Management of pulmonary embolism in the home

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ABSTRACT

Aim: To describe the characteristics, outcomes and treatment complications of patients with pulmonary embolism (PE) who were treated at home and as outpatients in an ambulatory care program.

Methods: Retrospective descriptive study of patients with PE who were treated in the ambulatory care unit during 2003. Ambulatory care unit data and medical record information were reviewed. Data collected included demographic and clinical data, standard clinical indicators of unplanned admission during treatment program, incidence of major bleeding, recurrent venous thromboembolism (VTE), and death within 3 months of admission into the ambulatory care program.

Results: 130 patients with PE were treated: 46% were treated totally as outpatients and 54% as early discharge patients. Mean age was 66.4 years; 61% were women. The program was successfully completed for 89% of patients; one patient was lost to follow-up. There were three episodes of major bleeding (2%; 95% CI, 0.5%–7%), all in patients aged > 70 years. Four patients died (3%; 95% CI, 0.8%–8%) within 3 months of admission into the program, but none in the first week, no death being directly attributable to PE. There were seven episodes of recurrent VTE (5%; 95% CI, 2%–11%).

Conclusion: Appropriately selected patients with sub-massive PE can be treated as outpatients and in the home. Although the outcome is good in most patients, a significant proportion will require admission, emphasising the need for a well defined protocol and close medical supervision. Further study will more closely define at-risk patients and refine the care pathways.

MJA 2005; 183: 239–242

Hospital-in-the-home services have expanded in the past decade, with conditions treated in such programs becoming more complex and acute.[1,2] Pulmonary embolism (PE) is traditionally treated in hospital. Massive PE is PE associated with systemic hypotension, cardiogenic shock, or respiratory failure, and has mortality of 14%–60%; sub-massive PE does not have these characteristics, and mortality is less than 5%.[3]

There is growing evidence that patients with sub-massive PE can be treated as outpatients or in the home.[4-6] These studies were not randomised controlled trials, but nevertheless reported good outcomes with outpatient treatment of patients with PE. The British Thoracic Society has recommended that outpatient treatment can be considered if the patient is not unduly breathless, there are no medical or social contraindications and there is an efficient protocol in place.[7] Most patients with deep venous thrombosis (DVT) are now treated as outpatients. As with DVT, there is now evidence that low molecular weight heparin (LMWH) is as effective as intravenous unfractionated heparin in the management of PE.[8]

Treatment of patients with PE in the outpatient ambulatory setting could result in cost savings. However, it is essential to ensure that the patients are appropriately selected and to demonstrate that these patients can be safely managed in the outpatient or home setting. Some centres in Australia, including ours, are already treating patients with PE as outpatients, but there have been no published studies on this specific topic in Australia. Therefore, in this descriptive study we examined the characteristics, outcomes and treatment complications of patients with PE treated in an ambulatory care program.

METHODS

Setting

Bankstown-Lidcombe Hospital is a 450-bed teaching hospital of the University of New South Wales and is part of the South Western Sydney Area Health Service. It serves a population of 165 000. Patients with PE are treated either as inpatients or as outpatients with the ambulatory care program. Patients can be admitted directly into the ambulatory care program via their general practitioner, specialist or hospital emergency department, or admitted as an "early discharge" patient from the hospital. Early discharge patients are those who were initially treated as inpatients and who still require LMWH therapy but are assessed not to require further hospital inpatient stay.

Patients are accepted into the ambulatory care program if they fulfil specific clinical and service criteria. Exclusion criteria are similar to those developed by Wells et al.[5] These include the presence of haemodynamic instability, hypoxia with an oxygen saturation of less than 90%, pain requiring intravenous narcotics, active bleeding, intercurrent illness that requires admission, and the likelihood of non-compliance. Other criteria for exclusion are lack of telephone, transport or home support.

Patients are also assessed clinically by a physician (usually a respiratory physician or cardiologist) in conjunction with an ambulatory care specialist before admission into the program. In the ambulatory care program, patients are given LMWH subcutaneously in the home by a registered nurse, GP, their carer, or themselves, or they may attend as an outpatient in the ambulatory care unit. Enoxaparin and dalteparin are the two main LMWH drugs used. Dosages are reduced if the patient's estimated creatinine clearance is impaired.

