Preoperative PROMIS Scores Can Predict Failure to Improve after Carpal Tunnel Release

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INTRODUCTION: Measuring patient-reported outcomes for orthopaedic procedures through the National Institutes of Health Patient-Reported Measurement Information System (PROMIS) is becoming increasingly widespread. PROMIS scores have been utilized in a variety of orthopaedic fields to facilitate discussion with patients regarding post-intervention expectations. We hypothesized that preoperative PROMIS scores correlate with patients' subjective level of improvement after carpal tunnel release (CTR).

METHODS: Retrospective chart review was performed to identify patients who underwent open or endoscopic CTR. Demographic data along with preoperative PROMIS Upper Extremity (UE), Pain Interference (PI), Depression (DP), and QuickDASH (QD) scores were collected. At a minimum of 3 months postoperatively, patients were asked a follow-up anchor question: "Since your treatment, how would you rate your overall function?". Significance between preoperative scores and subjective improvement were modeled using univariable and multivariable logistic regression. Correlation between preoperative scores and patient anchor question response was calculated using Receiver Operating Characteristic (ROC) Curves and reported as area under the curve (AUC) (values 0.6 - 0.69; moderate predictive ability, 0.7 - 0.79; strong, and > 0.8; excellent). An optimal cutoff value for each ROC curves was determined by maximizing sensitivity and specificity using Youden's Index.

RESULTS: There were 122 patients included in this study. The mean age was 56.7 years and 67% of patients were female. Mean follow-up time was 4.7 months. Ninety-three patients (74%) fell into the "improved" category and 32 (26%) patients fell into the "nonimproved" category.Univariate logistic regression revealed that preoperative UE, PI, and QD scores were significantly correlated with achieving subjective improvement (Table 1). Multivariate logistic regression revealed that only preoperative UE were correlated (Table 2). ROC curves revealed that a combination of preoperative UE and PI scores [formula (0.50*UE) – (0.1*PI)] yielded the greatest AUC (0.75) and highest specificity+specificity value (1.47) (Table 3). The optimal cutoff was 10.5 (specificity 70%, sensitivity 77%).

DISCUSSION AND CONCLUSION:

PROMIS UE scores is most independently correlated with patients' likelihood of reporting postoperative improvement after CTR. Surprisingly, preoperative PROMIS Depression scores do not correlate with and do not predict subjective postoperative improvement as had been previously reported (Ring et al. *JHS 2008*). Using the formula (0.50*UE) – (0.1*PI), where UE and PI are respective preoperative PROMIS scores, one can predict with 70% specificity and 77% sensitivity whether patients will report subjective improvement after CTR. The use of this formula can help predict subjective postoperative improvement for patients undergoing CTR, which may help in setting expectations.

Table 1. Univariable Logistic Regression. Odds ratio are reported relative to achieving subjective improvement.

	Non-Improved [Mean (SD)]	Improved [Mean (SD)]	Odds Ratio (5-point increase)	95% Confidence Interval	P-value
Preop UE	30.9 (6.6)	37.5 (7.3)	2.22	1.46-3.39	**P < 0.001**
Preop PI	62.2 (7.4)	58.6 (6.6)	0.64	0.45-0.91	**P = 0.01**
Preop DP	51.5 (11.8)	47.8 (9.5)	0.84	0.67-1.04	P = 0.17
Preop QD	54.3 (16.5)	43.0 (17.2)	0.82	0.72-0.94	**P = 0.004**

Preop, Preoperative; UE, PROMIS Upper Extremity; PI, PROMIS Pain Interference; DP, PROMIS Depression; QD QuickDASH

Table 2. Multivariable Logistic regression

	Odds Ratio (5-point increase)	95% Confidence Interval	P-value
Preop UE	1.98	1.20-3.27	**P = 0.004***
Preop PI	1.04	0.67-1.61	P = 0.85
Preop QD	0.95	0.79-1.14	P = 0.58

Preop, Preoperative; UE, PROMIS Upper Extremity; PI, PROMIS Pain Interference; DP, PROMIS Depression; QD QuickDASH

Table 3. ROC Curve illustrating diagnostic abilities of the preoperative PROMIS and QD scores to predict subjective patient outcome (AUC values of 0.6 to 0.69 - moderate predictive ability, 0.7 to 0.79 - strong, and > 0.8 - excellent).

	Receiver Operating Characteristic Curve				
	AUC	Optimal Cutoff	Specificity	Sensitivity	Sensitivity + Specificity
UE	0.75	31	53%	88%	1.41
PI	0.65	64	48%	91%	1.39
DP	0.58	57	32%	87%	1.19
QD	0.68	36.4	86%	42%	1.28
Multivariable (UE + PI + DP + QD) $-3.85 + (0.13 * UE) + (0.01 * PI) - (0.01 * Dep) - (0.01 QD)$	0.73	0.65	56%	85%	1.41
Multivariable (UE + PI + QD) $-3.6 + (0.13 * UE) + (0.01 * PI) - 0.01 (QD)$	0.74	0.77	79%	63%	1.42
Multivariable (UE + QD) $-2.75 + (0.13 * x) - (0.01 * QD)$	0.73	0.74	72%	69%	1.41
Multivariable (UE + PI) $-2.73 + (0.15 * UE) - (0.02 * PI)$	0.75	0.72	70%	77%	1.47
Modified (UE + PI) (0. 50 * UE) – (0. 1 * PI)	**0.75**	**10.5**	**70%**	**77%**	**1.47**

AUC, Area Under the Curve; UE, Preoperative PROMIS UE Score; PI, Preoperative PROMIS PI Score; DP, Preoperative PROMIS Depression Score; QD, Preoperative QuickDASH Score.