A threshold disability score corresponds with an estimated diagnosis of clinical depression in patients with upper extremity disease

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Abstract

Background The purpose of this study was to assess whether there is a threshold Disability of Arm, Shoulder and Hand (DASH) score among patients with common hand diagnoses that corresponds with an estimated diagnosis of clinical depression.

Methods Two hundred sixty-nine patients with one of five common upper extremity disorders completed a measure of upper extremity-specific disability (QuickDASH or DASH) and a questionnaire assessing depressive symptoms (Patient Health Questionnaire (PHQ) or Center for Epidemiologic Studies Depression scale (CES-D). A receiver operating characteristic (ROC) analysis of the discriminatory value of a threshold DASH score for an estimated diagnosis of clinical depression was assessed. The threshold DASH score with the highest positive predictive value for an estimated diagnosis of clinical depression was selected. In bivariate analysis, the association between demographic factors, disease factors, and an estimated diagnosis of clinical depression was examined.

Results The area under the ROC curve for a threshold DASH value diagnostic of an estimated diagnosis of clinical depression was 0.75, indicating clinical usefulness for a threshold DASH score as a screening test for depression. The highest positive predictive value of 72 % occurred at a threshold QuickDASH/DASH score of 55. In bivariate analysis, only diagnosis and years of education were significantly different between patients with and without an estimated diagnosis of clinical depression.

Conclusion A DASH score of 55 or greater in patients with common upper extremity disorders has an acceptable area under the curve and positive predictive value for an estimated diagnosis of clinical depression.

Level of Evidence: Level 3, diagnostic study

Keywords Function · Hand · Depression · Common hand diagnosis

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Introduction

A subset of patients experiences greater symptoms and disability than expected based on their pathophysiology [5]. Symptoms of depression, ineffective coping strategies (i.e., kinesiophobia, catastrophic thinking, and low pain self-efficacy), and heightened illness concern are strong determinants of symptoms and disability [7, 12, 16–18]. The variation in symptoms and disability for a given pathology is remarkable, and the highest disability scores draw attention as a possible indicator of clinical depression defined as a level of depressive symptoms that warrants treatment.

The aim of this study was to investigate whether there is a threshold score on the DASH questionnaire that corresponds with an estimated diagnosis of clinical depression. Secondary study question addresses whether demographic and disease factors were different between patients with and without an estimated diagnosis of clinical depression.

Table 1 Patients characteristics

	Mean	SD	Range
Age in years	53	15	20–87
	Median	IQR	Range
Years of education	16	12–16	8–25
	n	%	
Sex			
Men	92	34	
Women	177	66	
Diagnosis			
De Quervain's tendinopathy	69	26	
Carpal Tunnel Syndrome	90	33	
Trigger Finger	47	17	
Ganglion cyst	11	4	
Mallet finger	52	19	
Health-related outcomes			
	Median	IQR	Range
QuickDASH/DASH score	21	11–36	0–86
Depression score			
CES-D (n=248)	9	3–16	0–49
PHQ-9 (n=21)	1	0–2	0–9

SD standard deviation, *IQR* interquartile range, *DASH* disability of the arm, shoulder and hand, *CES-D* centre of epidemiologic studies depression scale, *PHQ* patient health questionnaire

Materials and methods

Subjects

Prospectively collected data from prior studies were used for this study after approval from our institutional review board. These prospective studies were performed between 2005 and 2013 and included 968 patients.

Patients diagnosed with de Quervain tendinopathy, trigger finger, carpal tunnel syndrome, ganglion cyst, or mallet finger were included when both questionnaire concerning depressive symptoms (i.e. Centre of Epidemiologic Studies Depression (CES-D) [15] or Patient Health Questionnaire (PHQ) [8]) and a disability questionnaire (DASH or QuickDASH) were completed. Exclusion criteria were the following: (1) patients with other concomitant upper extremity conditions and (2) patients who had prior surgery for their upper extremity condition. Two hundred sixty-nine patients satisfied these criteria. All patients were evaluated a single time prior to treatment. We used the explanatory variables (e.g., age, sex, and education) that were collected in all studies.

The 11-item QuickDASH outcome measure is a shortened version of the 30-item Disabilities of Arm, Shoulder, and Hand questionnaire (DASH) [6]. Both questionnaires score disability on a scale from 0 to 100 with a higher score reflecting more disability. Given that the QuickDASH and DASH scores are highly correlated [1, 2], we used the scaled score no matter the number of questions administered.

