Pulmonary embolism—incidence and prognosis in hospitalized elderly

D.M. Mangion

Department of Medicine for the Elderly, Barnsley District General Hospital, Gawber Road, Barnsley S75 2EP, UK.

Summary: In a retrospective study of 210 patients with pulmonary embolism diagnosed by ventilation perfusion lung scan or at post-mortem, the incidence of pulmonary embolism was greater in patients over 50 years old (1.4%; $P < 0.05$). This was largely due to an increased prevalence of serious associated disease (53%; $P < 0.05$).

Mortality in elderly patients (70 years and older) diagnosed by ventilation perfusion lung scan was similar to that in younger age groups ($P > 0.05$). However, the number of cases first diagnosed at post-mortem (44, 50%; $P < 0.05$) and total mortality (55%; $P < 0.05$) were highest in this age group. Of elderly patients first diagnosed at post-mortem 14 (32%; $P < 0.05$) had no other associated disease and had a recorded duration of symptoms sufficient to have allowed premortem diagnosis.

Introduction

Pulmonary embolism (PE) is a common clinical problem in hospitalized patients. The number of deaths from PE in these patients increases with age and few deaths occur below the age of 50 years.¹

Although some studies suggest an increased incidence^{2,3} and mortality³ from PE in patients over the age of 70 years, these predate the extensive use of ventilation perfusion (V/Q) lung scanning and pulmonary angiography. A number of post-mortem studies have found a higher incidence of PE in the over 70s.^{4–8} This may reflect an increased frequency of diagnoses missed premortem,⁹ as well as a higher prevalence of associated disease in the elderly.⁸

This study was undertaken to compare the incidence and mortality from PE in hospitalized elderly (70 years and older) with those in younger age groups.

Methods

All cases of PE diagnosed in patients aged over 15 years in the Departments of General Medicine and Geriatrics at Barnsley District General Hospital between 1st January 1983 and 31st December 1985, and the total number of patients admitted, were identified via the Hospital Activity Analyses files. For the purposes of comparison patients were divided into 3 age groups: (A) 15–49 years; (B) 50–69 years and (C) 70 years and older.

Out of 298 patients with a diagnosis of PE, the records were unavailable in 23 (8%) and 65 (22%) did not fulfil the criteria or had incomplete data. The records of 24 patients (75%) in group A (mean age 35.2 years; female = 10), 95 (69%) in group B (mean age 61.5 years; female = 37) and 91 (71%) in group C (age range 70–91 years; mean 77.5 years; female = 46) were analysed. The post-mortem rate was obtained from the records of the Department of Pathology and was 40% in group A, 37% in group B and 34% in group C.

The diagnosis of PE was considered definite if: (1) a combined V/Q scan showed either segmental unmatched perfusion defects or perfusion defects larger than corresponding ventilation defects, in the absence of corresponding radiographic shadowing on a recent chest X-ray;^{10, 11} or (2) a diagnosis of PE as a major cause of death was first made at post-mortem.

V/Q scans were performed using 133 xenon and 99m technetium labelled albumin and were interpreted by an experienced radiologist.

Details of associated diseases predisposing to PE^{12,13} or immobility were obtained from clinical, radiological, laboratory and autopsy data recorded in the medical records. For the purposes of this study, myocardial infarction was diagnosed according to WHO criteria.¹⁴ Cardiac failure was diagnosed on clinical and/or radiological signs of pulmonary congestion resulting in treatment, or autopsy evidence. Malignancy was diagnosed on clinical and histological and/or radiological or autopsy evidence. Sepsis was diagnosed on clinical findings, together with positive bacteriology or autopsy evidence. Stroke was defined

Correspondence: D.M. Mangion, M.R.C.P. (UK).
Accepted: 1 June 1989

as a neurological deficit of sudden onset persisting longer than 24 hours.¹⁵ Deep vein thrombosis (DVT) was diagnosed on the basis of a history of unilateral leg swelling, or on autopsy evidence; venography was performed infrequently. The records were also reviewed for a history of immobility (in the absence of life threatening disease), atrial fibrillation (electrocardiographic evidence), oestrogen therapy and pregnancy.

Predisposing factors were classified as 'serious' where the underlying condition itself was of serious prognosis (recent myocardial infarction, cardiac failure, malignancy, stroke and sepsis) and 'non-serious' where prognosis was excellent but for PE.

Follow-up data at 6 months was obtained in all patients with 'non-serious' predisposing factors via hospital or general practitioner records. No cases of neoplasia or cardiovascular disease were diagnosed on follow-up.

Statistical analysis was carried out by chi-square test with Yats's correction.

