Section: Dermatology, Venereology and Leprosy

Original Research Article

CLINICAL, ENDOSCOPIC, AND MANOMETRIC ASSESSMENT OF ESOPHAGEAL INVOLVEMENT IN PATIENTS WITH SYSTEMIC SCLEROSIS: A CROSS-SECTIONAL STUDY

Sushma Muralidharan[1], Gayatri Devi Bakuru[2], Gomkonda Prem Sagar[3], P Guruprasad[4], T Santhi[5]

[1]Senior Resident, Department of Dermatology, Venereology and Leprosy, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India
[2]Assistant Professor, Department of Dermatology, Venereology and Leprosy, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India
[3]Assistant Professor, Department of Dermatology, Venereology and Leprosy, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India
[4]Professor and Head of Department, Department of Dermatology, Venereology and Leprosy, Gayatri Vidya Parishad Medical College, Visakhapatnam, Andhra Pradesh, India
[5]Professor and Head of Department, Department of Dermatology, Venereology and Leprosy, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India.

Received : 09/02/2026
Received in revised form : 29/03/2026
Accepted : 14/04/2026

Keywords:
systemic sclerosis; esophagus; gastroesophageal reflux disease; endoscopy; high-resolution manometry.

Corresponding Author:
Dr. Sushma Muralidharan,
Email: sushmasushma04@gmail.com

DOI: 10.47009/jamp.2026.8.2.226

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (2); 1243-1247

ABSTRACT

Background: Systemic sclerosis frequently involves the gastrointestinal tract, and the esophagus is the most commonly affected segment. Esophageal disease contributes substantially to reflux, dysphagia, nutritional compromise, and long-term mucosal complications. **Objectives:** To evaluate the clinical, endoscopic, and manometric profile of esophageal involvement in adults with systemic sclerosis and to compare symptomatic and asymptomatic patients with respect to esophageal manifestations. **Materials and Methods:** A hospital-based cross-sectional study was conducted in 30 adults with systemic sclerosis attending a tertiary care center between June 2023 and December 2024. Clinical assessment, autoantibody evaluation, upper gastrointestinal endoscopy, and high-resolution manometry were performed. Comparisons were made between patients with and without gastroesophageal reflux disease symptoms. **Results:** Most patients were women, and limited cutaneous disease predominated. GERD-related symptoms were present in 83% of patients. Reflux esophagitis was identified in 73.3%, Barrett's esophagus in 10.0%, stenosis in 13.3%, and watermelon stomach in 6.7%. Symptomatic patients had lower mean lower esophageal sphincter pressure than asymptomatic patients. Elevated integrated relaxation pressure above 15 mmHg was significantly more frequent in symptomatic patients than in asymptomatic patients (64.0% vs 0.0%, p = 0.033). Distal latency abnormalities were more common in symptomatic patients, although the difference was not statistically significant. **Conclusion:** Esophageal involvement was common in systemic sclerosis and was not confined to overtly symptomatic individuals. Endoscopy and high-resolution manometry together improved detection of structural and functional disease, while elevated integrated relaxation pressure and reduced lower esophageal sphincter pressure identified patients with greater symptomatic burden.

INTRODUCTION

Systemic sclerosis is a chronic autoimmune connective tissue disorder characterized by immune dysregulation, microvascular injury, and progressive fibrosis involving the skin and multiple internal organs.[1] Among visceral sites, the gastrointestinal tract is affected very frequently, and the esophagus constitutes the most consistently involved segment.[2,3] Esophageal dysfunction in systemic sclerosis is clinically important because it lies at the intersection of impaired motility, lower esophageal sphincter incompetence, mucosal reflux injury, dysphagia, and nutritional decline. In routine practice, these abnormalities are often under-recognized when symptoms are mild, intermittent, or attributed to uncomplicated reflux disease.

The pathobiology of esophageal involvement reflects the broader disease process of systemic sclerosis. Smooth muscle atrophy and fibrosis predominantly affect the distal two-thirds of the esophagus, resulting

in hypoperistalsis or aperistalsis, impaired bolus transit, and delayed acid clearance.[4] Reduced lower esophageal sphincter pressure further promotes gastroesophageal reflux, which predisposes to erosive esophagitis, peptic stenosis, Barrett's esophagus, and occasionally aspiration-related pulmonary complications.[4] Importantly, structural injury and functional impairment do not always progress in parallel. Some patients present with significant reflux symptoms but limited endoscopic changes, whereas others show substantial manometric abnormalities despite relative clinical silence.

Because of this clinicophysiological dissociation, a combined diagnostic approach is recommended. Upper gastrointestinal endoscopy remains essential for identifying mucosal injury and sequelae of chronic reflux, while high-resolution manometry provides a more refined assessment of esophageal motor function and sphincter dynamics. Earlier studies have shown a high prevalence of motility disturbances in systemic sclerosis, yet the magnitude of abnormality and its relationship to symptoms vary across cohorts.[2-4] The burden of asymptomatic disease remains especially relevant, since delayed identification may allow progression to advanced reflux-related complications.

Data from Indian tertiary-care settings on the combined clinical, endoscopic, and manometric profile of esophageal involvement remain relatively limited. The present study was therefore undertaken to evaluate esophageal involvement in adult patients with systemic sclerosis using symptom assessment, endoscopy, and high-resolution manometry. The specific objectives were to describe the clinical, endoscopic, and manometric characteristics of esophageal disease and to compare findings between symptomatic and asymptomatic patients with respect to gastroesophageal reflux symptoms.