The CES-D scale is a short scale designed to measure self-reported depressive symptoms in the general population [15]. This score ranges from 0 to 60 with 60 being the highest possible score. For the CES-D, a cutoff score of 16 is indicative of clinical depression [19].

The PHQ-9 is a nine-item questionnaire to diagnose clinical depression based on nine depressive symptom criteria. Scores range from 0 to 27 with scores over 10 representing an estimated diagnosis of clinical depression [8, 10].

Of the 269 patients included, 92 (34 %) were men and 177 (66 %) were women with a mean age of 53 (±standard deviation [SD], 15) years (range 20–87 years; median, 53 years) (Table 1). Twenty-one patients completed the QuickDASH and 248 completed the DASH. In total, 68

Fig. 1 Receiver operating characteristic curve of a threshold DASH score as an estimated diagnosis of clinical depression. For an estimated diagnosis of major depression based on one of two questionnaires, the rate of false positives is plotted on the x-axis and the rate of true positives on the y-axis for a range of threshold values of QuickDASH/DASH scores. The area under the curve of 0.75 indicates acceptable discrimination. A DASH score of 0.55 had the highest positive predictive value and was selected as the threshold

Area under ROC curve = 0.7520
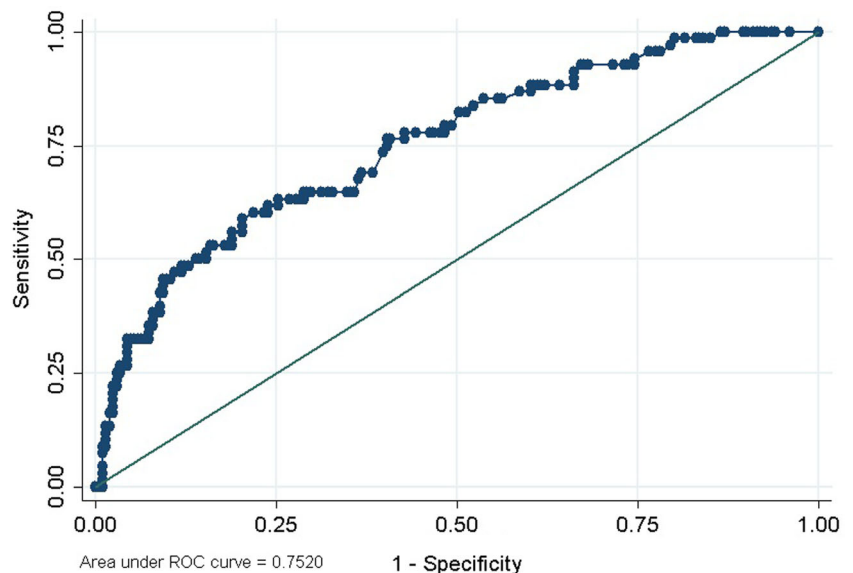
Table 2 ROC analysis for different thresholds of disability score

	Sensitivity (%)	Specificity (%)	PPV (%)
Threshold			
>0	100	0	25
>5	100	10	27
>10	93	25	30
>15	87	40	33
>20	78	54	36
>25	68	64	39
>30	63	72	43
>35	53	82	50
>40	47	89	59
>45	37	92	61
>50	28	96	68
>55*	26	97	72
>60	19	98	72
>65	10	99	70
>70	3	99	50
>75	0	99	0
>80	0	100	0

*Best cutoff value considering the positive predictive value

PPV positive predictive value

patients (25 %) qualified for an estimated diagnosis of clinical depression.

Statistical analysis

The results were presented with frequencies and percentages for categorical variables and as mean with standard deviation or median with interquartile range for normally and non-

normally distributed continuous variables, respectively. The normality of the continuous variables was tested using the Shapiro-Wilk test.

A receiver operator characteristic (ROC) curve was created to determine whether there is a cutoff value in DASH/QuickDASH scores that corresponds with an estimated clinical depression using the cutoff value with the highest positive predictive value (PPV). ROC analysis is a technique that measures the ability of a diagnostic test to discriminate between patients that do and do not have a given disease. A ROC curve is made by plotting the rate of false positives on the *x*-axis and the rate of true positives on the *y*-axis for a range of threshold values [14]. The discriminatory value of a test can be calculated in means of an area under the curve (AUC). An AUC of 1.0 indicates perfect discrimination whereas an area under the curve of 0.50 represents no discriminatory power [4, 11]. A diagnostic test with an AUC of at least 0.75 is generally considered clinically useful, where an AUC of around 0.98 is seen as clinically very useful [3].

