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Clinical determinants of postoperative exercise capacity following lung cancer resection: The Role of Skeletal Muscle Index and Inspiratory Muscle Strength

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Background

Surgical resection is essential for the curative treatment of early-stage lung cancer; however, postoperative exercise capacity often declines. Exercise capacity reflects overall physical function and has been shown to correlate with prognosis following lung cancer surgery. Therefore, proper assessment and effective restoration of exercise capacity after surgery are critical. This study aimed to identify clinical factors associated with postoperative exercise capacity in patients undergoing lung cancer surgery.

Methods

This retrospective study included 62 patients (mean age 67± 8.7years, 24 females, 38 males) who underwent lung cancer surgery and completed a postoperative assessment at 3 months. Exercise capacity was evaluated using the incremental shuttle walking distance (ISWD). Correlation and regression analyses were conducted to examine the associations between postoperative exercise capacity and forced expiratory volume in one second (FEV_1), maximal inspiratory pressure (MIP), maximal expiratory pressure (MEP), and skeletal muscle index (SMI).

Results

At 3 months postoperatively, ISWD was significantly correlated with SMI (r = 0.253, p = 0.048) and MIP (r = 0.293, p = 0.021), whereas FEV_1 and MEP showed no significant correlation (p = 0.061). SMI was associated with MIP (r = 0.281, p = 0.027), but not with spirometric lung function (**Table 1**). In regression analyses, both SMI and MIP were significantly associated with 3-month ISWD in unadjusted models. After adjusting for 1-month ISWD, age, and sex, both SMI (β = 0.340, p = 0.029) and MIP (β = 0.296, p = 0.026) remained independently associated with ISWD. The adjusted models explained 38.4% and 38.0% of the variance in ISWD for SMI and MIP, respectively(**Table 2**).

Table 1. Correlations Between 3-Month Incremental Shuttle Walking Distance (ISWD) and Clinical Variables

	ISWD	P value
Age (years)	−0.354	0.005*
Sex	0.137	0.288
3M MIP (cmH_2O)	0.293	0.021*
3M MEP	0.199	0.122
3M FEV_1 (%)	0.239	0.061
3M SMI (kg/m^2)	0.253	0.048*
	MIP	
3M SMI (kg/m^2)	0.281	0.027*

Correlations between 3-month incremental shuttle walking distance (ISWD) and clinical variables were analyzed using Pearson and Spearman's correlation analysis. Correlation between skeletal muscle index (SMI) and maximal inspiratory pressure (MIP) was also evaluated. Values represent correlation coefficients. *P < 0.05 was considered statistically significant.

Table 2. Univariate and Multivariable Linear Regression Analyses for postoperative 3-Month ISWD

Predictor	β	p value	ISWD Adjusted R^2	R^2 (%)	Partial R^2 (%)	N
Unadjusted models						
3M MIP (cmH_2O)	0.293	*0.021	0.071	8.6	-	62
3M FEV_1 (%)	0.239	0.061	0.041	5.7	-	62
3M SMI (kg/m^2)	0.253	*0.048	0.048	6.4	-	62
†Baseline-adjusted models						
‡Baseline				30.5		
3M MIP (cmH_2O)	0.296	*0.026	0.347	38.4	7.9	47
3M SMI (kg/m^2)	0.340	*0.029	0.321	38.0	7.5	47
3M MIP + SMI				41.8	11.3	47

† Adjusted for 1-month ISWD, age, and sex.
‡ The reduced baseline model (1-month ISWD + age + sex) explained 30.5% of the variance in ISWD (R^2 = 0.305, N = 47).

Unadjusted models represent simple linear regression analyses for each predictor. Baseline-adjusted models were adjusted for 1-month ISWD, age, and sex. β indicates standardized regression coefficients. Adjusted R^2 represents the proportion of variance in ISWD explained by the model after adjustment for the number of predictors. Partial R^2 values were calculated as the difference in R^2 between the baseline model and each extended model. Addition of both SMI and MIP increased the model R^2 to 0.418 (ΔR^2 = 0.113). Partial R^2 represents the incremental contribution of each predictor beyond the baseline model.

Conclusion

Skeletal muscle mass and inspiratory muscle strength—but not spirometric lung function—were independently associated with postoperative exercise capacity after lung cancer surgery. These findings support incorporating SMI and MIP into postoperative functional assessments and suggest muscle-targeted rehabilitation as a one strategy to optimize recovery