Results

PE was diagnosed by V/Q scan in 141 patients. A further 69 cases were first diagnosed at post-mortem (Table I).

There was no significant sex difference in the incidence of PE in any group ($P > 0.05$). The incidence of PE in group C (1.4%) was similar to that in group B (1.5%) but was significantly higher than in

group A (0.6%) ($P < 0.05$, relative risk 2.3, 95% CL 1.5–3.6). This reflects the higher prevalence of serious associated disease in groups C (52%) and B (53%) compared to group A (25%) ($P < 0.05$) (Table I). When patients with serious associated disease were excluded, there was no significant difference in the incidence of PE between the different age groups (A 0.4%; B 0.7%; C 0.7%) ($P > 0.05$). Predisposing factors for PE are listed in Table II.

Mortality in patients diagnosed by V/Q scan was 9% (95% CL 4–14%); there was no significant difference between the three age groups (A 8%; B 7%; C 13%) ($P > 0.05$) (Table I). Anticoagulants were used in 24 patients (100%) in group A, 67 (95%) in group B and 43 (96%) in group C. However, more patients in group C were first diagnosed at post-mortem (48%) than in group B (25%) ($P < 0.05$) or group A (0%) and overall mortality was highest in this age group (55%) (Table I).

Of all patients first diagnosed at post-mortem, 39 (57%) died suddenly or soon after admission. However, 30 had a recorded duration of symptoms after admission [dyspnoea (81%), chest pain (20%), pleurisy (14%) and haemoptysis (9%)] ranging from 1–6 days (median 2 days). Of these, 17 (57%) had no other underlying pathology; the incidence of such deaths was higher in the elderly (B 3/95, C 14/91, $P < 0.05$).

Table II Predisposing factors 210 patients with PE.

	Age group		
	A n = 24	B n = 95	C n = 91
'Serious' [†]			
Recent MI	2	15 (1)	15 (4)
Cardiac failure	1	13 (3)	13 (8)
Neoplasia	3	17 (8)	7 (4)
Sepsis	0	2 (1)	6 (5)
Recent CVA	0	4 (2)	3 (3)
Other	0	1 (1)	3 (3)
'Non-serious' [†]			
DVT only	1	12 (8)	21 (15)
Immobility	1	3 (1)	8 (2)
Post operation	3	3	3
Atrial fibrillation	3	7	0
Oestrogen therapy	2	0	0
No predisposing factor recorded	8	20	12

Numbers at post-mortem in parenthesis (); MI = recent myocardial infarction; CVA = cerebrovascular accident. Other = hepatocellular failure (2), renal failure (1), fibrosing alveolitis (1).[†] See text.

Table I Incidence of pulmonary embolism, prevalence of associated 'serious'[†] disease and mortality in different age groups

	A	Age group B	C
Admissions	4088	6554	6374
Diagnosed at post-mortem	0 (–)	25 (16)	44 (27)
Diagnosed by V/Q scan	24 (6)	70 (34)	47 (20)
Total	24	95	91
Mortality in patients diagnosed by V/Q scan	2 (1)	5 (5)	6 (5)

Number with associated 'serious' disease in parenthesis().

[†] See text.

Discussion

In this study, the incidence of PE was higher in patients aged over 50 years (1.4%) than in younger age groups. However, there was no further increase after the age of 70 years. Although this was a retrospective study, the availability of records and post-mortem rates were similar in the three age groups ($P < 0.05$).

The incidence of PE in this study is likely to be an underestimate since the post-mortem rate was low and cases diagnosed on the basis of clinical grounds only or by scans showing subsegmental perfusion defects or ventilation defects equal to or greater than perfusion defect were excluded, as diagnosis on these grounds is considered unreliable.^{6,10,11,16} Pulmonary angiography was not routinely available during the period of study but V/Q scanning was widely used for the diagnosis of PE in Barnsley, even in the elderly. V/Q scanning has been criticized as being non-specific¹⁷ but the criteria used in this study have been found to correlate well with pulmonary angiography.^{10,11}

Advanced age is often quoted as a risk factor for PE.^{12,13,18} Although the prevalence of associated disease predisposing to PE increases with age, few studies have analysed the effect of age *per se* on the incidence of PE. Because of its retrospective nature, this study is limited by the accuracy of recorded data. Nevertheless, no additional cases of neoplasia or cardiovascular disease were found on follow-up.

