Validation of the UCLA Scleroderma Clinical Trial Gastrointestinal Tract Instrument Version 2.0 for Systemic Sclerosis

MURRAY BARON, MARIE HUDSON, RUSSELL STEELE, ERNEST LO, and the Canadian Scleroderma Research Group

ABSTRACT. ***Objective.*** The University of California at Los Angeles (UCLA) Scleroderma Clinical Trial Consortium GI Tract Instrument (UCLA SCTC GITI) was recently developed to measure gastrointestinal tract disease in systemic sclerosis (SSc). Our study assesses the internal consistency and validity of the instrument in a different population than was used in the original study.

Methods. A sample of 113 consecutive patients with SSc from the Canadian Scleroderma Research Group (CSRG) Registry completed the UCLA SCTC GITI, a self-administered questionnaire with 7 scales and an overall score. Reliability was evaluated using Cronbach's alpha coefficient and validity was determined by testing multiple constructs.

Results. Our subjects were slightly older than the original cohort, and had less formal education and less diffuse cutaneous disease. The overall score of the instrument correlated well with the GI scale of the Health Assessment Questionnaire for the Spondyloarthropathies (GI-S-HAQ; $r = 0.58$, $p < 0.001$) and the total number of GI symptoms ($r = 0.77$, $p < 0.001$). Each subscale correlated well with the GI-S-HAQ. The individual scales and the overall score were able to differentiate between categorical groupings of the GI-S-HAQ. The scale scores differentiated well those patients with clinical involvement of the corresponding GI problem. Multiple linear regression adjusting for age, disease duration, sex, and ethnicity showed that the UCLA SCTC GITI had a significant association with both the physical component summary and the mental component summary of the Medical Outcomes Study Short-Form 36 questionnaire.

Conclusion. Our study confirms that the UCLA SCTC GITI version 2.0 will be a useful tool for assessing the role of GI involvement in SSc, even in a population with substantially different characteristics than the subjects originally tested. (First Release July 1 2011; J Rheumatol 2011;38:1925–30; doi:10.3899/jrheum.110060)

Key Indexing Terms:
SCLERODERMA GASTROINTESTINAL TRACT QUESTIONNAIRES
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Involvement of the gastrointestinal (GI) tract occurs in up to 90% of patients with systemic sclerosis (SSc)[1,2]. We have demonstrated that GI symptoms are associated with health-related quality of life (HRQOL)[3,4] in SSc and also with pain[5], depression[6], fatigue[7], pruritus[8], and malnutrition[9]. Although severe GI involvement affects only 8% of patients with SSc, mortality can be high in that situation, with only 15% of such patients alive after 9 years[10].

Because GI involvement is so prevalent and important in SSc, it is important to have a well validated, reliable measure of GI tract disease for the purposes of future research. The University of California at Los Angeles Scleroderma Clinical Trial Consortium Gastrointestinal Tract Instrument (UCLA SCTC GITI) has recently been developed to serve this purpose[11].

We wished to confirm the internal consistency and validity of this instrument in a different population from the American one in which it was first tested[11]. We thus administered the questionnaire to a sample of patients from the Canadian Scleroderma Research Group patient registry.

MATERIALS AND METHODS

Study subjects. Our study subjects were recruited from those enrolled in the Canadian Scleroderma Research Group Registry. Patients in this registry are recruited from 15 centers across Canada. They must have a diagnosis of SSc made by the referring rheumatologist, be > 18 years of age, and be fluent in either English or French. Patients are seen yearly. The patients included in our study were a convenience sample of 113 consecutive English-speaking patients from 1 site only who agreed to fill out 1 extra questionnaire. All patients recruited into the registry undergo an extensive medical evaluation with standardized reporting of history, physical evaluation, and laboratory investigations.

From the SMBD-Jewish General Hospital and McGill University, Montreal, Quebec, Canada.

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M. Baron, MD; M. Hudson, MD, MPH, SMBD-Jewish General Hospital; R. Steele, PhD, McGill University; E. Lo, PhD, SMBD-Jewish General Hospital.

