

Early discharge for patients with exacerbations of chronic obstructive pulmonary disease: a randomised controlled trial

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Abstract

Background—We have previously reported the use of a hospital based respiratory nurse service (Acute Respiratory Assessment Service, ARAS) to support home treatment of patients with exacerbations of chronic obstructive pulmonary disease (COPD). A controlled trial was undertaken to compare early discharge with home treatment supported by respiratory nurses with conventional hospital management of patients admitted with exacerbations of COPD.

Methods—Patients with COPD admitted as emergencies were identified the next working day. They were eligible for inclusion in the study if the differential diagnosis included an exacerbation of COPD, but were excluded if other medical conditions or acidotic respiratory failure required inpatient investigation or management. Of 360 patients reviewed, 209 were being assessed for other active medical problems and were excluded, 33 potential participants were already involved in research studies and so were ineligible, and 37 did not wish to participate in the study. Eighty one patients were randomised to receive conventional inpatient care (n=40) or to planned early discharge the next working day (n=41). Those discharged early continued treatment at home under the supervision of specialist respiratory nurses. Outcome measures were readmission, additional hospital days, and deaths within 60 days of initial admission. Process measures included number of visits, duration of follow up by the respiratory nurse, and additional treatment provided to support early discharge.

Results—On an intention to treat basis, a policy of early discharge reduced inpatient stay from a mean of 6.1 (range 1-13) days with conventional management to 3.2 (1-16) days with an early discharge policy. Twelve patients (30% conventional management, 29.3% early discharge) were readmitted in each group giving a mean difference in readmission of 0.7% (95% CI

of the difference -19.2 to 20.6). In the conventional management group readmitted patients spent a mean of 8.75 additional days in hospital compared with 7.83 days in the early discharge group, giving a mean difference of 0.92 days (95% CI of the difference -6.5 to 8.3). There were two deaths (5%) in the conventional management group and one (2.4%) in the early discharge group, a mean difference of 2.6% (95% CI of the difference -5.7 to 10.8).

Conclusions—Patients with acute exacerbations of COPD uncomplicated by acidotic respiratory failure or other medical problems can be discharged home earlier than is current practice with support by visiting respiratory nurses. No difference was found in the subsequent need for readmission.

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The Royal College of Physicians of London has recommended the provision of respiratory care helpers to improve the management of patients with chronic obstructive pulmonary disease (COPD) at home.¹ Previous trials in the UK of respiratory health workers visiting patients with chronic respiratory disability at home have failed to show a significant impact. Cockcroft *et al* reported decreased mortality but this was associated with increased hospital admissions and duration of stay,² while Littlejohns *et al* found decreased mortality but with increased general practitioner contacts and prescriptions.³ One study of a hospital at home service in the USA reported decreased hospital admissions but was not cost effective.⁴ An economic analysis failed to show benefit for a hospital at home service in the UK when the discharge diagnosis was COPD.⁵

We have adopted a different approach by focusing support by respiratory nurses at the time of acute exacerbations and not during the stable phase of the disease. We have previously described an Acute Respiratory Assessment

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Service (ARAS) for patients referred by their family physicians with exacerbations of COPD.⁶ This service aimed to reduce the necessity for admission to hospital by providing increased support at home. Based on our experience, we hypothesised that patients currently treated throughout the course of their illness in hospital could be successfully treated at home after a brief period as inpatients. We report the results of a randomised controlled trial comparing conventional inpatient management of patients with an acute exacerbation of COPD with a policy of early discharge followed by domiciliary respiratory nurse support.

Methods

PATIENT RECRUITMENT

A respiratory nurse visited every medical ward each morning (Monday to Friday) and identified all patients admitted as emergencies with a diagnosis of COPD. Glasgow Royal Infirmary is a large university hospital serving a deprived population in the east of Glasgow. For the purposes of the study a patient was considered to have an exacerbation of COPD if this formed part of the clinical differential diagnosis of the admitting medical unit.

Patients identified by the respiratory nurse were excluded if they were not resident in Glasgow, were homeless (including hostel dwellers), were unable to give informed consent, or did not have access to a telephone. Eligible patients at this stage had their medical charts, notes, and radiographs reviewed by a middle grade member of the respiratory medical staff. Patients requiring inpatient management or investigation for some other medical problem were excluded, as were patients with life threatening respiratory failure defined by an acidosis ($H^+ >45$ nM) at the time of assessment (not admission). Patients eligible at this stage were approached to take part in the study and were recruited on the morning of the next working day after admission; informed consent was obtained that day. All patients had been reviewed by a consultant general physician before assessment for the study. The study was approved by the hospital research ethics committee.