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The choice of treatment at home or as an outpatient is dependent on service and support availability. Patients are reviewed daily by a registered nurse and reviewed once or twice a week by a physician in the unit. There is a 24-hour contact number for support when required.

The ambulatory care program is completed when a patient's symptoms have stabilised, LMWH is no longer required, and the international normalised ratio (INR) is sufficiently stable that frequent monitoring is no longer required.

Patients

The clinical database and medical records of consecutive patients with the diagnosis of PE treated in Bankstown-Lidcombe Hospital ambulatory care unit during the period 1 January to 31 December 2003 were reviewed. Patients were included only if they had a diagnosis of PE by a high probability ventilation/perfusion (V/Q) scan, spiral computed tomography (CT) scan, or pulmonary angiogram, or an intermediate probability V/Q scan and documented DVT together with symptoms of PE.

Data collection and analysis

Data were collected by trained nursing and medical staff in the ambulatory care unit. Quality assurance of the data was performed by two specialist physicians, who checked 10% of patient records. Data were also counterchecked with the databases of medical records, and the nuclear medicine and ultrasound and radiology departments.

Data collected on these patients were demographic details (age, sex), treatment information (referral site, treatment given, site and modality of treatment), and clinical indicators (unplanned admission during treatment program, major bleeding, recurrent thromboembolism, mortality at 3 months from admission into the ambulatory care program, and readmission within 30 days of discharge from the program). We also examined specific risk factors (thrombophilia, family history of venous thromboembolism [VTE] in a first-degree relative, past VTE, chronic respiratory disease, cardiac failure, recent surgery, peptic ulcer disease, oesophagitis) that may be related to adverse outcomes in patients with PE treated in ambulatory care.

Major bleeding was defined as bleeding that was intraocular, intracranial, intra-abdominal, or any clinically overt bleeding that resulted in a drop of haemoglobin of $\geqslant 2$ g/L, required a blood transfusion, or resulted in hospital admission or death. Recurrent VTE was defined by evidence on clinical history of new onset symptoms together with a new defect on V/Q scan, spiral CT angiogram or duplex venous ultrasound.

Information on major bleeding, recurrent VTE and mortality at 1 week and 3 months from start of program was obtained from the ambulatory care database and medical records. When information was not available, the patient's GP or specialist was contacted.

Data were entered into a database in Microsoft Access and analysed using SPSS version 12 (SPSS Inc, Chicago, Ill, USA). Categorical data were compared using Pearson χ^2; Fisher exact test was used where cell sizes were less than five. Poisson distribution was used to calculate 95% confidence intervals expressed as a percentage. The level of significance was set at $P \leqslant 0.05$.

1 Patient characteristics (n = 130)

Variable	Number (%)
Age	
⩽ 69 years	60 (46%)
⩾ 70 years	70 (54%)
Sex	
Male	51 (39%)
Female	79 (61%)
Referral source	
Direct admission to program	60/130 (46%)
General practitioner	7/60 (12%)
Consultants' rooms	20/60 (33%)
Emergency department	14/60 (23%)
Nuclear medicine and ultrasound	17/60 (28%)
Other outpatient clinics	2/60 (3%)
Early discharge from hospital inpatient ward	70/130 (54%)
Delivery model of treatment	
Home visits	108 (83%)
Day clinic	5 (4%)
Self/family administration	15 (12%)
Other (hostel/nursing home administration, general practitioner)	2 (2%)
Risk factors and associated conditions	
Cancer	17 (13%)
Known thrombophilia	3 (2%)
Family history of VTE in first degree relative	4 (3%)
Past VTE	26 (20%)
Congestive cardiac failure	11 (9%)
Chronic respiratory disease	8 (6%)
Stroke	8 (6%)
Recent surgery (within 4 weeks)	6 (5%)
Peptic ulcer disease/ oesophagitis	19 (15%)
Readmission 30 days after discharge	7 (5%)

VTE = venous thromboembolism. ◆

Ethics approval

This study was approved by the South Western Sydney Area Health Service Human Research Ethics Committee.

RESULTS

There were 194 patients with a confirmed diagnosis of PE treated in Bankstown-Lidcombe Hospital in 2003; 130 of these patients (67%) were admitted with PE and treated in the ambulatory care unit (Box 1). The mean age of the 130 patients was 66.4 years (median, 71 years; range, 27–90 years). Women constituted 61%. Patients in the early discharge group had stayed an average of 5.7 days in hospital before admission to the ambulatory care program (SD, 3.47; median, 5 days; range, 2–19 days). Most patients were managed with home visits, with 12% of patients administering the subcutaneous injections themselves. A high proportion of patients had previous VTE, cancer and congestive cardiac failure.