Address correspondence to Dr. M. Baron, SMBD-Jewish General Hospital, Room A-725, 3755 Cote Ste Catherine Road, Montreal, Quebec H3T 1E2, Canada. E-mail: mbaron@rhu.jgh.mcgill.ca

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Instrument. We were given the UCLA SCTC GITI version 2.0 by its author[11,12]. The English version is also available free of charge at http://ucla-scleroderma.researchcore.org/. This is a self-administered questionnaire with a total of 34 questions that form 7 scales: reflux, distension/bloating, fecal soilage, diarrhea, social functioning, emotional well-being, and constipation. The items are scored on a 0 to 3 possible range, where 0 indicates better health and 3 indicates worse health, except for questions 15 and 31, which ask, "In the past 1 week, have you noticed your stools becoming...(15) watery (yes/no) and (31) harder (yes/no)". These questions are scored on 0 (better health) and 1 (worse health) possible range. Each scale is scored 0–3 except for diarrhea (0–2) and constipation (0–2.5) and there is an overall score of 0–3 as well. The reliability and validity of this instrument have been reported in the initial population[11].

Other variables. Disease duration is calculated from the first non-Raynaud's phenomenon manifestation, as in other studies[12,13,14,15,16,17]. As part of the routine questions for the CSRG, to assess GI involvement patients answer yes/no to a series of 14 questions concerning appetite loss, difficulty swallowing, regurgitation of acid, nocturnal choking, heartburn, early satiety, abdominal bloating, nausea and vomiting, constipation, diarrhea, need for antibiotics for diarrhea, greasy stools, fecal incontinence, and the need for parenteral nutrition. We reviewed protocols from 7 major SSc centers in North America and compiled this list of the GI symptoms included in those protocols. The overall GI involvement is assessed as the total number of questions to which the patient answers "yes." In other studies we have demonstrated an association between this score and quality of life[3] and we have shown that it has an excellent association with measures of malnutrition[9], and these studies thus validate this measure. In addition, we used combinations of physician-defined and patient-defined answers on the case report forms to determine what we will refer to as 7 "clinical GI tract diagnoses." Detailed definitions of gastroesophageal reflux disease (GERD), gastroparesis, bacterial overgrowth, pseudo-obstruction, diarrhea, rectal incontinence, and constipation are available as accessory material online.

Statistics. As closely as possible, we tried to reproduce the methodology of the authors of the UCLA SCTC GITI in their initial study of validation[11]. Internal consistency as a measure of reliability was estimated using Cronbach's alpha coefficient. Correlations ≤ 0.29 were considered to be small, between 0.30 and 0.49 moderate, and ≥ 0.50 large.

We examined the ability of the UCLA SCTC GITI 2.0 to differentiate among patients with mild, mild-moderate, and severe GI tract involvement. In the validation of Khanna, *et al*[11], patients were given a question to globally assess GI involvement: "How severe have your digestive tract symptoms been in general during the last 7 days?" (very mild, mild, moderate, severe, very severe). Instead of this question we used the GI question from the SSc version of the Health Assessment Questionnaire (HAQ; GI-S-HAQ)[18], which was originally a 150-mm visual analog scale. We adapted that to an 11-point numerical rating scale with the same anchors. For purposes of developing categories of GI severity, this was collapsed into 3 groups. Because of extremely right-skewed results, the categories we created were normal (score = 0), mild-moderate severity (scores = 1–3), and severe (scores = 4–10). The Tukey-Kramer posthoc adjustment was used to test for any significant differences in the analyses of variance.

We also hypothesized that symptom-specific scale scores (e.g., the reflux scale) would be higher (worse) in patients with a specific clinical GI tract diagnosis (e.g., GERD).

Exploratory factor analysis was performed to evaluate the underlying structure of the 7 multi-item scales[19]. Criteria used to select the most plausible model included components accounting for ≥ 5% of the variance and principal component eigenvalues > 1[20]. Oblique promax rotation was performed to estimate factor correlations (rather than assume they were uncorrelated)[21].

All statistical analyses were performed with R 2.10.0[22]; p values < 0.05 were considered statistically significant.