On the afternoon of the day of recruitment consenting patients were randomised to early discharge or to conventional inpatient management. Randomisation was carried out by telephoning a non-clinical member of staff based in a separate building who held a treatment allocation schedule generated by random numbers. Randomisation was stratified by sex, living alone, and ever smoked.

INTERVENTION

All inpatients continued under the care of the medical unit to which they had been admitted. A respiratory opinion was only given if specifically requested. Treatment with antibiotics, steroids, and bronchodilators during the admission and on discharge were at the discretion of the admitting unit.

The early discharge group was sent home on the next working day after recruitment (ideally within three days of admission). Patient

discharge was not supported by increased use of social services support or rehabilitation services such as physiotherapy. Pre-existing social services support was reinstated if stopped before discharge. Patients were visited by the respiratory nurse on the first morning after discharge and thereafter at intervals determined by the nurse. Treatment at home in the early discharge group could be adjusted by the respiratory nurse after discussion with a member of the respiratory medical staff. Home management followed the practice developed for ARAS.⁷ In brief, the nurse assessed the patient's progress based on subjective feelings and bedside observations (pulse, blood pressure, respiratory rate, temperature, oxygen saturation, chest auscultation, spirometry, and sputum appearance). The nurse did not prescribe but could advise on use of as required medication. Patients failing to make progress as expected were discussed with medical staff. Ill patients could be reviewed in the clinic or admitted. Out of hours care and management of other medical problems was the responsibility of the general practitioner as is the agreed format for ARAS. The conventionally managed group was discharged as soon as was felt appropriate by the admitting unit. Both groups were recalled for review at the chest clinic two months after discharge (unless a current or recent inpatient). Non-attenders were followed up by telephone or by a home visit from the respiratory nurse.

STATISTICAL ANALYSIS

The object of this study was to establish whether patients with acute exacerbations of COPD could be discharged early and supported at home without a subsequent increased readmission rate. Our main outcome measures were (1) the rate of readmission and consequent additional number of days spent in hospital during the 60 days following initial admission, and (2) deaths during that period. We chose 60 days on the basis that events within this time would probably be related to the initial admission and not be so long as to lose participants from follow up. The additional support to allow home discharge was documented as a process measure.

We analysed on an intention to treat basis. Baseline variables were compared between the two groups with an unpaired *t* test for continuous variables and a Fisher's exact test for categorical variables. Comparison of duration of readmission was made using the Mann-Whitney U test. Data were analysed using Statview 5.0 (SAS Institute Inc).

Results

We identified 412 emergency admissions over 14 months with a diagnosis including COPD, 38 of whom were excluded on the basis that they were homeless, unable to consent, or had no access to a telephone (fig 1). A further group of 14 patients already had discharge arrangements made when identified and were also excluded. The largest group of patients (n=209) were excluded on medical review because of the suspected or actual presence of

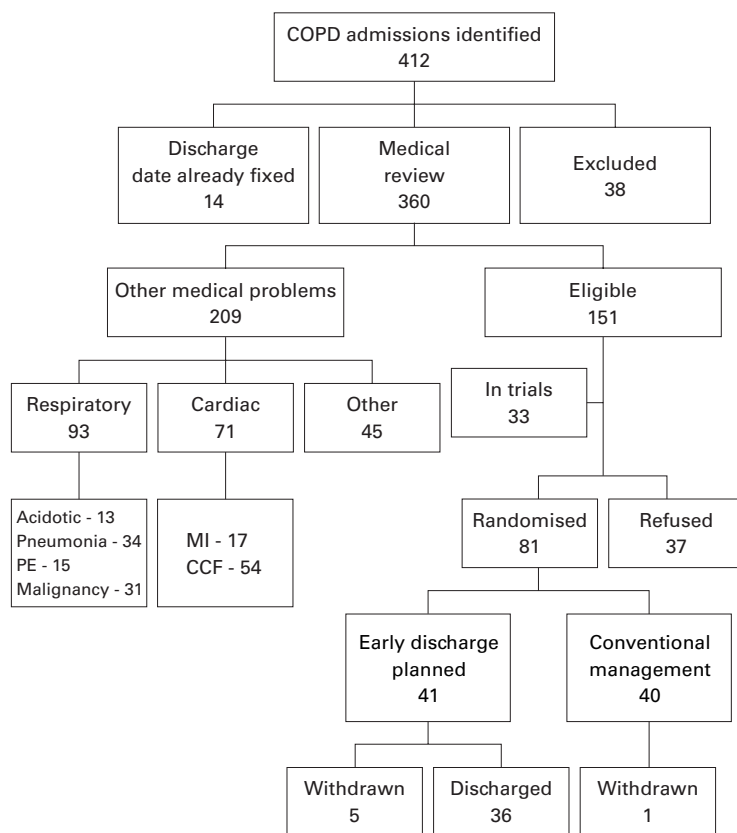


Figure 1 Recruitment to early discharge. PE = pulmonary embolism.