In bivariate analysis, the association between the response variable (estimated clinical depression) and explanatory variables (disability score, demographics, and disease factors) was examined using the chi-squared test for dichotomous and categorical explanatory variables. For continuous variables, either the Student *T* test or Mann-Whitney *U* test was used depending on the normality of the data.

Results

The area under the curve (AUC) was 0.75 (95 % confidence interval (CI), 0.68–0.82) indicating that QuickDASH/DASH

Table 3 Bivariate analysis

		No estimated diagnosis of major depression (*n*=201) *n* (%)	Estimated diagnosis of major depression (*n*=68) *n* (%)	*p* value
Sex				
	Male	75 (37 %)	17 (25 %)	0.06
	Female	126 (63 %)	51 (75 %)	
		Mean (SD)	Mean (SD)	
Age		54 (14)	50 (15)	0.06
		Median (IQR)	Median (IQR)	
Years of education		16 (13–16)	14 (12–16)	0.02
		n (%)	*n* (%)	
Diagnosis				
	De Quervain's tendinopathy	37 (54 %)	32 (46 %)	<0.01
	Carpal tunnel syndrome	68 (76 %)	22 (24 %)	
	Trigger finger	39 (83 %)	8 (17 %)	
	Ganglion cyst	11 (100 %)	0 (0 %)	
	Mallet finger	46 (88 %)	6 (12 %)	

SD standard deviation, *IQR* inter-quartile range

score can be useful for making an estimation of clinical depression (Fig. 1). The highest positive predictive value for an estimated diagnosis of clinical depression occurred at a threshold QuickDASH/DASH score of 55 (Table 2). At this threshold, there is a high specificity (98 %), moderate sensitivity (26 %), a positive predictive value of 72 %, and 79 % of the sample is correctly classified (Table 2).

In bivariate analysis, years of education ($p=0.02$) was significantly different between patients with and without an estimated diagnosis of clinical depression. We also found that there was a difference in estimated diagnosis of clinical depression among different upper extremity diagnosis ($p<0.01$); patients with De Quervain's tendinopathy most often had an estimated diagnosis of clinical depression (46 %) while there were no patients with ganglion cysts with an estimated diagnosis of clinical depression (Table 3).

Discussion

Given the correlation of disability with symptoms of depression, we were curious if there is a threshold level of disability that corresponds with an estimated diagnosis of clinical depression. Using ROC curves, we found that a QuickDASH/ DASH score of 55 or greater is very specific (specificity of 98 %) for an estimated diagnosis of clinical depression. Patients with substantial disability from common hand problems might benefit from screening for clinical depression.

This study should be considered in light of the fact that it is based on secondary use of data rather than a new prospective cohort. There is a spectrum bias due to the fact that we only studied patients with one of five common hand diagnoses. The results of this study therefore may only apply to the diagnoses studied. Nonetheless, we feel the results are representative of the most common hand and upper extremity conditions, applying best to non-traumatic painful conditions such as de Quervain tendinopathy and trigger finger. Data was obtained at a tertiary care referral center for hand and upper extremity conditions. Therefore, the results may apply best to our practice setting. We used two different measures of depressive symptoms that may have different diagnostic performance for an estimated diagnosis of clinical depression. Long and short versions of the disability measure were used which may have resulted in an underestimation of disability as QuickDASH scores are slightly lower than DASH scores [2]. Finally, some demographic factors were not included in every study, limiting the factors we could evaluate in bivariate analysis.

One study comparable to ours demonstrated via ROC analysis that there is a threshold in the amount of somatic symptoms in pediatric patients with chronic abdominal pain that corresponds with an estimated diagnosis of major depression [9]. Other studies found that having many somatic symptoms (more symptoms than the 90th percentile) or chronic pain predict the presence or a higher chance of developing a major depression disorder [13, 20]. This is consistent with our finding that questionnaires that assess symptoms and disability have threshold scores that can be used to identify patients with depressive symptoms.

The observation that a threshold QuickDASH/DASH score is a useful screening test for patients who may have an estimated diagnosis of clinical depression should affect hand surgery practice. Since these are common benign problems, its less likely that the depression is a reaction to the condition. The magnitude of upper extremity-specific disability in this group of patients is more likely due to the disease becoming a somatic focus of existing depression. When symptoms or disability are unexpectedly high, health-care providers should consider screening the patient for a treatable clinical depressive disorder.

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