RESULTS

All 113 patients given a questionnaire returned the completed questionnaire. Table 1 shows the characteristics of the patients.

There were several differences between our sample and that of Khanna, *et al*[11]. Our subjects were slightly older, only 5.3% had a postgraduate degree versus 20.4% of the UCLA cohort, 62.2% of our subjects had limited disease versus 40.7%, and self-rated GI severity tended to be lower in our cohort (54.9% with no symptoms vs 19.1%). This sample of 113 subjects seemed to have less GI involvement than our entire cohort of 1160 patients.

Figure 1 shows the good relationship between the UCLA SCTC GITI overall score and the GI-S-HAQ (A) and the total number of GI symptoms (B). Figure 1C shows that the relationship is slightly better when the psychosocial aspects of the UCLA SCTC GITI are removed.

Internal consistency. Table 2 demonstrates good internal consistency of items from the UCLA SCTC GITI. There was a moderately high percentage with a ceiling effect, which is slightly more than the same data from the original cohort.

Table 1. Baseline characteristics of the study participants (n = 113).

Variables	Mean or N	SD or %
Age, yrs	59.9	10.8
Women, %	103	91.2
Disease duration, yrs	12.6	9.4
Ethnicity, %		
Caucasian	100	88.5
French Canadian	56	49.6
Aboriginal	4	3.5
Other	21	18.6
Education, %		
Less than or equal to high school graduate	56	49.6
Some college/university	16	14.2
College/university graduate	35	31.0
Postgraduate	6	5.3
Type of systemic sclerosis*, %		
Limited	69	62.2
Diffuse	40	36.0
Sine scleroderma	2	1.8
Clinical GI tract diagnoses, %		
Gastroesophageal reflux	94	83.2
Gastroparesis	42	37.2
Bacterial overgrowth	39	34.5
Pseudo-obstruction	2	1.8
Diarrhea	24	21.2
Rectal incontinence	28	24.8
Constipation	31	27.4
Health-related quality of life		
SF-36 physical component summary	39.9	11.06
SF-36 mental component summary	48.6	10.21
Self-rated GI severity, %		
Normal	54.9	62
Mild-moderate	30.1	34
Severe	15.0	17

* Adequate data for subset classification was missing on 2 subjects. GI: gastrointestinal; SF-36: Medical Outcomes Study Short-Form 36 questionnaire.