other medical conditions. The presence of radiographic abnormalities suggesting pneumonia or lung cancer, or the occurrence of chest pain suggesting myocardial infarction or pulmonary embolism, were common causes of exclusion. Among other conditions (n=45) were anaemia (5), gastrointestinal disorders (6), musculoskeletal disease (6), nausea, vomiting, and dehydration (6), endocrine disorders (4), and social admissions (17) (usually illness of spouse, but also general non-specific debility). The tight schedule of the study required a decision to discharge on the day of assessment (usually the day after admission) with actual discharge on the following day. Thus, any patient who was awaiting results or had planned investigations such as a ventilation/perfusion lung scan had to be excluded. Of the 151 eligible admissions, 37 patients refused to take part and 33 were not recruited as they were already participating in trials (most were readmissions of patients already in this study). Of 81 patients randomised, one withdrew from the study in the conventional management group as he wished to go home early with nurse support and one withdrew in the early discharge group because he wished a longer period of respite for his wife. Four patients were withdrawn from the early discharge group after randomisation due to the recognition of some other medical problem. In retrospect, in three of the four cases this problem could have been recognised on admission resulting in exclusion from the study. In one case pulmonary embolism occurred the day after admission and the patient was withdrawn from the

Table 1 Characteristics of patients

	Conventional management (n=40)	Early discharge (n=41)
Age (years)	68.0 (1.2)	65.7 (1.6)
Women	24 (60%)	22 (54%)
Living alone	13 (33%)	11 (27%)
Home nebuliser	19 (48%)	24 (59%)
Home oxygen	5 (13%)	8 (20%)
Oral steroids	5 (13%)	4 (10%)
PaO ₂ (kPa)	9.2 (0.4)	8.5 (0.4)
Paco ₂ (kPa)	5.5 (0.2)	6.0 (0.3)
H ⁺ (nM)	40.0 (0.8)	39.3 (0.8)
FEV ₁ (l)	0.94 (0.06)	0.95 (0.08)
FEV ₁ (% predicted)	44 (3)	41 (3)
FEV ₁ /FVC (%)	46 (2)	45 (2)
Body mass index (kg/m ²)	25.8 (1.1)	26.0 (1.2)

PaO₂, Paco₂ = arterial oxygen and carbon dioxide tensions; FEV₁ = forced expiratory volume in one second; FVC = forced vital capacity.

Values are mean (SE) except where numbers and percentages are given.

There were no significant differences between the groups.

Table 2 Features on admission

	Conventional management (n=40)	Early discharge (n=41)
Respiratory rate (breaths/min)	24.4 (0.7)	24.3 (0.7)
Heart rate (beats/min)	103.2 (2.8)	100.2 (3.6)
Purulent sputum	25 (63%)	21 (51%)
Fever	15 (38%)	18 (44%)

Values are mean (SE) except where numbers and percentages are given.

There were no significant differences between the groups.

study and anticoagulated. This patient, the one death in the early discharge group, died suddenly at home several weeks after discharge. Thirty six patients underwent nurse supported early discharge.

The control and early discharge groups were well matched for features that might affect success of early discharge (table 1). There were no significant differences between the groups in terms of age, sex, or proportion living alone. The proportion on long term treatment with nebulised bronchodilators, long term oral steroids, or domiciliary oxygen was similar in the two groups. Pulmonary function tests (simple spirometry and capillary blood gases while breathing air) were not significantly different. Clinical features at time of admission (table 2) showed no significant differences.

Of the 36 patients who underwent early supported discharge, 34 were discharged on nebulised bronchodilators, 22 of whom already used a nebuliser. A nebuliser was lent to the remaining 12 and, of these, 10 were changed back to a conventional inhaler device and two continued on long term nebulised bronchodilators. Eight already used oxygen at home and eight more patients were supplied with supplementary oxygen to support discharge, four of whom continued to use oxygen after discharge from nursing supervision. There were no clear criteria for supplying this, but we provided cylinder oxygen for use as required in those who gained marked symptomatic benefit or who had a partial pressure of oxygen of <7.3 kPa breathing air. The decision to supply an oxygen concentrator for long term oxygen therapy was deferred until clinic review. The median duration of nurse follow up was 24 days and the median number of nurse visits was 11.

