Deep Vein Thrombosis in Patients Admitted for Exacerbation of Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: There is a lack of data on the prevalence of deep vein thrombosis and pulmonary embolism in patients admitted to hospital for exacerbation of chronic obstructive pulmonary disease. Studies have found that most pulmonary embolism originate from deep vein thrombosis in the lower limbs, thus the prevalence of deep vein thrombosis may give an accurate reflection of the prevalence of pulmonary embolism. The aim of our study was to determine the prevalence of deep vein thrombosis in these patients, using duplex ultrasound of the lower limbs as the screening tool.

Methods: Thirty-three male patients admitted to the general ward for exacerbation of chronic obstructive pulmonary disease were screened for presence of deep vein thrombosis of the lower limbs using duplex ultrasound scan.

Result: No patient in this study was found to have deep vein thrombosis of the lower limbs.

Conclusions: The prevalence of deep vein thrombosis in local patients admitted for exacerbation of chronic obstructive pulmonary disease is likely to be low. We do not recommend the use of duplex ultrasound to screen for deep vein thrombosis in this group of patients.

Keywords: chronic obstructive pulmonary disease, deep vein thrombosis, pulmonary embolism, venous thromboembolism, duplex scan

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INTRODUCTION

There is a lack of data available regarding the prevalence of deep vein thrombosis (DVT) and pulmonary embolism (PE) in patients with exacerbation of chronic obstructive pulmonary disease (COPD) despite evidence that presence of thromboembolic diseases may have adverse effect on outcome[1,2]. The prevalence of DVT in COPD patients requiring hospitalisation in the West is generally accepted to be in the range of 12 to 15%[3], although some studies have reported rates more than 20%[4].

Extensive clinical and post-mortem studies have established that more than 90% of PE originates from venous thrombosis in the deep veins of the lower limbs[5,6]. The prevalence of DVT of the lower extremities in a group of patients may therefore reflect the prevalence of PE.

The aim of our study was to determine the prevalence of DVT in local patients admitted to hospital for COPD exacerbation, using duplex ultrasound of the lower limbs as the screening tool.

METHODS

We conducted a prospective study on the prevalence of DVT using duplex ultrasound scan of the lower limbs on patients admitted to the respiratory wards, Tan Tock Seng Hospital for COPD exacerbation from July 1999 to Jan 2000. The hospital's ethics committee approved the study protocol. Informed consent was obtained from all study patients. Enrolment was consecutive except during weekends when the investigators were not available to perform the duplex ultrasound scan. The diagnosis of COPD was based on the following features: a history of cigarette smoking, progressive dyspnea and obstructive lung function as indicated by a ratio of FEV_1 to FVC of less that 70%. Patients were recruited to the study if they fulfilled the American Thoracic Society criteria for COPD exacerbation, as defined by a history of COPD with increased dyspnea, wheezing, cough or production of sputum[7]. COPD patients with malignancy, pneumothorax, left ventricular failure, neurological diseases or history of DVT were excluded. In addition, patients on anticoagulation therapy for any reason were also excluded. Patients' demographic data, smoking history, duration of COPD, frequency of exacerbations, functional status prior to the current exacerbation, and presence of any co-morbid conditions were determined. The mode of presentation and the types of symptom were established.

All patients had the following investigations done on admission: full blood count, arterial blood gas

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Table I. Clinical characteristics of study subjects.

	Number of patients (n=33)
Age, year, mean ± SD	73.8 ± 8.8
Duration of COPD, year, mean ± SD	18 ± 6.2
Spirometry	
FEV_1, L, mean ± SD	0.91 ± 0.36
% Predicted FEV_1, mean ± SD	41.7 ± 18.5
FVC, L, mean ± SD	2.13 ± 0.78
Haemoglobin, g/dl, mean ± SD	14.2 ± 1.29
Clinical Presentation	
Acute dyspnea	32 (96.7%)
Pleuritic chest pain	1 (3.0%)
Haemoptysis	0 (0%)
Lower limb swelling	0 (0%)
Blood gases at presentation	
PAO_2/FiO_2 < 300 mmHg/%	3 (9.1%)
$PACO_2$ > 45 mmHg	10 (30.3%)
pH < 7.35	5 (15%)

Table II. Radiographic and electrocardiographic characteristics.

	Number (% of patients) with feature (n=33)
Electrocardiogram	
Tachycardia	22 (66.7%)
P pulmonale	12 (36.4%)
Right axis deviation	7 (21.2%)
Right bundle branch block	4 (12.1%)
Right ventricular hypertrophy	2 (6.1%)
S1Q3T3 pattern	0 (0%)
Chest radiograph	
Parenchymal infiltrates	20 (60.6%)
Cardiomegaly	5 (15.2%)
Pleural-based opacities	2 (6.1%)
Raised hemidiaphragm	1 (3.0%)
Oligaemic lung field	1 (3.0%)
Pleural effusion	0 (0%)

analysis, an electrocardiogram and a chest radiograph. Spirometry was performed subsequent to the current exacerbation for patients who did not have one done in the last six months. Duplex ultrasound study of both lower limbs was performed within 24 hours of admission for all patients in the study.

