiography, lower limb venous doppler, D-dimer, Troponin-T, N-terminal pro-Brain Natriuretic Peptide (NT pro-BNP), PT-INR} who had radiologically confirmed evidence of PE were included in our study after taking written informed consent. Patients with creatinine >2.0mg/dL or contrast - induced allergy did not undergo CTPA. All patients with suspected acute pulmonary embolism underwent CTPA on a 128-MDCT scanner (Philips Ingenia) in a supine position and a scan being done in cranio-caudal direction. 120ml of a non-ionic contrast medium [Iohexol (Omnipaque 350mg/I)] was administered at a standardized flow rate of 4–5 ml/s followed by 50ml of saline bolus injected via the antecubital vein. Pulmonary arterial phase bolus tracking was done through main pulmonary trunk followed by aortic phase immediately following pulmonary arterial phase. Direct visualization of non-occlusive endoluminal thrombus seen as filing defect was searched in main/segmental/subsegmental pulmonary arteries.

The Qanadli score (QS) was calculated by assuming 10 segmental pulmonary arteries and a score of 1 was given to an embolus in each segmental pulmonary artery. An embolus in a more proximal artery was specified the value of all the segmental arteries distal to affected pulmonary artery. A weighting factor of 0 for no defect, 1 for partial occlusion and 2 for complete occlusion were assigned based on degree of occlusion. The maximum possible score was 40. Mediastinal pulmonary arteries (i.e., pulmonary artery trunk, main right and left pulmonary arteries, and right and left interlobar pulmonary arteries), lobar pulmonary arteries, segmental pulmonary arteries, and sub-segmental pulmonary arteries were used to reflect the most proximal level of the embolus. Peripheral arteries include segmental and sub-segmental pulmonary arteries whereas the rest were taken as central arteries.

RVD parameters (RV/LV ratio, interventricular septum morphology, SVC diameter, Azygos vein diameter, PA/Ao ratio and IVC reflux) were also recorded based on clot burden (QS<15

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and QS≥15) and outcome (survivors vs non-survivors). Interventricular septum morphology was classified as normal, flattened/bowing (depending whether its convexity is towards right ventricular cavity or left ventricular cavity respectively). Data were analysed using SPSS version 22.0 software.

Statistical analysis

Students t-test was used to compare continuous variables and Pearson's chi square was used for categorical variables. Pearson correlation coefficient (r) was calculated between QS and cardiovascular measurements. ROC curve for QS showed a cut-off of 15 to precise predict RVD. $P<0.05$ was considered as statistically significant.

Results

Among 100 patients having acute pulmonary thromboembolism, proportion of cases with right ventricular dysfunction was calculated using Qanadli scoring (QS)and its correlation was done with clinical findings and patient outcome.

The study consisted of 100 patients, with mean age of study population being 41.64± 16.03 years (Range: 18-76years) out of which 58% were male and 42% were females. Maximum number of patients (24%) in our study population belonged to the 3rd and 4thdecade.Dyspnoea was the most common presenting symptom (84%) followed by chest pain and cough. The most common presenting sign was tachycardia (HR>110/min) in 84% of the patients followed by hypotension.

The most common ECG findings were sinus tachycardia (82%) followed by S1Q3T3 pattern, and right bundle branch block (RBBB) pattern. Right ventricular hypokinesis was the most common echocardiographic finding found in 22% of the cases followed by D-shaped cavity in 15% and pulmonary artery dilatation in 12%.

The most common risk factor/comorbidity associated was DVT (58%) followed by history immobilization (42%) and history of surgery within 3 weeks (34%).

Procoagulant workup revealed 4 patients with serology positive anti- ds DNA antibody, 4 patients with hyperhomocysteinemia and 2 patients of protein-C deficiency. Investigations done for assessing the severity of pulmonary embolism revealed that Troponin-T and NT pro-BNP were significantly higher in patients with RVD.

Based on location of thrombus in pulmonary artery, 14% of patients had thrombus involving main pulmonary artery, 42% patient had thrombus in right pulmonary artery, 37% in left pulmonary artery. Saddle thrombus was present in 14 % of population which showed poorer prognosis with more proximal location of thrombus.

