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Pulmonary embolism: differences in presentation between older and younger patients

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Abstract

Background: the incidence of pulmonary embolism increases with age but the 'classical' presentation of acute pulmonary embolism may not occur in older persons.
Objectives: to compare the clinical presentation of younger and older patients with acute pulmonary embolism.
Design: retrospective identification of 60 consecutive cases of spiral computed tomography confirmed acute pulmonary embolism over a 3-year period, with blinded review of radiological films and electrocardiographs, and analysis of clinical presentation.
Setting: a district general hospital serving a population of 200,000 people.
Subjects: 31 younger and 29 older patients with acute pulmonary embolism.
Results: older persons less often complained of pleuritic chest pain ($P < 0.02$), particularly as their primary presenting complaint ($P < 0.002$). Twenty-four percent of older but just 3% of younger persons presented with collapse ($P < 0.02$), despite similar proportions of central and peripheral emboli in the two groups. Older persons were more often cyanosed ($P = 0.05$) and hypoxic ($P < 0.04$) than younger persons but there were no significant differences with respect to heart rate, respiratory rate or mean arterial blood pressure.
Conclusions: older people present atypically with acute pulmonary embolism, potentially leading to delays in diagnosis and initiation of treatment. Collapse is a particularly important symptom of acute pulmonary embolism in older persons, even in the absence of pain.

Keywords: *pulmonary embolism, presentation, computed tomography*

Introduction

The incidences of venous thromboembolism and pulmonary embolism (PE) are known to increase with age [1]. The annual incidence of PE is 1.3/1000 at age 65–69 years and 3.1/1000 at age 85–89 years of age [2]. With age, fibrinogen levels increase and anti-thrombin 3 levels decline [3], while reduced lower limb musculature and decreased mobility may encourage venous stasis. Although these physiological changes may predispose older persons to thromboembolism, there is also a rise in specific risk factors for thromboembolism with aging, such as congestive heart failure, stroke and hip fracture, among many others.

Previous studies have yielded conflicting results as to whether PE presents differently in younger and older patients [4–8] but these have been based on a selected group of patients in a trial of thrombolysis [4], cases diagnosed primarily by ventilation-perfusion (V/Q) imaging [5, 6], and fatal cases [7]. The hospital in this study did not have facilities to perform V/Q imaging and therefore spiral computed tomography (CT) was the first-line imaging investigation in all cases of suspected PE. This was easily and equitably accessed by patients of all ages and thus afforded a relatively unique opportunity to use this radiological investigative tool, which has been well validated in diagnosing suspected PE [9–12], to assess differences in presentation between older and younger patients.The ACCP Consensus Committee on Pulmonary Embolism [12] found that the overall sensitivity and specificity of spiral CT in acute PE was 94% and 97% respectively. (The sensitivity for detecting subsegmental emboli is lower but isolated subsegmental emboli are reported to occur in only 5–36% of cases with PE [13, 14].)

Methods/population

Population

All spiral CT reports since introduction of this technique to the hospital in 1999 were reviewed and the CT films of definite or possible cases of PE were obtained. A consultant radiologist blindly reviewed all the CT films and determined firstly whether there was evidence of pulmonary embolism and if so, the degree of pulmonary embolism, using standard radiology nomenclature (Table 1). A second radiologist reviewed any equivocal cases and if doubt remained as to whether or not the CT demonstrated a definite PE, the case was deemed negative.

Sixty cases of definite, spiral CT demonstrated PE were thus identified and the case notes of these patients were reviewed. Patients were separated into 'younger' and 'older' groups, using a cut-off of 65 years. This led to two similar sized groups, with 31 younger patients (median age 48 years, range 24–64) and 29 older patients (median age 73 years, range 65–88).

Data

In each case, details were recorded of presenting complaints and duration of symptoms. For the purposes of the study, 'collapse' was defined as involving cardiac arrest or the patient falling to the floor, with or without remembered loss of consciousness. Postural dizziness, pre-syncope, weakness and sweating were not considered to represent collapse. The outcome of each case was recorded, including any recurrence of venous thromboembolism or death. Physiological parameters at presentation and respiratory and lower limb examinations were reviewed. Arterial blood gas results and serum white cell count were also recorded.

Stastical analysis

Data was analysed using the Chi-squared test for comparisons between the two groups and Fisher's exact test for sub-population analysis where the numbers involved were smaller.

