Autopsy proven pulmonary embolism in hospital patients: are we detecting enough deep vein thrombosis?

D A Sandler MD MRCP **J F Martin** MD MRCP *Department of Medicine, Royal Hallamshire Hospital, Sheffield S10 2JF*

Summary

To investigate the present status of pulmonary embolism as a cause of death in a general hospital patient population, a 5-year retrospective study of all autopsy reports and associated hospital records was undertaken. Pulmonary embolism was thought to be the cause of death in 239 of 2388 autopsies performed (10%): 15% of these patients were aged less than 60 years and 68% did not have cancer. Of these patients, 83% had deep-vein thrombosis (DVT) in the legs at autopsy, of whom only 19% had symptoms of DVT before death. Only 3% of patients who had DVT at autopsy had undergone an investigation for such before death. Twenty-four per cent of patients who died from pulmonary embolism had undergone surgery a mean of 6.9 days before. Screening tests for DVT should be applied widely in the hospital population.

Introduction

Pulmonary embolism (PE) is a serious cause of mortality in both surgical and non-surgical patients[1] and most pulmonary emboli are associated with deep vein thrombosis (DVT) in the legs[2]. X-ray venography for the diagnosis of DVT was established many years ago[3]. Since then, many techniques have been developed for the diagnosis of DVT and these have been recently reviewed[4]. During this same period, the prevention of DVT has been attempted using several therapeutic regimens[5]. However, it is known that DVT can be difficult to diagnose[4] and that death may be the first manifestation of PE[6].

We have, therefore, investigated the incidence of DVT and fatal PE in hospital patients to see if it remains a serious problem, and whether there is a need for the widespread use, in hospitals, of a non-invasive, inexpensive screening test.

Methods

The Royal Hallamshire Hospital, a teaching hospital in a city of approximately 650 000 residents, incorporates most general and specialist services, but not paediatric, obstetric and gynaecological nor special facilities for the health care of the elderly. Otherwise, its admission rates and policies are not thought to be different from any British district general hospital in a teaching area.

The reports of all autopsies performed in the Royal Hallamshire Hospital between 1979 and 1983 were reviewed. The records of all patients in whom pulmonary embolism was judged by the pathologist performing the autopsy to have contributed primarily to death were further investigated.

In each of these patients, DVT had been sought at autopsy either by dissection and examination of the femoral veins, or by removing and slicing blocks of calf muscle, or both.

Further information obtained about these patients from the hospital inpatient notes included whether DVT was suspected clinically before death, as indicated by the medical attendant's written notes (and whether or not the patient had been treated with anticoagulants or fibrinolytics), whether any objective investigation for suspected DVT had been performed (those available in this hospital included X-ray venography, doppler ultrasound and impedance plethysmography), and details of any surgical procedure performed.

The total number of admissions and deaths in the hospital during the study period were obtained from the Data Control Centre of the Sheffield Area Health Authority.

Results

During the period 1 January 1979 to 31 December 1983, there were 66 100 inpatient admissions to the Royal Hallamshire Hospital in Sheffield, and there were 6085 (9.2%) deaths. Autopsies were performed on 2857 deceased patients (47%) and the reports of 2388 autopsies (84%) were available for scrutiny. Of these, 313 patients were shown to have pulmonary embolism and in 239 (10%) the pulmonary embolism (PE) was thought to have substantially contributed to the death. It was possible to review the case notes of 195 (82%) of those in whom PE was the cause of death. Of the 195 patients, only four had clinically suspected PE on admission to hospital and a further five had a clinical diagnosis of PE made whilst in hospital.

Table 1. *Details of age, sex, whether deep vein thrombosis (DVT) was clinically suspected, objectively proven and later found at autopsy in 195 patients who died of pulmonary embolism*

Number of patients		195
(male : female)		(86 : 109)
Mean age (years)		72
(range)		(28–92)
DVT suspected clinically before death?	yes	38 (19%)
	no	157
DVT objectively diagnosed before death?		5 (3%)
DVT found at autopsy?	yes	162 (83%)
	no	12
	unknown	21

Details about the age and sex of the patients studied, whether DVT had been clinically suspected or objectively diagnosed before death and whether DVT had been found at autopsy are given in Table 1. Fifteen per cent of the patients were aged less than 60 years at death. DVT was identified at autopsy in 162 (83%) of the 195 patients who died of PE. Thirty-eight (19%) of these patients had symptoms of DVT before death and five (3%) had an objective test to confirm the diagnosis.

