

Abstract

RATIONALE: Patients admitted to pulmonary rehabilitation (PR), besides having significant lung disease, typically have substantial comorbidities such as diabetes mellitus, heart failure, and vascular disease that can augment respiratory symptoms, impact functional status, and increase health care utilization and mortality risk. While the prognostic significance of the underlying lung disease is typically considered to be paramount, the impact of comorbid conditions on outcomes, including mortality, is often underemphasized. Because of this, we quantified comorbidity in PR patients and evaluated it as a predictor of mortality.

METHODS: We analyzed a sample of 50 patients who participated in outpatient PR at our institution, relating patient characteristics to mortality, utilizing electronic medical data and Connecticut Department of Public Health statistics on mortality. The primary analysis was a Cox Proportional Hazards analysis relating the level of comorbidity (Charlson Comorbidity Index. CCI) to mortality over three years following pulmonary rehabilitation. The CCI is a widely accepted measure of comorbidity assessment; an adapted International Classification of Diseases 10th revision (ICD-10) was utilized in this study. Demographics (age, body mass index, sex), respiratory disease severity (FEV1 percent-predicted, supplemental oxygen requirement), race, and socioeconomic status (Medicaid insurance utilization) were used as covariates in this multivariable analysis.

RESULTS: The mean age was 70 ± 10 years, body mass index 29 kg/m², and FEV1 was 51%. Fifty-four percent were female, 68% had chronic obstructive pulmonary disease, and 40% had been prescribed supplemental oxygen. The CCI ranged from 0 to 8; 8 had scores over 3. Those with elevated CCI scores (analyzed as a continuous variable) had substantially higher mortality at three years (p < 0.0001). The hazard ratio predicting mortality of those with CCI > 3 was 11 (p < 0.0001); the Kaplan Meier graph representing this relationship is depicted in the Figure.

CONCLUSIONS: These preliminary data indicate that comorbidity is a very strong predictor of mortality in PR patients. This finding underscores the importance of evaluating coexisting medical problems in these patients.

Background

Comorbid conditions are important predictors of health status, functional status, and hospitalization and mortality risks in respiratory patients. We evaluated the relationship between comorbidity and mortality in COPD patients participating in pulmonary rehabilitation (PR).

Methods

- This was a retrospective record review of 50 patients referred to PR
- The principal analysis was the comparison of an objectively measured determination of comorbidity with mortality
- The Charlson Comorbidity Index (CCI) was used as our measure of comorbidity
- Mortality was determined using a Connecticut DPH database of mortality
- All cause mortality was evaluated
- Cox proportional hazards ratio and Kaplan Meier survival curves were used in the analysis
- Predictor variables: patient demographics, respiratory disease severity (FEV1 percent-predicted, supplemental O₂ requirement, race, socioeconomic status (SES, low SES = Medicaid or no insurance)
- The CCI was entered into the regression either as a continuous variable or as a categorical variable at ≥ 3 in the mortality prediction

Results

Patient Characteristics

Age (SD)	70 (9)
Male/Female	23 / 27
Body-mass index (kg/m ²) (SD)	29 (7)
COPD diagnosis (%)	68
FEV1 (% predicted) (SD)	51 (19)
Using supplemental O ₂ (%)	40
Black/African-American (%)	24
Low SES (%)	26
Charlson Comorbidity Index (SD)	2.66 (1.94)
Charlson Comorbidity Index (range)	0 - 8

