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Low Physical Performance as a Marker of Cardiorespiratory Fitness Recovery after Abdominal Surgery

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Introduction

Cardiorespiratory fitness (CRF) has been emphasized in perioperative care for non-cardiac surgery. Despite standardized recovery protocols, patients undergoing major abdominal surgery show heterogeneous functional recovery, and there is limited research on early predictors of postoperative CRF. This study aimed to investigate whether early physical performance measures can predict postoperative CRF and its recovery trajectory.

Methods

- A prospective cohort study in 105 patients undergoing postoperative rehabilitation (deep breathing, aerobic, and resistive training) after major abdominal surgery
- All participants underwent the Short Physical Performance Battery (SPPB), bioelectrical impedance analysis, and handgrip strength tests before discharge, and classified into a low physical performance (PF) group and a high PF group based on the criteria of the 2019 Asian Working Group for Sarcopenia.
- Cardiopulmonary exercise testing was assessed at 1 month and 6 months after surgery.
- Two-sample t-tests for between-group comparisons and paired t-tests for within-group changes.
- A two-way repeated-measures ANOVA was performed, with Time as the within-subject factor and Group (low PF vs. high PF) as the between-subject factor.

Results

	Low physical performance (n = 61)	High physical performance (n = 44)	P
Female	29 (47.5%)	10 (22.7%)	0.017*
Age, yr	69.6 ± 13.3	61.1 ± 11.0	0.001**
BMI, kg/m^2	23.7 ± 4.3	23.6 ± 3.4	0.930
Body fat, %	29.3 ± 9.0	27.1 ± 7.0	0.185
Obesity	20 (32.8%)	14 (31.8%)	1
SMI, kg/m^2	6.6 ± 1.5	7.0 ± 1.0	0.089
Handgrip strength, kg	26.3 ± 10.6	34.2 ± 8.5	<0.001***
SPPB score	9.7 ± 2.2	11.9 ± 0.3	<0.001***
ASA Class	2.5 ± 0.6	2.2 ± 0.6	0.009**
Peak VO_2, mL/kg/min	17.8 ± 6.7	22.3 ± 4.8	<0.001***
AT VO_2, mL/kg/min	14.9 ± 6.2	17.4 ± 4.4	0.025*
% ppVO_2	69.9 ± 35.3	84.7 ± 26.2	0.016*
VE/VCO_2	36.6 ± 6.9	34.5 ± 7.9	0.168
Peak RER	1.01 ± 0.1	1.07 ± 0.1	0.006**

Table 1. Baseline Characteristics of the Low and High Physical Performance Groups

Abbreviations: ASA, American Society of Anesthesiologists; AT, anaerobic threshold; BMI, body mass index; RER, respiratory exchange ratio; SMI, skeletal muscle index; SPPB, short physical performance battery; VCO2, carbon dioxide production; VE, minute ventilation; VO2, oxygen uptake

- The low PF group (58.1%) was older, had a higher proportion of female, a higher ASA class, and lower handgrip strength and SPPB scores than the high PF group (41.9%)