CT pulmonary angiographic parameters of right ventricular dysfunction in the study population showed the following findings:40 out of 100 patients (40%) in our study had RVD who presented with acute pulmonary embolism. The mean clot burden (QS) was 37.5 ± 22.5 points and 44% of patients had QS ≥15 points.46% of the patients had PA/AO ratio >1.0. IVC reflux was found to be Grade 1 in 16% of cases, Grade 2 in 14% of cases and Grade 3 in 4% of patients. Interventricular septal abnormality was identified in 40 (40%) patients. The mean SVC diameter and azygos vein diameter was 19.06±0.169 and 8.60±1.82 respectively. 42% of patients had pulmonary infarct identified as wedge-shaped consolidation on CTPA.

Association between cardiovascular parameters and mortality as demonstrated in [Table 1] revealed the RV/LV ratio, PA/Ao ratio, bowing of interventricular septum, IVC reflux, SVC, and azygos vein diameters were equivalent in survivor and non-survivor groups (deaths recorded during hospital course). In our study, cancer patients had higher mortality due to paraneoplastic embolism than those without malignancy. Mean age of non-survivor group is significantly higher than in survivor group. DVT was the most significant risk factor found in non-survivor group. IVC reflux grade 3 correlated well with the poor prognosis as there is a

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statistically significant correlation found between grade 3 IVC reflux and non-survivor group. The mortality rate was comparably higher in patients with higher Q-score. Multivariate regression analysis revealed that neither RV/LV ratio nor clot burden score were independent foreteller for mortality [Table 1].

ROC curve showed an area under the curve (AUC) for the prediction of RV dysfunction based on PA clot burden to be 0.897 (95% CI: 0.840–0.955, P = 0.001). In our study, the optimal cut-off value of QS for the identification of RV dysfunction was considered to be 15 based on highest pair of sensitivity (80%) and specificity (80%).

Clinico-radiological features of PE patients according to clot burden (QS <15 vs. ≥15) as shown in [Table 2]. The two groups were comparable for age, gender, and pre-existing comorbidities/risk factors. However, hypertension (50% vs. 21.4%; P < 0.05), higher Trop-T levels (43.2% vs. 7.1%; P <0.001), Pro-BNP levels (70.5% vs 14.3%) were highly significant in patients with QS ≥15. Among RV dysfunction parameters, RV/LV ratio (P < 0.001), bowing of interventricular septum (P < 0.001), PA/Ao ratio (P<0.05), SVC diameter (P<0.05), azygos vein diameter (P<0.001) was associated with higher QS. The mortality rate was comparable in patients with higher clot scores (QS ≥15) (13.6% vs 3.6%; P >0.05) as compared to low scores (QS <15).

A significant positive correlation was found between PA clot burden and RV diameter in four chamber view (r = 0.59, P < 0.001), RV/LV ratio (r = 0.577, P <0.001), and azygos vein diameter (r = 0.345, P = 0.04) .Moreover, LV diameter in four chamber view showed a significant negative correlation with clot burden (r = −0.352, P < 0.001) as shown in [Table 3].

Tables 1: CTPA findings of RV dysfunction

Variables	Survivors (N=92)	Non-survivors (N=8)	P value
Age(Mean—±SD)	39.61±14.92	65±7.96	(P<0.001)
DVT	50(86.2%)	8(13.79%)	(P<0.05)
Cancer	4(4.3%)	4(50%)	(P<0.001)
Abnormal Coagulation			
Protein C	2	0	P>0.05
Hyperhomocysteine	4	0	P>0.05
APLA	4	0	P>0.05
D-Dimer	8152.11±6494.2	7282.50±1258.3	P>0.05
PT-INR	1.33±.212	1.24±0.277	P>0.05
TROP- T	19(20.65%)	4(50%)	P>0.05
PRO-BNP	35(38.04%)	4(50%)	P>0.05
RV/LV RATIO	1.10±0.45	1.08±0.29	
<1.2	56(60.86%)	4(50%)	P>0.05
>1.2	36(39.13%)	4(50%)	P>0.05
Bowing Of Interventricular Septum	4(4.3%)	4(50%)	P>0.05
PA Diameter	28.26±4.79	29±3.29	P>0.05
Aorta Diameter	28.91±4.1	32±5	P>0.05
PA/AO Ratio			
>1	48(52.17%)	6(75%)	P>0.05
<1	44(47.82%)	2(25%)	P>0.05
SVC diameter	18.98±2.9	20±2.3	P>0.05
Azygos Vein Diamter	8.7±1.8	7.4±0.62	P>0.05
QS Score			