Quality assurance of the data revealed an error rate of 2%. These errors were eliminated by counterchecking main information with the patient's medical record and record of the nuclear medicine and ultrasound, radiology and pathology departments.

The ambulatory care program was successfully completed by 89% of patients (116/130); 14 patients (11%) had an unplanned hospital admission during the treatment program. Ten patients were admitted for reasons related to the PE or anticoagulation; six admissions were due to symptoms of chest pain or dyspnoea, and two were confirmed to have recurrent VTE. The other four admissions were due to bleeding, with three being major bleeds, as described below. One patient was lost to follow-up, leaving 129 for further analysis.

2 Adverse events within 3 months of admission into the ambulatory care program for 130 patients with sub-massive pulmonary embolism

		Unplanned admission to hospital	*P*	Major bleed	*P*	Recurrent VTE	*P*	Death	*P*
Total number (%)		14/130 (11%)		3/129* (2%)		7/129* (5%)		4/129* (3%)	
Age	⩽ 69 years	5/60 (8%)	0.57	0/60	0.25	5/60 (8%)	0.25	0/60	0.12
	⩾ 70 years	9/70 (13%)		3/69 (4%)		2/69 (3%)		4/69 (6%)	
Sex	Male	6/51 (12%)	0.78	0/51	0.28	2/51 (4%)	0.70	2/51 (4%)	0.65
	Female	8/79 (10%)		3/78 (4%)		5/78 (6%)		2/78 (3%)	
Classification	Direct ambulatory care admission	3/60 (5%)	0.086	1/60 (2%)	1.0	3/60 (5%)	1.0	1/60 (2%)	0.62
	Early discharge	11/70 (16%)		2/69 (3%)		4/69 (6%)		3/69 (4%)	
Delivery model	Home visit	13/108 (12%)	0.46	3/107 (3%)	1.0	6/107 (6%)	1.0	4/107 (4%)	1.0
	Other	1/22 (5%)		0/22		1/22 (5%)		0/22	

Data are expressed as number of patients who experienced the outcome / total number of patients (% of total). *One patient was lost to follow-up at 3 months. VTE = venous thromboembolism. ◆

Adverse events

There were three (2%; 95% CI, 0.5%–7%) episodes of major bleeds within 3 months. All three patients were older than 70 years. Two episodes occurred in the first week of the program. One person bled from ulcers associated with gastric lymphoma. The second patient had a pelvic haematoma. Both these patients had been accepted directly into the ambulatory care program. Recommended dosages of LMWH were used in both instances, and the highest INR was 2.6 at the time of bleeding. The third patient had bleeding from gastric ulcers.

There were four deaths (3%; 95% CI, 0.8%–8%) within 3 months, but none occurred in the first week of treatment. Two patients had underlying neoplasia; another patient died from gram-negative sepsis and another died from aspiration pneumonia. None of the deaths were directly attributable to PE. There were seven episodes of recurrent VTE (5%; 95% CI, 2%–11%); four of these occurred in the first month.

We examined various factors that might be associated with an adverse outcome (ie, major bleed, recurrent VTE and death over 3 months, and unplanned admission during program). Although a higher proportion of elderly patients experienced an adverse outcome, no factor was statistically significant. Patients from the early discharge group were more likely to be readmitted (16% v 5%), but the difference was not significant ($P = 0.086$) (Box 2). There were no significant differences in adverse outcomes between the various delivery models (Box 2).

DISCUSSION

Our data add to the increasing evidence that selected patients with PE can be treated as outpatients. In almost 90% of our patients, the acute treatment phase was completed successfully. Two previous studies compared treatment of patients with PE as inpatients versus outpatients.[5,6] In one study of 34 people with VTE treated as outpatients, it was estimated that about 50% of patients may be treated as outpatients.[5] In another study, 68% (108/158) of patients with PE were treated as outpatients (a similar percentage to ours), and there were no unplanned admissions during outpatient LMWH therapy.[6] Our treatment program phase covered a longer period, as it involved INR stabilisation, but the unplanned admission rate appears high. Our higher hospital admission rate may also be due to differences in age group (mean, 66.4 years compared with 56.9 years in the previous study[6]), practice and complexity of illness. Our selection criteria may need to be more rigid. In general, our results indicate that these patients require close and frequent medical input.