Table 1. Degree of pulmonary embolism

Degree	Location of embolus	Younger patients	Older patients
	Central		
0	Pulmonary artery trunk		
1	Right or left pulmonary artery	60%	63%
2	Lobar artery		
	Peripheral		
3	Lobular or segmental artery		
4	Sub-segmental artery	40%	37%

Results

Over a 3-year period, there were 60 cases of spiral CT demonstrated acute PE in our hospital. The average age of the younger group was 45.6 years and 61% were male. The average age of the older group was 74.7 years and 41% were male. There was no significant difference between the groups with respect to the proportion of patients with central or peripheral emboli (Table 1).

Symptoms

Approximately 50% of both groups presented within 24 hours of symptom onset, while 25% had symptoms for longer than one week.

Eighty-seven per cent of younger *versus* 60% of older patients experienced pleuritic chest pain ($P < 0.02$). Pain was the primary presenting complaint in 84% of younger patients but only 45% of older patients ($P < 0.002$). One-quarter of older patients had one or more episodes of collapse while only one younger patient had such an episode ($P < 0.02$). Although not statistically significant, younger patients more often had cough and haemoptysis than older patients (Table 2). Approximately 60% of both groups complained of dyspnoea.

Clinical examination

Despite the greater incidence of collapse, older patients did not have a significantly greater incidence of hypotension, tachycardia or tachypneia. Fever above 37.5°C was rare in either group, Table 3. A similar proportion of both groups had clinical evidence of DVT (16%), while approximately 12% had an audible pleural rub. Fourteen percent of older patients, but none of the younger patients, appeared to be cyanosed at the time of medical review ($P = 0.05$).

Blood results

One-third of patients had a mild neutrophil leucocytosis but only 6% had a serum WCC greater than 13×10^9/l.

Table 2. Symptoms and primary presenting complaint

Symptom	Percentage and (number)	
	Younger patients (31)	Older patients (29)
Pain	87% (27)	59%[a] (17)
Pain as primary presenting complaint	84% (26)	45%[b] (13)
Collapse	3% (1)	24%[a] (7)
Dyspnoea	58% (18)	59% (17)
Cough	36% (11)	24% (7)
Haemoptysis	23% (7)	14% (4)
Palpitations	3% (1)	7% (2)

[a] $P < 0.02$.
[b] $P < 0.002$.

Table 3. Clinical findings

Examination parameter	Younger patients	Older patients
Hypotension (mean arterial pressure < 70 mmHg)	0	11 %
Tachycardia (heart rate > 100/min)	21%	31%
Tachypnoea (respiratory rate > 24/min)	8%[a]	8%[a]
Fever (temperature > 37.5°C)	13%[a]	4%[b]
Cyanosis	0	14%[c]
Abnormal lower limb examination	26%	17%
Pleural rub	16%	7%

[a] $n = 24$.
[b] $n = 26$.
[c] $P = 0.05$.

Older patients were significantly more often hypoxic than younger patients ($P < 0.04$, Table 4).

ECG findings

Sixty-one per cent of older patients had some ECG finding that was compatible with or suggestive of PE (Table 5) while only 33% of younger patients had such findings ($P < 0.04$). However, there was not any significant difference between the two groups with regard to S1Q3T3 or right bundle branch block, which are more specific for PE.

Clinical outcome

One young patient with a large, proximal PE had delayed distant embolisation of his initial blood clot with no serious consequences. One elderly patient had a sudden death at home at two weeks post discharge (while receiving therapeutic doses of warfarin), possibly representing a recurrent, fatal PE. A second elderly patient with catastrophic acute cerebral infarction complicated by acute PE was not anticoagulated and died a few days later.

As ours is the only acute hospital in the region, it is unlikely that patients presented elsewhere with recurrent PE or venous thromboembolism. Obviously, sub-clinical recurrences or fatal recurrent PE without hospitalisation cannot be excluded.

Table 4. Arterial blood gas results

	Younger patients ($n = 21$)	Older patients ($n = 19$)	P-value
PO_2 < 8.0 kiloPascal	9%	42%	< 0.04
O_2 saturation < 90%	5%	32%	< 0.04
PCO_2 < 4.0 kiloPascal	14%	16%	n/s
pH > 7.48	19%	32%	n/s

Table 5. ECG findings

ECG findings	Percentage and (number)	
	Younger patients ($n = 30$)	Older patients ($n = 28$)
S1 Q3 T3	13% (4)	14% (4)
Right bundle branch block	10% (3)	18% (5)
Sinus tachycardia	7% (2)	18% (5)
Atrial fibrillation	3% (1)	7% (2)
Anterior T wave inversion	0	4% (1)
Any of the above findings[a]	33% (10)	61% (17)

[a] $P < 0.04$.

