Exploring Pulmonary Decline at a CF Center

[1]RA Soni, [2]J Duprey, [3]AM Cairns, [1]JT Dziodzio, [1]JB Zuckerman

1. Division of Pulmonary and Critical Care Medicine, Maine Medical Center, Portland, ME
2. Department of Medicine, Maine Medical Center, Portland, ME
3. Division of Pediatric Pulmonology, Maine Medical Center, Portland, ME

Maine Medical Center
MaineHealth

INTRODUCTION

Cystic fibrosis is characterized by progressive loss of lung function. The percent predicted FEV1 (FPP) is an accepted predictor of early mortality in this population. Data tracked within the registry has become a valuable tool for change in care across the CF center network as programs establish targets for improvement in clinical outcomes. Median FPP for CF centers is now reported on an annual basis through the National Registry and is available for public review. However, cross-sectional annual reporting of median FEV1 for CF centers may not provide the richest information about overall pulmonary care, particularly for centers that absorb and release a sizable proportion of patients. We set out to examine decline in FPP for patients who have received longitudinal treatment at our center in hopes of developing a more refined tool for assessing quality of pulmonary care. The average rate of decline in FPP has been previously reported to be 1.8 – 3.6% annually (ref).

In this project we identified several objectives:

• Assess the degree of flux in our Center population over time

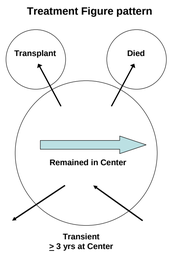
• Develop a practical method for assessing the rate of pulmonary decline among patients receiving longitudinal care within our Center

• To compare our institution's rate of pulmonary decline in FPP with published rates

• Identify patient subgroups that exhibit more rapid decline in lung function than our overall patient population

• Evaluate demographic and clinical characteristics within our patient population that might associate with more rapid pulmonary decline

Median FEV1 Percent Predicted (FPP) for different age groups at our Center in the 2007 Patient Registry Annual Data Report. This provides a "snapshot" of pulmonary status for all patients (except post-lung transplant) who are able to perform spirometry at our Center. The red line on each plot indicates the median value for our Center. The green line indicates the national median.



Schematic showing patterns of patient care. Refer to pie chart for the breakdown of patients within our care center during the study period.

METHODS

•Retrospective study of all adult and pediatric CF patients followed at our center from January, 1999 to December, 2006 who had successful spirometry in at least 3 years during the study period

•All FEV1 measurements during the study period were recorded. FPP was determined using the appropriate equations in current use on PortCF (Hankinson and Wang).

•Rate of FPP decline for each eligible patient was determined by linear regression.

• Eligible patients were evaluated in two ways:

By program of care:

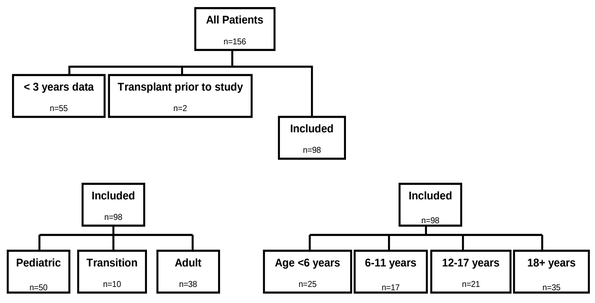
• **Pediatric** (defined as patients who were followed for at least 3 years in the Pediatric CF Program and less than 2 years in the Adult Program)
• **Transition** (defined as at least 2 years in the Pediatric Program and 2 years in the Adult Program)
• **Adult** (defined as patients who were followed for at least 3 years in the Adult Program)

By age cohort (at the start of the study on January, 1999):

• **Age < 6 years**
• **Age 6-11 years**
• **Age 12-18 years**
• **Age 18+ years**

• Comparisons of median rates of FPP decline among the cohorts were performed using the Mann-Whitney U test

• Differences in FPP decline were examined among patients with the following characteristics:
- Presence or absence of cystic fibrosis related diabetes (CFRD)
- Frequency of pulmonary exacerbations requiring inpatient IV antibiotics (2 or more versus <2 during the study period)
- Presence or absence of Pseudomonas on sputum culture
- Distance of residence from the CF Center (< 50 miles or ≥ 50 miles)
- Nutritional status: nutritional insufficiency or at risk at the beginning of the study (BMI < 19 [adults] or BMI percentile <25% [pediatrics]) versus not



RESULTS

• A nearly equal number of eligible patients received "transient care" at our Center versus longitudinal care during the study period

• The mean annual rate of decline in FPP at our Center during the study period was -1.1% and the median was -1.4%.

• In adult patients over the age of 18 at the start of the study (n=38), the median annual rate of decline was -1.7%.

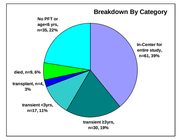
• Both of these values compare favorably to published rates of decline for CF patients.

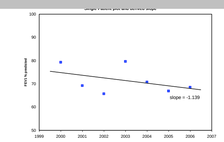
• However, an accelerated rate of decline was noted in several subgroups.
-Patients who were 12-18 years of age at the start of the study (n=21) had a rate of decline of -2.6%, significantly different from pediatric patients age <6 (n= 25, p= 0.0002).
-Patients going through transition (n=10) experienced a particularly high rate of decline in lung function with median slope of -2.9%, significantly different from pediatric patients (p= 0.009).

• There was a significant difference in decline between patients infected with Pseudomonas and those unaffected (p= 0.02).

• There was significant difference in the slope between patients with >1 exacerbation versus those with 1 or no exacerbation (p= 0.009).

• Accelerated rates of decline were also seen in adult patients with CFRD, patients with or at risk for nutritional failure at the beginning of the study, infection with Burkholderia cepacia complex and those who lived >50 miles away from the CF center, though the differences were not statistically significant.





Decline in FPP by Cohort

	age <6	age 6-11	age 12-18	age18+
median	1.672	-0.671	-2.612	-1.582
n	25	17	22	35

	age<6 vs age 6-12	age<6 vs age12-17	age<6 vs age 18+	age6-12 vs age12-18	age6-12 vs age 18+	age12-17 vs age 18+
P	0.0091	0.0002	0.0006	0.0668	0.2483	0.0985

	pedi	transition	adult
median	-0.164	-2.929	-1.653
n	50	10	38

	adult vs transition	adult vs pedi	transition vs pedi
P	0.1003	0.0125	0.0089

Results are expressed as change in FFP per year (negative numbers indicate decline). P values were calculated with the Mann-Whitney U test.

MEDIAN SLOPE	Positive	Negative	P
CFRD	-1.59	-1.15	0.2389
P.Aeruginosa	-1.51	0.06	0.0228
B.Cepatia	-1.99	-1.31	0.4761
Exacerbations (>1)	-2.18	-0.56	0.0089
Pancreatic insufficiency	-0.84	-1.44	0.1562
Nutritional Status	-1.37	-1.22	0.4801
Distance to center (>50mi)	-1.65	-1.16	0.3936

Differences in FFP decline by clinical and demographic characteristics.

CONCLUSIONS

Significant turnover in our patient population over time appears to limit the utility of cross sectional measurement of lung function in assessing longitudinal care at our CF Center. This may be more of an issue for small CF centers than for larger Centers.

Rate of decline in of FPP appears to be a useful tool for assessing overall pulmonary care at CF centers and could be widely utilized if incorporated into PortCF.

Our analysis revealed patient subgroups (particularly teens and those who are going through transition to the adult program) that may benefit from additional focus or novel approaches to therapy in order to prevent accelerated pulmonary decline.

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