Ultrasound scans were done on either an Acuson Sequioa system, using a linear probe with frequencies ranging from 3 to 6 MHz, or an Acuson XP 10 system, using a 5 to 7.5 MHz linear probe. Scans were done by the same radiologist or by a sonographer and checked by the radiologist. Scan techniques involved grey scale assessment and compressibility, and the use of Doppler ultrasound to assess presence of flow as well as phasicity and response to augmentation. The veins were studied from the groin till the ankle. The presence of DVT was established using widely accepted standard[8,9]. A scan was considered negative when all the following features were fulfilled: full compressibility, absence of echogenic material within the vein lumen, and normal doppler characteristics.

RESULTS

Thirty-three patients were studied out of a total of 35 patients. Two patients refused to participate in the study. All subjects were male and their clinical characteristics were shown in Table I. Our patients had moderately severe COPD with a FEV_1 of 41.7% of predicted value. All of them presented with breathlessness and increased cough. No patient had symptoms or clinical signs suggestive of DVT in the lower extremities. Only five study patients had decompensated COPD, as defined by the presence of respiratory acidosis with pH < 7.35 and $PACO_2$ > 45 mmHg on admission. None of the other patients developed respiratory failure requiring intensive care management during the hospitalisation. There was no death in our study group.

Radiographic and electrocardiographic findings are shown in Table II. Specific electrocardiographic signs suggestive of PE such as S1Q3T3 pattern and right ventricular hypertrophy were either absent or infrequent. Pleural-based opacity, raised hemidiaphragm, oligaemic lung field and pleural effusion were rare.

None of our study patients had evidence of DVT of the lower limbs. All subjects studied fulfilled criteria for a negative duplex scan. In all except three patients there were good visualisation of calf veins.

Based on an estimated western figure of 12 to 15% prevalence[3] for DVT in hospitalised COPD patients and setting the criterion for significance at 0.05, a sample size of 33 in our study would give us a power of more than 90% to detect a statistically significant result.

DISCUSSION

To the best of our knowledge, no data is available on the prevalence of DVT and PE in local patients admitted for COPD exacerbation. This study was done to determine the prevalence of DVT in this group of patients using duplex ultrasound of the lower limbs as the screening tool. Previous studies have found that most cases of PE arise from DVT of the lower extremities and one may expect the occurrence of DVT to be an accurate reflection of the occurrence of PE. In fact, some authors consider the two to be part of the same pathological process[10,11]. Duplex ultrasound was used for detecting DVT, as it was non-invasive, readily available, and shown to be applicable with high sensitivity and specificity in local patients[12].

PE has been found at postmortem in up to 51% of those patients who had had COPD[13]. In an analysis of PIOPED study population, about 20% of 108 patients

with COPD had PE[14,15]. Analyses by Carson et al have shown an increase in mortality at one year in COPD patients with PE[1].

The prevalence of venous thromboembolic disease in COPD varies widely in different studies[4,16-18]. Winter et al in particular screened 29 COPD patients admitted to the general thoracic wards for the presence of DVT and found an alarmingly high prevalence of 44.8%. The use of radionuclide scanning in that study may be the reason for such a high pickup, but such high prevalence still suggests that DVT may be common enough in COPD patients with exacerbation to warrant routine screening. Using duplex ultrasound as a screening tool, Schönhofer and Köhler demonstrated the presence of DVT in 10.7% of their COPD patient admitted to the intensive care unit for respiratory failure.

In our study, there was no patient with DVT in the lower extremities detected on duplex ultrasound. There may be several possible explanations for this result.

DVT and PE may not be a common entity in local population. Previous epidemiological studies have suggested that venous thromboembolism may be uncommon in Asian population[19-22]. Thrombophilic state secondary to mutation like the Leiden V also appeared to be rare in Southeast Asians[23].

It is possible that DVT and PE will be more likely in the setting of severe decompensated COPD. Most published data on the prevalence of DVT and PE in COPD involved patients with decompensated COPD[16,17] and patients admitted to intensive care units[18]. In contrast, our patients had less severe exacerbations, and this could be a reason for our negative study.

It is known that the sensitivity of duplex ultrasound scan is lower in patients without symptoms or signs of DVT[8,9]. None of our study patients had clinical features suggestive of thrombosis in the deep vein of the lower limbs.

Ventilation-perfusion scan of the lungs was not used in our study, as the results are difficult to interpret in patients with abnormal pulmonary pathophysiology[24-26]. Alternative investigation like spiral CT of the thorax have been reported[27] recently to be a useful tool for the diagnosis of PE, however its use as a screening tool in COPD patients is not known.

Despite the limitations due to the lower sensitivity of duplex scanning in patient with no signs and symptoms of DVT, and the screening of patients with relatively milder form of COPD exacerbation compared to earlier studies, the disparity between our DVT prevalence rate and that found in the West cannot be ignored. However, whether one would expect a similar lower prevalence in local COPD patients with respiratory failure requiring ICU care is unknown. Further study is needed to determine the value of DVT screening in that setting.

We conclude that DVT and PE may be uncommon in local COPD patients admitted to the general ward for exacerbation of their disease. Based on our study, we do not recommend that duplex ultrasound of the lower limbs be used as a routine screening tool for DVT in this cohort of patients.

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