Although no definite predisposing factor was demonstrated in 19% of cases, this probably reflects the difficulties in the clinical diagnosis of DVT; in a post-mortem study⁶ 90% of patients with PE had no clinical evidence of DVT. This study suggests that the higher incidence of PE in patients over the age of 50 years was due to an increased prevalence of serious associated disease. Similarly, Sigel *et al.*,¹⁹ in a prospective study using perfusion scanning, did not find age to be a risk factor for PE, although the age range of patients studied was not specified and ventilation scanning was not used. Coon and Collier,²⁰ in a post-mortem study including elderly patients, found that the incidence of PE plateaued after the age of 30 when patients with cardiac failure and neoplasia were excluded.

Mortality from PE is reduced by appropriate treatment.^{13,21} In this study, mortality in elderly patients diagnosed by V/Q scan (13%, 95% CL 3.4–22.6) was similar to that in younger age groups. However, in common with a previous study,⁹ the diagnosis was unsuspected pre-mortem more commonly in the elderly. While the majority had serious underlying disease, such that pre-mortem diagnosis and treatment might not have affected outcome, 32% had no other underlying disease and had a duration of symptoms sufficient for diagnosis and initiation of treatment. With greater awareness, earlier diagnosis and treatment might have improved mortality in this age group.

References

1. Department of Health and Social Security, Office of Population Census and Surveys. *Hospital In Patient Enquiry (Main Tables)*, 1985, Series MB4 no. 27.
2. Morrell, M.J., Truelove, S.L. & Barr, A. Pulmonary embolism. *Br Med J* 1963, **2**: 830–835.
3. MacIntyre, I.M.C. & Ruckley, L.V. Pulmonary embolism - a clinical and autopsy study. *Scott Med J* 1974, **19**: 20–24.
4. Towbin, A. Pulmonary embolism: incidence and significance. *JAMA* 1954, **156**: 209–215.
5. Morrell, M.T. & Dunnill, M.S. The post-mortem incidence of pulmonary embolism in hospital population. *Br J Surg* 1968, **55**: 347–352.
6. Coon, W.W. The spectrum of pulmonary embolism - 20 years later. *Arch Surg* 1976, **111**: 398–401.
7. Sion, A. & Lopez-Majano, V. Incidence of pulmonary embolism. *Respiration* 1978, **35**: 181–185.
8. Knight, B. & Zaini, M.R.S. Pulmonary embolism and venous thrombosis: a 70 year experience. *Am J Forensic Med Pathol* 1980, **1**: 227–232.
9. Goldhaber, S.Z., Hennekens, C.H., Evans, D.A., Newton, E.C. & Godleski, J.J. Factors associated with the correct antemortem diagnosis of major pulmonary embolism. *Am J Med* 1982, **73**: 822–826.
10. Bogren, H.G., Berman, D.S., Vismara, L.S. & Mason, D.T. Lung ventilation perfusion scintigraphy in pulmonary embolism. *Acta Radiol* 1978, **19**: 933–944.
11. Hull, R.D., Hirsch, J., Carter, C. *et al.* Pulmonary angiography, ventilation lung scanning and venography for clinically suspected pulmonary embolism with abnormal perfusion lung scans. *Ann Intern Med* 1983, **6**: 891–899.
12. Morriss, G.K. & Mitchell, J.R.A. The aetiology of acute pulmonary embolism and the identification of high risk groups. *Br J Hosp Med* 1977, **18**: 6–12.
13. Sharma, G.V.R.K. & Sasahara, A.A. Diagnosis and treatment of pulmonary embolism. *Med Clin North Am* 1979, **63**: 239–250.
14. WHO Regional Office for Europe: *Public Health in Europe 5: Myocardial Infarction Community Registers*. World Health Organization, Copenhagen, Annexe 1, 1976.
15. Hatano, S. Experience from a multicentre stroke register: a preliminary report. *Bull WHO* 1978, **54**: 541–553.
16. Hildner, F.J. & Ormond, R.S. Accuracy of the clinical diagnosis of pulmonary embolism. *JAMA* 1967, **202**: 115–118.

17. Robin, E., Stevas, P. & Jackson, D. Spurious pulmonary embolism—a non disease. *Heart Lung* 1974, **8**: 141–147.
18. Divertie, M.B. The problem of pulmonary embolism. *Geriatrics* 1983, **38**: 29–32.
19. Sigel, B., Justin, J. & Gibson, R.J. Risk assessment of pulmonary embolism by multivariate analysis. *Arch Surg* 1979, **114**: 188–192.
20. Coon, W.W. & Coller, F.A. Some epidemiological considerations of thromboembolism. *Surg Gynecol Obstet* 1959, **109**: 487–501.
21. Dalen, J.S. & Alpert, J.S. Natural history of pulmonary embolism. *Prog Cardiovasc Dis* 1975, **17**: 259–270.