The major bleeding rate of 2% was similar to rates in previous studies (1.9%–2.0%).[5,6] As two of the episodes occurred in the first week, further examination as to whether the recommended doses of LMWH need review in the elderly and consideration of other risk factors for bleeding are required. The mortality rate in the previous studies ranged from 3.7% to 7.2% at 3 months. Our mortality rate of 3% was slightly lower. Similar to the previously mentioned studies, neoplasia featured prominently as a diagnosis in the patients who died, accounting for half of the cases. None of these patients died within a week of commencing treatment, when they would traditionally have been admitted as inpatients. The recurrent VTE rate of 5% was similar to rates in previous studies (3.6% to 5.6%).[5,6]

We were unable to identify any significant patient characteristics that might be associated with poorer outcomes. Some trends are worth discussion. Elderly patients constituted a higher proportion of those who experienced a poorer outcome. This could be expected, as age is a risk factor for poorer outcomes in PE.[9] It is debatable as to whether it is age per se or whether it is the concomitant comorbidities that accentuate the risk for bleeding and other poor outcomes for elderly patients. However, this should not preclude elderly patients with PE being treated through ambulatory care, as 87% of patients aged ⩾ 70 years completed the program successfully. It is also possible that the elderly would have an equivalent adverse outcome if they were admitted to hospital. Caplan et al found that the elderly have similar to better outcomes in a hospital-in-the-home program compared with an inpatient group.[10] Patients in our early hospital discharge group had a higher frequency of unplanned admission (16%) than those admitted directly to ambulatory care (5%). It is possible that those who were initially admitted as hospital inpatients constitute a group who are more ill and thus are more clinically unstable.

The study was limited by its retrospective design. Under-reporting of comorbidities and complications may have occurred, and

not all information was recorded in the notes. However, the major information required, particularly epidemiological and outcome data, was objectively defined and less subject to interpretation.

Predictors of survival such as the Geneva Prognostic Index[11] can be used to refine selection protocols. This index assigns two points each for a history of cancer and hypotension, with one point each for heart failure, previous or current DVT, and hypoxia. More than two points is correlated with an adverse outcome. Other predictors of short-term survival that can be included in a prognostic index include age; location of VTE onset; chronic lung, renal or liver disease; and neurological disease.[9] Physical findings such as haemodynamic status can be used to estimate severity of PE, but may be unreliable in patients with prior cardiopulmonary disease.[12]

Specific investigations can help select appropriate patients for outpatient management of PE. Evidence of right ventricular dysfunction on electrocardiography or echocardiography is a key prognostic marker.[13,14] New prognostic markers include CT pulmonary angiography,[15] troponin,[16] pro-brain natriuretic peptide[17] and brain natriuretic peptide.[18,19] However, further study is required to more closely examine the cost–benefit ratio of these tests and their usefulness in the clinical context. None of the above specialised tests are routine investigations in Bankstown-Lidcombe Hospital ambulatory care unit.

One of the main differences between management of patients in hospital and hospital-in-the-home programs is the rapidity of access to high-level care. The progress, and response to treatment, of patients can be variable, and it is essential that these two settings be close. It is also essential to have an effective communication process and ongoing reviews. A clear protocol should be in place for early detection and prompt response to any changes in the patient's condition.

CONCLUSION

A diagnosis of PE need not mean automatic hospital admission, as many patients with PE can be managed in ambulatory care. It is important to examine this further with a randomised controlled study. The question may best be focused on appropriate selection criteria, as a significant proportion of these patients will have a good outcome. Further study is also required to define clinically useful prognostic indicators for PE in the ambulatory care setting and refine optimal care pathways, particularly the timing of early hospital discharge. The fact that a relatively high proportion of patients required admission emphasises the need for a well defined protocol and close medical supervision. It is likely that we will see more patients with PE being treated as an outpatient or at home in the future.

ACKNOWLEDGEMENTS

We wish to sincerely thank Dr Triet Bui for the time he gave to review this paper and offer constructive criticisms.

COMPETING INTERESTS

None identified.

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(Received 4 Nov 2004, accepted 9 May 2005) ❑