Discussion

Firstly, we acknowledge that the major limiting factor in this study is that it is based on retrospective case-note review. However, PE is a common condition and most doctors recorded the relevant positive and negative symptoms very well and there was no significant difference in documentation between the two groups. Secondly, our patients were selected on the basis of a positive spiral CT result. Obviously this excluded patients with PE who did not attend hospital and also those who did not have a CT performed in hospital, either because PE was not considered (biased against atypical cases) or where treatment would not be altered by confirmation of PE. Equally, false negative cases of PE and those who died from PE before a CT scan could be performed would have been excluded. All studies of PE to date have some inherent bias in their selection of cases, often excluding atypical cases (not diagnosed as PE so not included in the studies) or massive PE where patients died quickly. Thrombolytic and autopsy based studies are biased towards massive PE while studies based on pulmonary angiography are biased towards cases with a high clinical suspicion and hence typical symptoms.

As we confined our study to cases diagnosed by spiral CT, the group of patients with PE is relatively homogeneous (not immediately fatal but with symptoms significant enough for hospital attendance). This facilitated comparisons between the two groups. All CT films were blindly assessed for the degree of pulmonary embolism, to ensure a bias did not exist between the two groups with regard to the degree of PE (and hence the expected presentation).

The finding that older patients with acute PE less often experienced chest pain than younger patients has been previously described [4, 6] although post-hoc review of the PIOPED study [5] did not find a significant difference (Table 6). Older people may have reduced visceral pain sensation, as has been previously described in case series including pneumothorax [15], peptic ulcer disease [16, 17] and myocardial infarction [18]. It is also interesting to note that in our study, older patients who had chest pain were less likely to complain of it as their primary symptom. This may indicate that they attached less significance to the pain than younger patients did, seeking medical attention

Table 6. Summary of previous studies comparing young and old patients with acute PE

Symptom	Author	Younger patients	Older patients
Chest pain	Gisselbrecht [4]	61%	35%[a]
	Ramos [6]	53%	27%[b]
	Stein [5]	61%	51%[c]
Dyspnoea[d]	Gisselbrecht	89%	85%
	Ramos	56%	66%
	Stein	79%	78%
Haemoptysis[d]	Gisselbrecht	0%	0%
	Ramos	3%	3%
	Stein	10.6%	8%

[a]Retrospective. 28 younger, 26 older patients (> 75 years old), $P < 0.07$.
[b]Retrospective. 32 younger, 64 older patients (> 65 years old), $P < 0.05$.
[c]Post-hoc review of PIOPED study. 188 younger, 72 older patients (> 70 years old), P = n/s.

instead because they had suffered a collapse or had haemoptysis. The effects of ageing on the physiology of pain sensation are very complex [19]. Older people may have a higher threshold for acute pain, including visceral pain [20], due to age-related decline in sensory receptor function, afferent pathways or central pain processing. However, the possible contributions of altered attitudes to pain and reluctance to report pain in elderly persons, although harder to quantify, may also play a significant role.

The greater incidence of collapse in older patients probably reflects their reduced cardiopulmonary reserve. We had expected that older patients would have more frequent hypotension due to reduced homoeostatic mechanisms. This was not the case, but the two groups were not matched for pre-morbid blood pressure, which was likely to be higher in the older group. Equally, supine-recorded blood pressure does not reflect accurately the entire, complex haemodynamic changes induced by PE. More invasive continuous blood pressure monitoring or tests for orthostatic hypotension, had they been performed, may well have demonstrated greater cardiovascular instability in the older group.

We had expected that older patients would experience greater dyspnoea than younger patients with PE, due to more frequent concurrent cardiopulmonary disease. However, although older patients were more often hypoxic, dyspnoea was equally prevalent in both groups. It is possible that older patients may have subconsciously slowed their usual pace of exertion to compensate for their respiratory compromise, or may have had an intrinsically higher threshold for experiencing dyspnoea. The fact that older patients were not more tachypnoeic than younger patients, despite being more hypoxic, suggests that the latter is more likely.

In conclusion, this study demonstrates the more atypical presentation of older patients with acute pulmonary embolism, particularly their predilection to collapse rather than chest pain. Once diagnosed and treated, these patients had a favourable outcome, emphasising the importance of vigilance in making this diagnosis in older patients.

Key points

- Older patients present atypically with acute pulmonary embolism, potentially leading to delays in diagnosis and treatment.
- Only 60% of older patients with acute pulmonary embolism experience chest pain and only three-quarters of these present with pain as their primary complaint.
- One-quarter of older patients with acute pulmonary embolism present with one or more episodes of collapse.

Funding/Conflict of interest

None

Ethical approval

Tralee General Hospital ethics committee.

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