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>15 <15	38(41.30%) 54(58.69%)	6(75%) 2(25%)	P>0.05 P>0.05
INFARCTION (%)	40(43.47%)	2(25%)	P>0.05
IVC Reflux **No Reflux** **Grade 1** **Grade 2** **Grade3**	 62(67.39%) 16(17.39%) 12(13.04%) 2(2.17%)	 4(50%) 0 2(25%) 2(25%)	 P>0.05 P>0.05 P>0.05 P<0.05

(DVT-deep venous thrombosis, APLA- anti-phospholipid antibody, RV- right ventricle, LV- left ventricle, PA- pulmonary artery, Ao- Aorta, SVC- Superior vena cava, IVC- Inferior vena cava, QS- Qanadlii score)

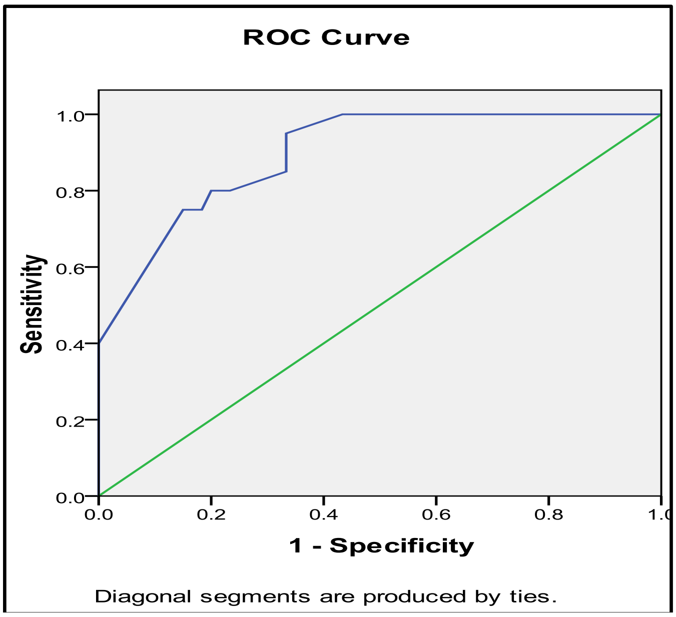

Table 2: Correlation between clinic-radiological parameters and clot burden.

Variables	QS<15(N=56)	QS≥15(N=44)	P
Males(%)	30(53.6%)	28(63.6%)	(P>0.05)
Age (MEAN±SD)	40.54±16.61	43.05±15.34	(P>0.05)
Abnormal Coagulation **Protein C** **Hyperhomocysteine** **APLA** **D-DIMER** **PT-INR**	 0 0 4(7.1%) 5953.36±3344.77 1.25±0.15	 2(4.5%) 4(9.1%) 0 10792.41±7868.223 1.42±0.25	 (P>0.05) (P<0.05) (P>0.05) (P<0.001) (P>0.05)
TROP-T(>0.017)	4(7.1%)	19(43.2%)	(P<0.001)
NT PRO -BNP(>133ng/ml)	8(14.3%)	31(70.5%)	(P<0.001)
Deep Venous Thrombosis(DVT)	26(46.4%)	32(72.7%)	(P>0.05)
Postpartum	18(32.1%)	4(9.1%)	(P>0.05)
Smoking	12(21.4%)	10(22.7%)	(P>0.05)
Hypertension	12(21.4%)	22(50%)	(P<0.05)
Obesity	18(32.1%)	6(13.6%)	P<0.05)
Diabetes Mellitus	14(25%)	14(31.8%)	(P>0.05)
History of Surgery	20(35.7%)	14(31.8%)	(P>0.05)
History of Polytrauma	10(17.9%)	6(13.6%)	(P>0.05)

