Association between Muscle Health and Patient-Reported Outcomes after Lumbar Microdiscectomy

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INTRODUCTION:

Poor muscle health has been implicated as a source of back pain among patients with lumbar spine pathology. Recently, a novel magnetic resonance imaging (MRI)-based lumbar muscle health grade was shown to correlate with health-related quality of life scores. However, the impact of muscle health on postoperative functional outcomes following spine surgery remains to be investigated. Therefore, the purpose of this study was to determine whether muscle health grade measured by preoperative psoas and paralumbar muscle cross-sectional areas impact the achievement of minimal clinically important difference (MCID) following lumbar microdiscectomy.

METHODS:

Consecutive patients who underwent 1-level lumbar microdiscectomy in a single institution between 2017-2021 were included. Two previously validated methods for muscle health grading were applied. Axial T2 MRI were analyzed for muscle measurements. The psoas-based method utilized the normalized total psoas area (NTPA), which is the psoas cross-sectional area divided by the square of patient height. Patients were divided into low and high NTPA groups based on sex-specific lowest quartile NTPA thresholds. The paralumbar-based method incorporated the paralumbar cross-sectional area normalized by body mass index (PL-CSA/BMI) and Goutallier classification. Score of 1 was added for either PL-CSA/BMI >130 or Goutallier class of ≤2. “Good” muscle health was defined as score of 2, and “poor” muscle health was defined as score of 0-1. Prospectively collected PROMs were analyzed at various postoperative timepoints up to 2 years. The rate of and time to MCID achievement were compared among the cohorts. Bivariate analyses were performed to assess for correlations between psoas/paralumbar cross-sectional areas and change in PROM scores from baseline.

RESULTS: The total cohort included 163 patients with minimum follow-up of 6 months and mean follow-up of 16.5 months. 40 patients (24.5%) were categorized into the low NTPA group, and 55 patients (33.7%) were categorized into the poor paralumbar muscle group. Low NTPA was associated with older age, lower BMI, and greater frequencies of Charlson Comorbidity Index (CCI) ≥1. Poor paralumbar muscle health was associated with older age, female sex, higher BMI, and CCI ≥1. There were no differences in rates of MCID achievement for any PROMs between low vs. high NTPA groups or between poor vs. good paralumbar groups. Low NTPA was associated with longer time to MCID achievement for ODI, VAS back, VAS leg, and SF-12 MCS. Poor paralumbar muscle health was associated with longer time to MCID achievement for VAS back, VAS leg, and SF-12 PCS. NTPA negatively correlated with change in VAS back (6-week, 12-week) and VAS leg (6-month). PL-CSA/BMI positively correlated with change in PROMIS-PF at 3 months follow-up.

DISCUSSION AND CONCLUSION: To our knowledge, this is the first study to evaluate the impact of psoas muscle health on achievement of MCID for functional outcomes after spine surgery. Overall, the current study revealed that unlike in fusion populations, poor muscle health as determined by psoas and paralumbar muscle grading scales did not impact the achievement of MCID in patients undergoing microdiscectomy for the treatment of radiculopathy. A likely contributing factor for this difference in findings is that microdiscectomy is an inherently less invasive procedure with more predictable and predominantly positive outcomes relative to fusion procedures. Nevertheless, our results support that muscle health remains important for patients undergoing microdiscectomy in terms of recovery after surgery. Therefore, spinal surgeons should consider a patient's muscle health status in the preoperative stage.

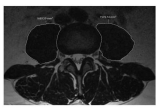

Figure 1. Example bilateral psoas muscle cross-sectional area measurements on axial T2-weighted MRI at the L3-4 disc space performed using Sectra Workstation IDS7.

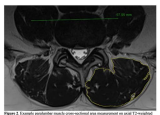

Figure 2. Example paralumbar muscle cross-sectional area measurement on axial T2-weighted MRI performed using ImageJ.

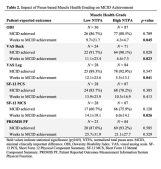

Table 2. Impact of Preoperative Muscle Health Grading on MCID Achievement

	Muscle Health Grade		
Patient-reported outcome	**Low NTPA**	**High NTPA**	**p-value**
ODI	n = 24	n = 72	
MCID achieved	20 (90.7%)	77 (89.9%)	0.789
Weeks to MCID achievement	9.7±21.7	6.0±4.7	**0.045**
VAS Back	n = 24	n = 71	
MCID achieved	22 (91.7%)	64 (90.1%)	0.820
Weeks to MCID achievement	11.1±23.4	8.0±7.2	**0.023**
VAS Leg	n = 24	n = 64	
MCID achieved	23 (95.5%)	79 (92.9%)	0.547
Weeks to MCID achievement	12.1±23.4	5.9±13.1	**0.041**
SF-12 PCS	n = 24	n = 67	
MCID achieved	17 (70.8%)	64 (75.9%)	0.385
Weeks to MCID achievement	13.8±23.8	13.3±14.9	0.433
SF-12 MCS	n = 24	n = 67	
MCID achieved	17 (80.7%)	64 (75.9%)	0.120
Weeks to MCID achievement	14.1±18.1	8.0±14.1	**0.026**
PROMIS-PF	n = 21	n = 64	
MCID achieved	20 (87.0%)	69 (93.2%)	0.301
Weeks to MCID achievement	25.7±31.9	21.1±27.7	0.329

Bold values indicate statistical significance (p<0.05). NTPA, normalized total psoas area; MCID, Minimum Clinically Important Difference; ODI, Oswestry Disability Index; VAS, Visual Analog Scale; SF-12 PCS, Short Form-12 Physical Component Summary; SF-12 MCS, Short Form-12 Mental Component Summary; PROMIS-PF, Patient-Reported Outcomes Measurement Information System Physical Function.

Table 3. Impact of Paralumbar-based Muscle Health Grading on MCID Achievement

	Muscle Health Grade		
Patient-reported outcome	**Poor (score≤1)**	**Good (score=2)**	**p-value**
ODI	n = 55	n = 41	
MCID achieved	55 (92.1%)	66 (95.7%)	0.324
Weeks to MCID achievement	13.3±17.7	7.7±16.8	0.212
VAS Back	n = 51	n = 41	
MCID achieved	44 (90.9%)	41 (90.2%)	0.907
Weeks to MCID achievement	14.7±28.6	4.9±7.6	**0.015**
VAS Leg	n = 51	n = 41	
MCID achieved	52 (97.0%)	51 (87.0%)	0.113
Weeks to MCID achievement	16.0±31.3	5.7±9.8	**0.029**
SF-12 PCS	n = 54	n = 40	
MCID achieved	39 (82.4%)	42 (78.8%)	0.841
Weeks to MCID achievement	19.9±29.7	7.9±9.9	**0.018**
SF-12 MCS	n = 54	n = 40	
MCID achieved	34 (70.6%)	39 (75.0%)	0.729
Weeks to MCID achievement	9.9±22.3	7.1±13.8	0.401
PROMIS-PF	n = 54	n = 73	
MCID achieved	29 (82.9%)	41 (83.0%)	0.876
Weeks to MCID achievement	23.1±35.7	20.7±24.8	0.588

Bold values indicate statistical significance (p<0.05). MCID, minimum clinically important difference; ODI, Oswestry Disability Index; VAS, Visual Analog Scale; SF-12 PCS, Short Form-12 Physical Component Summary; SF-12 MCS, Short Form-12 Mental Component Summary; PROMIS-PF, Patient-Reported Outcomes Measurement Information System Physical Function.