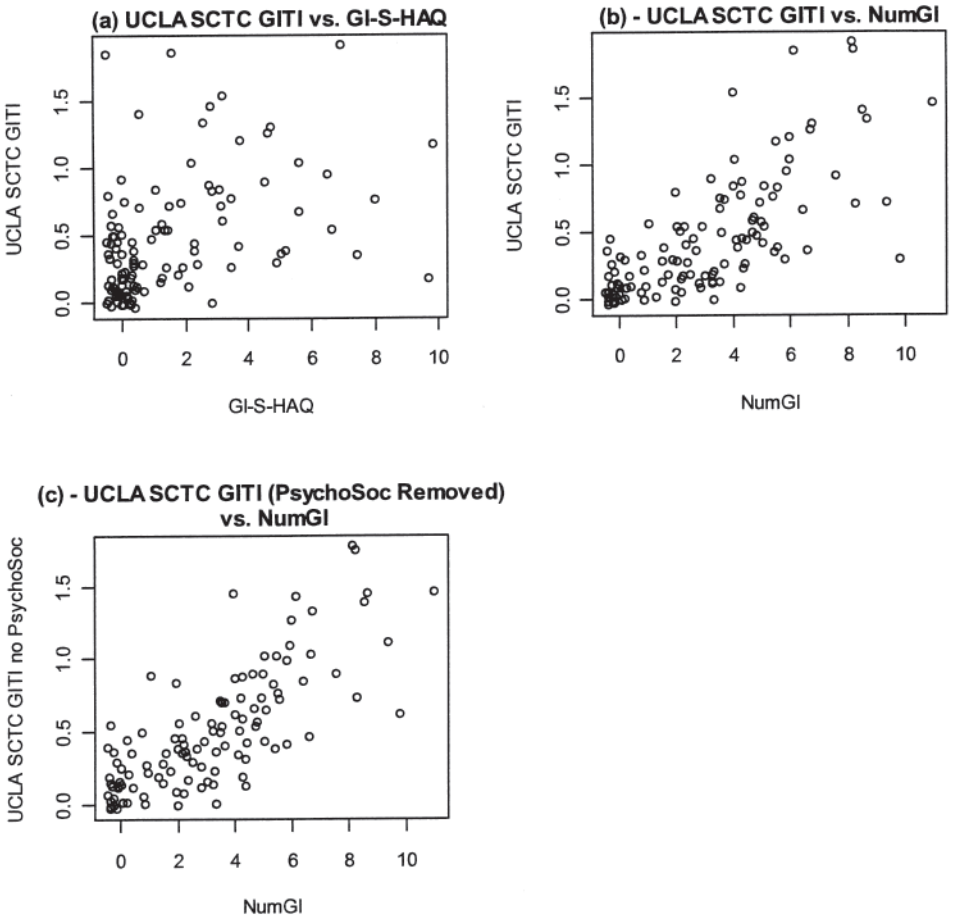

Figure 1. The relation between the UCLA Scleroderma Clinical Trial Consortium GI Tract Instrument overall score and the GI scale of the Health Assessment Questionnaire for the Spondyloarthropathies [GI-S-HAQ; (a)] and the total number of GI symptoms (b). Graph (c) demonstrates the same relationship as (b) but with the psychosocial questions of the UCLA SCTC GITI removed.

Validity. Table 3 shows the relationship between the scales of the UCLA SCTC GITI score and the GI-S-HAQ question. The correlations were all highly significant, with both each subscale and the overall score. There were also good correlations between the number of GI symptoms and both the total UCLA SCTC GITI score ($r = 0.77$, $p < 0.001$) and the total UCLA SCTC GITI score with the psychosocial scales "social functioning" and "emotional well-being" omitted ($r = 0.79$, $p < 0.001$).

Table 2. Descriptive statistics and internal consistency of the University of California at Los Angeles (UCLA) Scleroderma Clinical Trial Consortium GI Tract Instrument (UCLA SCTC GITI) 2.0, using the Canadian Scleroderma Research Group cohort (n = 113).

Scale	No. Items	Mean	SD	Median	Range of Scores in Our Patients		% with Floor Effect*	% with Ceiling Effect**	Cronbach's Alpha Coefficient
					Min	Max			
Reflux	8	0.43	0.52	0.25	0	3	0.9	25.7	0.83
Distension/bloating	4	0.86	0.82	0.67	0	3	0.9	24.8	0.82
Diarrhea	2	0.33	0.57	0	0	2	3.5	67.3	0.80
Fecal soilage	1	0.35	0.68	0	0	3	2.7	73.5	0.00
Constipation	4	0.47	0.60	0.25	0	2.50	2.7	46.0	0.85
Emotional well-being	9	0.39	0.54	0.11	0	2.44	0.0	45.1	0.87
Social functioning	6	0.32	0.44	0.17	0	2.33	0.0	45.1	0.77
Total UCLA SCTC GITI score	30	0.45	0.43	0.33	0.00	1.86	0.9	9.7	0.83

* Since 0 represents the absence of the GI problem, the floor effect represents the percentage that scored the maximum possible score. ** Represents percentage that scored the minimum possible score, which represents the absence of a problem.

Table 3. Spearman's correlation coefficient between the University of California at Los Angeles Scleroderma Clinical Trial Consortium GI Tract Instrument (UCLA SCTC GITI) and the gastrointestinal scale of the Health Assessment Questionnaire for the Spondyloarthropathies.