History of Immbolisation	30(53.6%)	12(27.3%)	(P>0.05)
Cancer	4(7.1%)	4(9.1%)	(P>0.05)
Coronary Artery Disease (CAD)	4(7.1%)	8(18.2%)	(P>0.05)
Covid-19 Pneumonia	8(14.3%)	6(13.6%)	(P>0.05)
Echocardiography **1)Right Ventricular Hypokinesis** **2) D Shaped Cavity** **3) Pulmonary Artery Dilatation**	 2(3.6%) 0 6(10.7%)	 20(45.5%) 15(34.1%) 6(13.6%)	 (P<0.001) (P<0.001) (P>0.05)
CTPA FINDINGS			
RV/LV Ratio **<1.2** **>1.2**	 48(85.7%) 8(14.3%)	 12(27.3%) 32(72.7%)	 (P<0.001)
Bowing of Interventricular Septum	4(7.1%)	36(81.8%)	(P<0.001)
PA Diameter	27.32±5.1	29.59±3.70	(P<0.05)
Aorta Diameter	29.36±4.23	28.91±4.29	(P>0.05)
PA/AO Ratio **>1** **<1**	0.934±0.169 18(32.1%) 38(67.9%)	1.03±0.02 28(63.6%) 16(36.4%)	(P<0.05)
SVC Diameter	18.43±3.08	19.86±2.44	(P<0.05)
Azygos Vein Diameter	7.99±1.55	9.37±1.87	(P<0.001)
Infarction (%)	22(39.2%)	20(45.45%)	(P>0.05)
IVC Reflux **No Reflux** **Grade 1** **Grade 2** **Grade3**	 44(78.6%) 4(7.1%) 6(10.7%) 2(3.6%)	 22(50%) 12(27.3%) 8(18.2%) 2(4.5%)	(P>0.05)
Mortality	2(3.6%)	6(13.6%)	(P>0.05)

(DVT-deep venous thrombosis, APLA- anti-phospholipid antibody, RV- right ventricle, LV- left ventricle, PA- pulmonary artery, Ao- Aorta, SVC- Superior vena cava, IVC- Inferior vena cava, QS- Qanadlii score)

Table 3: Correlation between various cardiovascular measurements and RV dysfunction.

Measurements	Correlation Coefficient (r)	P Value
RV, four chamber	0.590	<0.001
LV, four chamber	-0.352	<0.001
RV/LV Ratio	0.577	<0.001
PA Diameter	0.0181	0.07
AO DIAMETER	-0.100	0.32
PA/AO Ratio	0.274	0.06
SVC Diameter	0.082	0.417
Azygos Vein Diameter	0.345	0.04

(RV- right ventricle, LV- left ventricle, PA- pulmonary artery, Ao- Aorta)

Discussion

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This prospective study gives insight into clinical profile of 100 hospitalized patients with confirmed diagnosis of pulmonary embolism based on CTPA and assess the correlation between clinico-radiological parameters and RVD with pulmonary clot burden.
The mean age of the study participants in our study was 41.64±16.03 years. The findings were consistent with the study by Tambe J et al[15] in which 37 cases of acute pulmonary thrombo-embolism detected with multi detector computed tomography. The mean age of these patients was 47±0.5 years.
In our study majority of patients were males (58%) with a Male to female ratio being1.3:1. This was similar to the study done by Kang DK et al[16]that showed that the majority of PE positive cases were males (53%). A similar observation was made in the study by Naes et al.[17]
The most common symptom in our study was dyspnoea similar to results in PIOPED I study.[18] The most common presenting sign in PIOPED II[18] study was tachypnoea which correlated well with our study.
The most frequent ECG finding in our study was sinus tachycardia irrespective of clot burden score which was similar to results in PIOPED study.[18]
On echocardiography, patients having RV hypokinesis were 22%, D shaped cavity were 15% suggesting RV dysfunction and pulmonary artery dilatation was seen in 12% patients which was similar to the study by El-Menyar et al.[19
Earlier studies suggested that echocardiography is effective in predicting RV dysfunction and clinical outcome.[20] However echocardiography is now recommended mainly for hemodynamically unstable patients because of its lower sensitivity.
In comparison to echocardiography, CTPA not only assess embolization in the pulmonary arteries but also detects other pulmonary disorders and acute cause of chest pain.[21] Moreover, it helps risk stratification of patients based on the degree of vascular obstruction which could be used as a marker for selection of suitable treatment.[8]Apart from the size of embolus, the clinical consequence of patients with PE also relies on various cardiopulmonary dimensions (RV diameter, LV diameter, RV/LV ratio, PA, AO diameter, and PA/AO ratio) measured by CTPA.
The various risk factors associated were deep venous thrombosis, bed ridden status/immobilisation, history of surgery within 3 weeks, postpartum, history of polytrauma, hypertension, diabetes mellitus, smoking, COVID-19 pneumonia, history of coronary artery disease, malignancy similar to the study results in RIETE registry.[24] Malignancy was the most significant risk factor associated with poor prognosis and mortality.
Elevated Troponin-T and NT pro-BNP (>133 nanogram/l) were significantly associated with RV dysfunction similar to study by T Henzler et al.[25]
ROC curve analysis showed a cut-off value of QS≥15 (clot burden 37.5%) for the identification of RV dysfunction which was considered based on highest pair of sensitivity (80%) and specificity (80%).
In the study by El-Menyar et al,[19] ROC curve analysis determined the cut-off point for obstructive index (QS) to be 17.5 points (clot burden of 43.7%) which could foresee RV dysfunction with reliable sensitivity (77.8%) and specificity (72.2%).
Qanadli scoring (QS) is important as it helps direct visualization of the clot and accurate diagnosis of PE.[26] The present study quantified clot burden scoring according to QS since it is easier to calculate, can distinguish between partial and complete obstruction, and has less inter-observer variability. Previous studies have identified the clot burden score to be a predictor of RV dysfunction and poor outcomes.