Patients died between 0 and 100 days after admission (mean 12.9 days, median 8 days). Forty-eight (24%) of the 195 patients who died of PE had undergone a surgical procedure relating to their last illness. The time from surgery to death was a mean of 6.8 days. Three patients died of PE whilst under-going surgery: one during femoral thrombectomy and two during amputation of ischaemic limbs. Thirty two per cent of the patients studied were shown to have had a malignant disease at the time of death.

Eleven patients (6%) were receiving full anti-coagulation because of the clinical diagnosis of DVT or PE made before death.

Discussion

This study shows that death from pulmonary embolism is a frequent complication in hospital patients and, as retrospective analysis is likely to underestimate the problem[7], the finding that 10% of patients under-going autopsy died of PE may itself be a serious underestimate of the true incidence. Of the 195 patients studied, only four were admitted to hospital with a diagnosis of suspected PE and a further seven because of suspected DVT.

Homans first noted the relationship between DVT and PE in 1934[8]. In the present study, DVT was present in at least 83% of the patients who had a fatal PE and therefore screening the legs for the presence of DVT might be sufficient to prevent many of these fatalities.

The occurrence of DVT in hospital patients can be reduced by prophylactic measures[5], but if DVT does occur, adequate treatment will reduce the incidence of PE[9]. However, it is known that DVT may be asymptomatic[10] and its initial presentation may be that of a fatal PE[6]. In 63% of the cases in the present study, the DVT found at autopsy had given rise to no clinical symptoms before death, and it is these patients in whom screening might have resulted in early diagnosis. Only 3% of the patients studied had had an investigation for DVT.

The number of preventable deaths is purely speculative, although it is worthy of note that two-thirds of the patients studied were not suffering from a malignancy at the time of death and a considerable number were aged less than 60 years of age.

We did not identify those patients in the study population who received prophylactic anticoagulation before death, but 11 patients were being fully anticoagulated at the time of their fatal pulmonary embolism.

We are aware of potential sources of error in our study. A considerable number of patients (53%) who died in hospital did not have an autopsy. In other studies, autopsy rates have ranged from 40 to 70%[11-13]. There was no standard procedure for autopsy and the experience, thoroughness and motivation of the pathologists will have greatly in-fluenced the detail and quality of both the autopsy

report and the significance assigned to the finding of pulmonary embolism. The study sample was incomplete because some autopsy reports and clinical case notes could not be located and those patients had to be excluded. Variable standards of clinical note keeping affected the amount of information that was obtained about each patient. Each of these factors will have affected our estimate of the frequency of autopsy-proven PE. Routine autopsy itself will underestimate the true incidence of PE[6,14] and although the rate of detection can be increased by fixation of the lung by inflation with formalin and careful sectioning[14,15], routine techniques in this hospital found fatal pulmonary embolism in 10% of autopsies. Other studies have found the incidence to be between 9% and 21%[1,6,11,14,17].

This study has demonstrated that PE is still a major cause of death in hospital patients despite advances in diagnosis and treatment of this condition. A 10% incidence of hospital patients dying of PE is un-acceptably high, since PE is preventable and treatable. Screening tests for DVT should be applied widely and frequently in the general hospital population. Such tests should be relatively non-invasive to reduce patient morbidity and increase patient acceptability. The tests should be relatively quick and inexpensive to favour widespread use, and they should be accurate and reliable. Such tests could include the fibrinogen-uptake test (FUT) which is widely used in studies of the prevention of DVT in at-risk patients[18]. Although only accurate for DVT in the distal veins, a positive FUT represents DVT in over 90% of cases[19], but there is argument about whether DVT confined to the calf gives rise to pulmonary embolism[20]. Impedance plethysmography, with its overall sensitivity of 95% and specificity of 96% for proximal DVT[18], would be a useful test for the development of DVT in the proximal veins. Other non-invasive screening tests have predominantly been evaluated in patients with symp-toms, and one such test, liquid crystal thermography with its 97% sensitivity and 96.5% negative-prediction value[21], may be worth evaluating in asymptomatic, at-risk patients. Further non-invasive methods for screening for DVT and PE need to be developed.

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