UCLA SCTC GITI Scale	Spearman's ρ	95% CI	p
Reflux	0.37	0.23–0.50	< 0.001
Distension/bloating	0.42	0.28–0.54	< 0.001
Diarrhea	0.34	0.20–0.47	< 0.001
Fecal soilage	0.32	0.17–0.45	< 0.001
Constipation	0.26	0.10–0.40	0.003
Social functioning	0.52	0.40–0.63	< 0.001
Emotional well-being	0.61	0.50–0.70	< 0.001
Total UCLA SCTC GITI score	0.58	0.47–0.68	< 0.001

Table 4 shows the ability of the UCLA SCTC GITI to differentiate between the categorical groupings of the GI-S-HAQ. In most cases the UCLA SCTC GITI was able to differentiate well between the patients with no symptoms and either mild-moderate or severe symptoms. Differentiation between mild-moderate and severe categories was not good due to the reduced number of patients in the severe category and the large range of values included in this category. This was true for all scales and the overall score.

Table 5 shows the relationship between clinical GI tract diagnoses in our sample and the corresponding scales of the UCLA SCTC GITI. The scales of the UCLA SCTC GITI that we chose to correspond with the GI diagnoses were reflux for GERD; distension/bloating for gastroparesis; distension/bloating for bacterial overgrowth; distension/bloating for pseudo-obstruction; diarrhea for diarrhea; fecal soilage for rectal incontinence; constipation for constipation. In each case, except for pseudo-obstruction, the UCLA SCTC GITI scale scores differentiated well those patients with clinical involvement of the corresponding GI problem from those without.

Multiple linear regression was performed to assess the contribution of the UCLA SCTC GITI to HRQOL as measured by the Medical Outcomes Study Short-Form 36 (SF-36) questionnaire (Table 6). Covariates included age, disease duration, sex, and race. The UCLA SCTC GITI had a statistically significant association with both the SF-36 physical component summary (PCS) and the mental component summary (MCS) after adjustment for possible confounding variables. A 1 SD increase in UCLA SCTC GITI (0.43) is associated with a decrease of 3.14 (95% CI 1.06, 5.22) in the PCS and 2.98 in the MCS (95% CI 1.04, 4.92). The models explain 6% of the variance of the SF-36 MCS and 4.6% of the variance of the SF-36 PCS.

Table 5. Comparison of mean scores of UCLA SCTC GITI subscales in patients with and without a clinical gastrointestinal tract diagnosis.

Clinical GI Tract Diagnosis	Mean Score of Relevant UCLA SCTC GITI Scale: With Clinical GI Tract Diagnosis	Mean Score of Relevant UCLA SCTC GITI Scale: Without Clinical GI Tract Diagnosis	p
GERD	0.50	0.07	< 0.001
Gastroparesis	1.36	0.57	< 0.001
Bacterial overgrowth	1.28	0.64	< 0.001
Pseudo-obstruction	0.63	0.87	0.72
Diarrhea	1.15	0.11	< 0.001
Rectal incontinence	1.14	0.09	< 0.001
Constipation	1.15	0.22	< 0.001

UCLA SCTC GITI: University of California at Los Angeles Scleroderma Clinical Trial Consortium GI Tract Instrument; GI: gastrointestinal; GERD: gastroesophageal reflux disease.

DISCUSSION

We assessed internal consistency and construct validity of the UCLA SCTC GITI in a sample of 113 Canadian patients. We demonstrated good internal consistency. Construct validity was also good in that the overall score of the instrument correlated well with the GI scale of the S-HAQ and the total num-

Table 4. Ability of the UCLA SCTC GITI to differentiate between degrees of severity of self-rated GI tract involvement.

Scale	Severity of GI Involvement According to Categorization of GI-S-HAQ Results: Normal, n = 62	Mild-moderate, n = 34	Severe, n = 17	F Test	p	p Values for Pairwise Differences Using Tukey's Honestly Significant Differences Test: Mild-moderate vs Normal	Severe vs Normal	Severe vs Mild-moderate
Reflux	0.26	0.62	0.66	8.12	0.001	0.003	0.010	0.951
Distension/bloating	0.60	1.13	1.29	8.33	0.000	0.005	0.004	0.754
Diarrhea	0.18	0.41	0.74	7.83	0.001	0.104	0.001	0.107
Fecal soilage	0.16	0.62	0.53	6.12	0.003	0.004	0.102	0.892
Constipation	0.32	0.71	0.56	5.04	0.008	0.007	0.299	0.669
Social functioning	0.15	0.48	0.62	13.51	0.000	0.000	0.000	0.449
Emotional well-being	0.14	0.56	0.95	24.67	0.000	0.000	0.000	0.013
Total UCLA SCTC GITI score	0.25	0.64	0.80	20.64	0.000	0.000	0.000	0.312

UCLA SCTC GITI: University of California at Los Angeles Scleroderma Clinical Trial Consortium GI Tract Instrument; GI: gastrointestinal; GI-S-HAQ: GI scale of the Health Assessment Questionnaire for the Spondyloarthropathies.