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Qanadli et al.[27]found that an higher obstruction score correlates well with RV dilatation similar to our study. Another study described significant correlation between QS,RV/LV ratio, IVC reflux, and the short term PE related mortality.[28]Consistent with these reports, our findings revealed no correlation of clot burden with in hospital mortality(within duration of hospital stay) except for IVC reflux Grade III showed statistically significant correlation between survivors and non-survivor groups similar to Kang et al. This variability can be explained by other factors such as mechanical obstruction, vasoactive agents, reflex vasoconstriction, and systemic hypoxemia.[28] However, obstructive index can precisely be used as an indicator for severity and treatment response of PE.

The appraisal of cardio-respiratory status secondary to an acute PE should not only depend on the degree of pulmonary obstruction but also contemplate the signs of RV strain (RV/LV diameter ratio >1) as a potential indicator for the RV dysfunctions, which occurs due to sudden increase in the afterload caused by mechanical obstruction and vasoconstriction. In our study, no correlation was found between RV dysfunction (RV/LV ratio>1.2) and PE related mortality which was similar to previous studies like Araoz PA et al, Stein PD et al, which suggest that RV/LV ratio and clot burden are not associated with PE related mortality. These controversies could be partially explained by the variability in measurements of RV/LV ratio.

In our study, hypertension (50%) and D-dimer were significantly correlated with severity of clot burden (QS ≥15) which was similar to the study by El-Menyar et al.[19]

According to our study, 72.7% of patients had RV/LV ratio >1.2 who had larger clot volume as compared to those without RV dilatation. Similarly, the larger clot volume (QS ≥15) was observed in patients with inter-ventricular septal defect including bowing/straightening (81.8%) in comparison to patients with normal inter-ventricular septal morphology similar to the study by Araoz et al.[27]The higher clot volume blocks the pulmonary circulation, causing RV pressure overload and its dilatation. Therefore, assessment of the degree of vascular obstruction (clot burden) would aid in the PE risk stratification in clinical practice and treatment monitoring. Moreover, we found a significant positive correlation between RV/LV ratio and PA diameter with clot burden (QS). Our findings concurred with earlier studies which also detected a good correlation between severity of obstruction and RV dysfunction parameters (RV/LV ratio and PA diameter).[8]

We observed no significant difference between mortality and clot burden which is consistent with an earlier study by Rodrigues et al.[8]

The present study highlighted that RV/LV ratio and clot scores were not independent predictors for mortality which was similar to observations by El-Menyar et al.[19]Mean SVC diameter and azygos vein diameter was significantly higher in patients with QS≥15 which is similar to study by Collomb et al[28]and Furlan et al[29] respectively.

Conclusions

Clot burden determined by Qanadli score (QS) correlates firmly with indicators of RV dysfunction on CT Pulmonary Angiogram and can be used to anticipate a higher mortality risk and guide treatment accordingly in patients with acute pulmonary embolism.

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