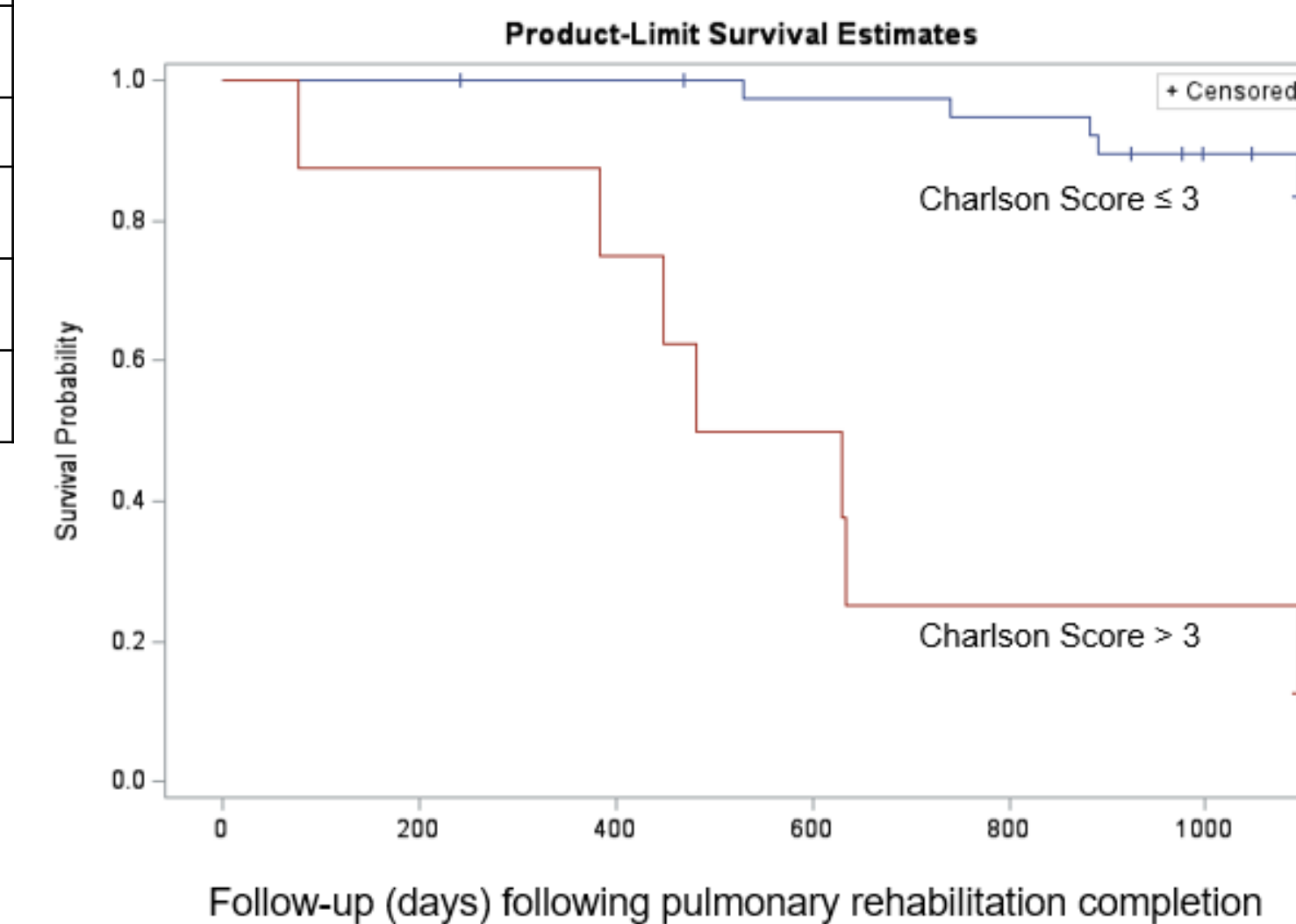
26% died over 917 days of follow up

Factors not related to mortality:

- Age
- Sex
- Body mass index
- FEV1 (% predicted)
- Supplemental O₂
- Race or ethnicity
- SES
- COPD diagnosis

Results (cont.)

- In multiple Cox regression analysis, only CCI expressed as a continuous variable predicted a 3-year all-cause mortality: p < 0.0001
- Eight of 50 (16%) had CCI > 3
- The Kaplan-Meier graph (below) depicts mortality of those ≤ 3 and above 3. The hazard ratio for mortality of the latter was 11 (p < 0.0001)



Summary and Conclusion

- **The Charlson Comorbidity Index strongly predicts survival in respiratory patients attending pulmonary rehabilitation**
- **These results underscore the importance of evaluating coexisting medical problems in patients attending pulmonary rehabilitation**