Table 6. Linear regression between SF-36 PCS and UCLA SCTC GITI score adjusted for age, disease duration, sex, and ethnicity (n = 113).

	ß	Standard Error	95% CI for ß	p
Dependent variable = SF-36 MCS				
UCLA SCTC GITI score	–6.94	2.27	–11.44; –2.44	0.0029
Age	–0.04	0.09	–0.21; –0.14	0.7006
Disease duration	0.08	0.10	–0.12; 0.28	0.4397
White ethnicity	2.34	2.97	–3.54; 8.23	0.4317
Women vs men	2.04	3.43	–4.75; 8.82	0.5536
R^2 adj = 0.04621				
Dependent variable = SF-36 PCS				
UCLA SCTC GITI score	–7.31	2.43	–12.12; –2.49	< 0.001
Age	–0.13	0.10	–0.32; 0.06	0.0033
Disease duration	–0.09	0.11	–0.31; 0.13	0.1922
White ethnicity	2.36	3.18	–3.93; 8.65	0.4599
Women vs men	1.96	3.67	–5.29; 9.22	0.5932
R^2 adj = 0.0595				

SF-36: Medical Outcomes Study Short-Form 36 questionnaire; MCS: mental component summary; PCS: physical component summary; UCLA SCTC GITI: University of California at Los Angeles Scleroderma Clinical Trial Consortium GI Tract Instrument.

ber of GI symptoms that patients complained of. Each subscale also correlated well with the GI-S-HAQ and both all scales and the overall score were able to differentiate between the categorical groupings of the GI-S-HAQ. The UCLA SCTC GITI scale scores also differentiated well those patients with clinical involvement of the GI problem corresponding to that scale from those without, except for pseudo-obstruction. Factor analysis showed that the primary factor is dominated by diarrhea (and related symptoms) and the secondary factor is dominated by constipation (and related symptoms). These results are similar to those of Khanna, *et al*[11]. In addition, the data show clear evidence that GI involvement affects HRQOL as measured in our study by the SF-36.

Our patients differed somewhat from those in the original validation study. In particular, our patients had less severe GI disease. In addition, our subjects were slightly older, fewer had a postgraduate degree, and more had limited disease. As there is some suggestion that the validity of an instrument is population-specific[23,24], we feel that our study is important in that it confirms the validity of the UCLA SCTC GITI in a substantially different population of patients from those in the initial report. This validation exercise thus implies that the instrument is likely to be valid in a more diverse group than those in the original study group.

Our study confirms that the UCLA SCTC GITI version 2.0 will be a useful tool for assessing the role of GI involvement in SSc. One recent report has already used the tool to demonstrate that GI tract involvement is associated with depression[25]. To our knowledge this is the only such tool that has been developed specifically for use in SSc.

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APPENDIX

List of study collaborators. The Canadian Scleroderma Research Group Investigators: J. Pope, London, Ontario; J. Markland, Saskatoon, Saskatchewan; D. Robinson, Winnipeg, Manitoba; N. Jones, Edmonton, Alberta; N. Khalidi, Hamilton, Ontario; P. Docherty, Moncton, New Brunswick; E. Kaminska, Hamilton, Ontario; M. Abu-Hakima, Calgary, Alberta; S. LeClercq, Calgary, Alberta; A. Masetto, Sherbrooke, Quebec; D. Smith, Ottawa, Ontario; E. Sutton, Halifax, Nova Scotia; J-P. Mathieu, Montreal, Quebec; S. Ligier, Montreal, Quebec; M. Fritzler, Advanced Diagnostics Laboratory, Calgary, Alberta.

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