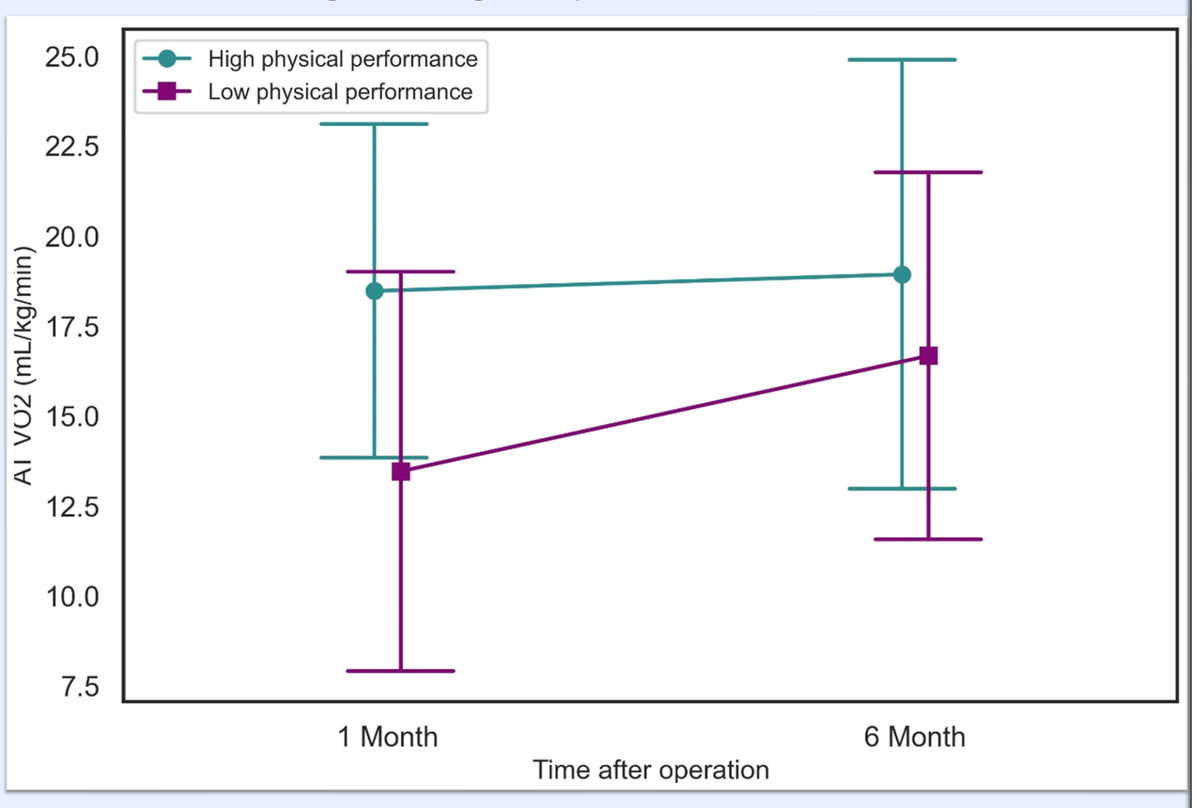

Figure 1. Changes in AT VO_2 from 1 to 6 Months After Major Abdominal Surgery

	Low physical performance (n = 17)			High physical performance (n = 23)		
	1 month after operation	6 months after operation	P	1 month after operation	6 months after operation	P
Peak VO_2, mL/kg/min	16.9 ± 6.2	19.8 ± 6.0	0.005**	23.1 ± 5.4	24.8 ± 7.9	0.122
AT VO_2, mL/kg/min	13.5 ± 5.4	16.7 ± 5.0	0.001**	18.4 ± 4.6	18.9 ± 5.8	0.575
% ppVO_2	59.2 ± 28.8	72.8 ± 35.3	0.010*	90.1 ± 26.8	96.2 ± 32.7	0.148
VE/VCO_2	37.5 ± 5.1	34.7 ± 4.8	0.060	33.7 ± 7.0	32.1 ± 6.2	0.188

Table 2. Cardiopulmonary Exercise Testing Results at 1 Month and 6 Months After Surgery in the Low vs. High Physical Performance Groups

- Compared to the high PF group, the low PF group showed significantly lower peak oxygen consumption (VO_2), anaerobic threshold (AT) VO_2, and percentage of predicted peak VO_2 (%ppVO_2) at 1 month after surgery ($p < 0.05$).
- The low PF group demonstrated a significant improvement in peak VO_2, AT VO_2, and %ppVO_2 between 1 and 6 months, whereas the high PF group did not.
- The two-way repeated-measures ANOVA revealed main effects of Group ($F(1, 37) = 4.977$, $p = 0.032$) and Time ($F(1, 37) = 7.998$, $p = 0.008$) on AT VO_2, and a significant Time × Group interaction ($F(1, 37) = 5.211$, $p = 0.028$)

Conclusion

Early postoperative physical performance status can be associated with postoperative recovery of CRF after major abdominal surgery. Simple physical performance tests, such as SPPB, may help identify patients who require postoperative rehabilitation to enhance CRF recovery