

An Evaluation on the Effects of Inpatient Pulmonary Rehabilitation Following Acute Exacerbation of Chronic Obstructive Pulmonary Disease in a Singapore Hospital

Dear Editor,

To minimise rapid decline in physical function, current consensus have now supported the initiation of an early pulmonary rehabilitation programme (PRP) during hospitalisation or within 1 month after discharge for people with an acute exacerbation of chronic obstructive pulmonary disease (AECOPD).^{1,2} A Cochrane meta-analysis in people with AECOPD reported clinically significant improvements in exercise capacity, health-related quality-of-life (QOL) and hospitalisation rate following early PRP over usual care.³ However, these findings were based on a heterogeneous mix of service delivery designs, i.e. inpatient PRP without a convalescence period (administered during hospitalisation), elective inpatient PRP after home convalescence and outpatient PRP. Findings on effects of inpatient PRP without a convalescence period for AECOPD are few, with only 2 studies^{4,5} in the Cochrane meta-analysis and a recent randomised controlled trial.⁶

The aim of this retrospective study is to examine the effects of our hospital's inpatient PRP without a convalescence period (referred to as inpatient PRP hereon) on exercise capacity, health status and 30-day readmission following an AECOPD. As there is a paucity of studies on inpatient PRP for AECOPD, our retrospective analysis may add evidence to earlier prospective studies.^{4,6}

Methods

Design and Participants

An observational retrospective analysis of our inpatient PRP was performed from its inception in October 2012 to December 2013. Prior to enrolment, patients admitted for AECOPD were screened for eligibility, deemed medically stable by the attending respiratory physicians and gave consent. Patients were ineligible for the programme if they had severe cognitive impairment, psychotic disturbance, severe pre-morbid clinical depression, or musculoskeletal, neurological or unstable cardiovascular disease precluding exercise. Ethics was approved by the National Healthcare Group Domain Specific Review Board.

Inpatient PRP

Enrolled patients remained in the hospital for a further 2 weeks. Our inpatient PRP consisted of 20 physiotherapy

exercise sessions (twice daily), 3 occupational therapy sessions and a diet counselling session. Each exercise session consisted of 30 minutes of aerobic and strength training, with at least 10 minutes spent in walking exercise.⁷ Walking exercise intensity was prescribed using 80% of the average speed achieved in the 6-minute walking test.⁸ Other exercises were prescribed at a moderate intensity using symptom score of 3 to 4 on the modified Borg dyspnoea scale 0 to 10.⁷ The occupational therapy sessions consisted of pacing and energy conservation strategies during activities of daily living. Those who were on long-term oxygen therapy (LTOT) trained with supplemental oxygen.

Outcome Measures

The outcomes investigated in this study were the distance walked during the 6-minute walk test (6MWT distance), the COPD Assessment Test (CAT) scores and 30-day hospital readmission. The 6MWT was performed on a straight 25-metre indoor corridor according to guidelines.⁹ The minimal important differences (MID) for the 6MWT and CAT score are 25 metres¹⁰ and 2 points¹¹ respectively for individuals with COPD. Negative CAT score change indicates improvement in health status.¹¹

Data Analysis

Group values were reported as mean and standard deviation (SD), unless otherwise stated. Pre- and post-programme 6MWT and CAT scores were compared using a paired t-test. A Pearson's correlation was performed to examine the relationship between changes in 6MWT distance and in CAT scores. Odds ratio was calculated to examine the likelihood that any changes in outcomes or patients' characteristics would affect 30-day hospital readmission. The level of significance was set at $P < 0.05$. Statistical analysis was performed using IBM SPSS (IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp).

Results

Of 93 patients with AECOPD screened, 30 (32%) agreed to enrol into the inpatient PRP, 9 (10%) were unsuitable and 54 (58%) declined enrolment. The main reasons for rejecting inpatient PRP were fear of increased dyspnoea

from exertion, prolonged hospital stay and uncomfortable hospital environment. Of the enrolled patients, 2 were taken off the programme due to the administration of antibiotics for hospital-acquired pneumonia and 3 asked to be discharged before they completed at least 12 physiotherapy sessions.² Therefore, data of the remaining 25 (27%) enrolled patients were analysed.

Table 1 shows the characteristics of the enrolled patients. They were male and predominantly in Group D classifications.¹² The median number of physiotherapy exercise sessions completed was 18 (interquartile range [IQR], 15 to 20). Missed exercise sessions were due to complaints of fatigue and breathlessness. All enrolled patients completed occupational therapy and dietician sessions. The median number of days from admission to commencement of PRP was 4 (range, 3 to 7 days). None of the patients had previously undergone a PRP.

The 6MWT distance increased significantly by 54 metres (95% CI, 30 to 77 metres, $P < 0.001$) and CAT scores reduced significantly by 6 points (95% CI, -9 to -3 points, $P < 0.001$). The increase in 6MWT distance is moderately correlated with the reduction in CAT score ($r = -0.533$, $P = 0.006$) (Fig. 1).

Of the 13 patients who had been admitted previously for AECOPD in the past 30 days, 9 (69%) did not readmit within the next 30 days following inpatient PRP. Altogether, 20 patients (80%) did not readmit within 30 days. The likelihood ratios between 30-day readmission rate and other outcomes or patient characteristics were not significant (Table 2).