Table 3 Outcome of study

	Conventional management (n = 40)	Early discharge (n = 41)
Length (range) of initial admission	6.1 (1–13)	3.2 (1–16)
Readmissions		
No (%)	12 (30.0%)	12 (29.3%)
Difference (95% CI)	0.7% (–19.2 to 20.6)	
Days to readmission from day of first admission (n=12)	25.6	29.6
Difference (95% CI)	4 (–10.9 to 18.9)	
Additional days (n=12)	8.75	7.83
Difference (95% CI)	0.92 (–6.5 to 8.3)	
No (%) deaths within 60 days	2 (5%)	1 (2.4%)
Difference (95% CI)	2.6 (–5.7 to 10.8)	

All values are means.

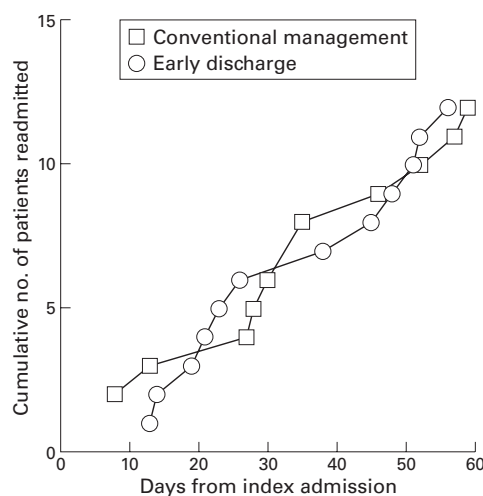


Figure 2 Time to readmission from first admission.

The readmission rates for the two groups were identical (table 3). The duration of inpatient stay after readmission was similar in the two groups. The plot of time to readmission (fig 2) shows that the early discharge group did not have a different pattern of readmissions from the control group. The mean difference in stay between the two groups (on an intention to treat basis) was 2.9 days.

Discussion

In this study we have compared conventional inpatient management of patients being treated for exacerbations of COPD with early discharge from hospital supported by a respiratory nurse. The study was designed to evaluate this within the framework of patients receiving care by general physicians in a general hospital, with little additional input other than the nurse based home care package. Our pre-existing ARAS service operates between 09.00 hours and 17.00 hours, takes referrals directly from general practitioners, and operates in an outpatient setting. Patients arriving at the accident and emergency department are not seen by ARAS. Most of the patients assessed in this study had not been seen by ARAS. A small number had been admitted from ARAS and were assessed for the study, but all were excluded as they were suffering from other acute problems.

This approach resulted in reducing hospital stay to just three days (half that of the control group) with no increase in subsequent rate or

duration of readmission or increase in mortality. The duration of inpatient stay for our control group was shorter than has previously been reported⁸ for exacerbations of COPD. This may be because of a general tendency towards reduction in the duration of hospital stay over time,⁹ or because the patients eligible for the study did not have complicating medical conditions that might have resulted in longer admissions. Many of the patients with COPD admitted to hospital required investigation or treatment of other medical conditions. The definition of an exacerbation of COPD varies and includes a broad view that all possible related conditions may be included, such as pneumonia or osteoporotic vertebral collapse. We have taken a narrower view, excluding patients who were suspected or known to have some other condition for which specific management exists, and viewing an exacerbation as an airways disease. We accept therefore that our results cannot be assumed to apply to exacerbations of COPD complicated by extensive co-morbidity.

In our study the rate of readmission was high at 30% within 60 days. These readmitted patients are high users of the health service and further studies to try to identify risk markers for readmission and interventions to reduce risk of readmission would be of value. Although living alone did not seem to be a risk factor for readmission in our small group, social isolation or increased levels of anxiety or depression may be relevant.

Studies of hospital at home services for COPD in the UK have varied in showing economic benefit.^{5–10} Our service differs from these in providing treatment at home supported by visits from hospital based respiratory nurses, but does not automatically include increased support by other services such as community physiotherapy or social services. As this study involved a new service and we did not carry out a formal economic evaluation, we are cautious about drawing any conclusions about the economics of the service. The number of nurse visits and duration of follow up may not be the same in an established service with experienced staff. For the study we recruited a staff nurse with previous experience on a general medical ward. The nurse received training from our ARAS nurses by assisting them in assessing patients referred by general practitioners for outpatient management of exacerbations of COPD and accompanying them on home visits. The number of visits and duration of follow up were greater than we reported for our ARAS service.⁶ This may be because the patients in this study were more dependent or because the nurse was less experienced.

We have shown that patients with acute exacerbations of COPD may be successfully discharged home shortly after admission to hospital with support from visiting respiratory nurses. This approach cut the length of hospital stay by half and did not appear to increase the readmission rate, number of additional days in hospital, or deaths within 60 days of admission.

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