Table 1. Baseline Characteristics of Patients

Characteristics	n = 25
Age, years	72 (1)
GOLD classification	
Group A, n (%)	1 (4%)
Group B, n (%)	1 (4%)
Group C, n (%)	2 (8%)
Group D, n (%)	21 (84%)
Smoker, n (%)	8 (32%)
LTOT, n (%)	9 (36%)
FEV ₁ , % predicted	40 (2)
mMRC score	2 (1)
BMI, kg/m ²	21.0 (5.4)
6MWT distance, metres	204 (119)
CAT score, units	19 (10)

6MWT: Six-minute walk test; BMI: Body mass index; CAT: Chronic obstructive pulmonary disease Assessment Test; FEV₁: Forced expiratory volume in one second; GOLD: Global initiative for Obstructive Lung Disease classification; LTOT: Long-term oxygen therapy
 *The values are presented in mean (SD), unless otherwise stated.

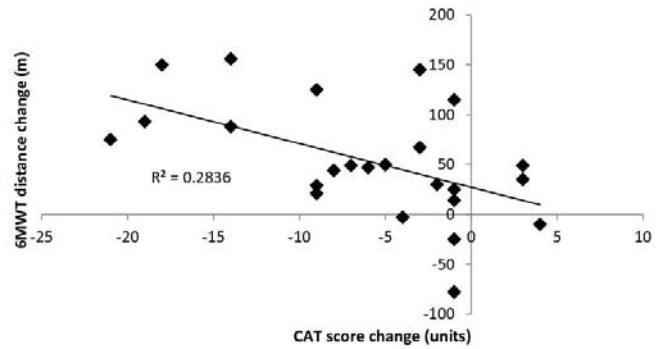


Fig. 1. Relationship between changes in 6MWT distance and in CAT score. Negative CAT score changes indicate better perceived quality of life.

Discussion

The findings from our retrospective study demonstrated that an inpatient PRP elicited clinical and significant improvements in exercise capacity and health status in patients admitted for AECOPD. In patients with a 30-day readmission history of exacerbation prior to current admission, more than half did not readmit in the next 30 days following PRP. However, improvements in exercise capacity and health status achieved during PRP did not explain readmission rate. It appears that an inpatient PRP during AECOPD may minimise the deleterious consequences from hospital stay and exacerbations.

Our use of moderate intensity for exercise training closely reflected training protocols recommended for stable COPD⁷ and elicited clinically important improvements in the 6MWT distance and CAT scores, adding to the positive results of other trials investigating exercise rehabilitation during hospitalisation.⁴⁻⁶ The finding of a median of 90% completed sessions seemed to indicate that moderate exercise intensity was tolerable by our patients with AECOPD, despite exercising twice daily. While an exercise-based intervention during acute illness has raised safety concerns,¹³ serious adverse events were reported to be minimal.⁶ An inpatient

Table 2. Likelihood of Variables Affecting 30-day Readmission Rate

Variables	Odds Ratio (95% CI)	P Value
Change in 6MWT distance	1.02 (1.00 – 1.04)	0.13
Change in CAT score	0.92 (0.78 – 1.10)	0.38
Age	0.95 (0.81 – 1.10)	0.50
BMI	1.02 (0.82 – 1.28)	0.83
FEV ₁ % predicted	0.99 (0.91 – 1.07)	0.74
Smoking history	0.22 (0.02 – 1.74)	0.15
LTOT use	0.81 (0.11 – 6.04)	0.83

6MWT: Six-minute walk test; BMI: Body mass index; CAT: Chronic obstructive pulmonary disease Assessment Test; CI: Confidence interval; FEV₁: Force expiratory volume in 1 second; LTOT: Long-term oxygen therapy

PRP using moderate intensity training is therefore feasible and safe for patients with AECOPD.

While outcomes could not explain 30-day readmission rate in our study, an important factor strongly associated with readmission is physical activity,¹⁴ which was not measured. It is possible that, with PRP, patients had improved motivation, confidence and self-efficacy¹⁵ to regain physical activity levels following discharge. This could explain our finding of more than half of our PR patients not being readmitted despite having consecutive admissions within a month. More studies are needed, however, to examine the short- and long-term effects of inpatient PRP on self-efficacy and physical activity levels.¹

The value of an inpatient PRP prior to discharge lies in providing an earlier opportunity to initiate gains in exercise capacity and health status, which may otherwise decline without rehabilitation.¹ The finding of a moderate relationship between improvements in 6MWT distance and CAT score shows the degree of contribution walking capacity has on health status and further supports the recommendation of starting an inpatient PRP early prior to discharge.

There was no comparative data on the group who declined the inpatient programme which limits the interpretation of our findings. The sample size was also small and therefore, the study may be underpowered. Furthermore, selection bias may be introduced into our results as more patients declined PRP (58%) than those who enrolled. Our programme would benefit from a reassessment of patients to determine how long benefits of inpatient PRP, including physical activity, are retained following discharge.¹

Conclusion

Our intensive inpatient PRP is feasible to be delivered to patients with AECOPD, resulting in clinical and significant improvements in exercise capacity and health status and reduced 30-day readmission rate.

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