MATERIALS AND METHODS

Study design and setting. This hospital-based cross-sectional study was conducted in the Departments of Dermatology, Venereology and Leprosy and Gastroenterology, King George Hospital, Visakhapatnam, over an 18-month period from June 2023 to December 2024. The study was designed to characterize esophageal involvement in adult patients with systemic sclerosis through integrated clinical, endoscopic, and manometric assessment.

Study population and eligibility. Thirty consecutive patients aged 18 years or older with newly diagnosed or previously established systemic sclerosis were enrolled after informed consent. Diagnosis was based on the 2013 American College of Rheumatology/European League Against Rheumatism classification criteria.[5] Pregnant women, immunocompromised individuals, patients younger than 18 years, and those with other known gastrointestinal disorders likely to confound esophageal evaluation were excluded.

Clinical assessment. For each participant, demographic details, age at disease onset, disease duration, and systemic sclerosis subtype were recorded. Esophageal symptom assessment focused on heartburn, acid regurgitation, and dysphagia. Each symptom was graded according to intensity and frequency, and a cumulative GERD symptom score was generated. Patients with a score above 0 were categorized as symptomatic, whereas those with a score of 0 were categorized as asymptomatic for comparative analysis.

Laboratory and endoscopic evaluation. All patients underwent autoimmune profile assessment including ANA profile and anti-Scl-70 antibodies. Upper gastrointestinal endoscopy was performed after a 12-hour fasting period. Reflux esophagitis was graded using the Los Angeles classification, and additional findings such as Barrett's esophagus, stenosis, ulcers, and watermelon stomach were documented.[6] For tabulation, reflux-related mucosal disease was summarized according to the ordinal grades recorded in the study dataset together with the absence category.

High-resolution manometry. Esophageal motor function was assessed using high-resolution manometry. Parameters analyzed included lower esophageal sphincter pressure, peristaltic function, distal latency, and integrated relaxation pressure. Interpretation was aligned with conventional manometric thresholds and the Chicago classification framework for esophageal motility disorders.[7] Distal latency was categorized using 4.5 seconds as the threshold, while integrated relaxation pressure was categorized as below or above 15 mmHg.

Statistical analysis and ethics. Data were analyzed using SPSS version 26.0. Continuous variables were summarized as mean with standard deviation, whereas categorical variables were presented as frequency and percentage. Categorical comparisons between symptomatic and asymptomatic groups were assessed using chi-square testing. For continuous manometric comparisons, independent-samples testing was used; in this manuscript, p values for group means were derived from the available summary statistics. A p value below 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee of Andhra Medical College, and all patient information was anonymized before analysis.

RESULTS

Thirty patients with systemic sclerosis were evaluated. The mean age of the cohort was 36.0 +/- 10.97 years, and the largest age group was 36-45 years. Women constituted 80.0% of the study population. The mean duration of disease was 8.3 +/- 5.51 years, limited cutaneous systemic sclerosis accounted for 80.0% of cases, and anti-Scl-70

ISSN (O): 2687-5365; ISSN (P): 2753-6556

positivity was observed in 23.3%. The mean GERD symptom score was 1.83 +/- 2.02. The baseline demographic and disease characteristics are summarized in Table 1

Table 1. Demographic and clinical characteristics of the study population [N = 30]

Characteristic	n (%) / Mean +/- SD
Age group, 16-25 years	7 (23.3)
Age group, 26-35 years	8 (26.7)
Age group, 36-45 years	10 (33.3)
Age group, 46-55 years	3 (10.0)
Age group, 56-65 years	2 (6.7)
Women	24 (80.0)
Men	6 (20.0)
Mean age, years	36.0 +/- 10.97
Mean age at onset, years	36.0 +/- 6.37
Mean duration of disease, years	8.3 +/- 5.51
Mean ACR/EULAR score	10.3 +/- 1.02
Mean GERD symptom score	1.83 +/- 2.02
Limited cutaneous systemic sclerosis	24 (80.0)
Diffuse cutaneous systemic sclerosis	6 (20.0)
Anti-Scl-70 positive	7 (23.3)
Anti-Scl-70 negative	23 (76.7)

Endoscopic abnormalities were frequent. Reflux esophagitis of any grade was identified in 22 patients (73.3%), whereas 8 patients (26.7%) had no reflux esophagitis. Barrett's esophagus was documented in 3 patients (10.0%), stenosis in 4 (13.3%), and watermelon stomach in 2 (6.7%). Grade 1 and grade 2 reflux esophagitis were the most common endoscopic patterns. Overall endoscopic findings are presented in Table 2.

Table 2. Endoscopic findings in patients with systemic sclerosis

Endoscopic finding	n (%)
Reflux esophagitis grade 1	6 (20.0)
Reflux esophagitis grade 2	6 (20.0)
Reflux esophagitis grade 3	3 (10.0)
Reflux esophagitis grade 4	5 (16.7)
Reflux esophagitis grade 5	1 (3.3)
Reflux esophagitis absent	8 (26.7)
Stenosis present	4 (13.3)
Barrett's esophagus present	3 (10.0)
Watermelon stomach present	2 (6.7)

Twenty-five patients (83.3%) were categorized as symptomatic and 5 (16.7%) as asymptomatic based on GERD symptom score. Symptomatic patients showed a heavier burden of reflux-related mucosal disease: reflux esophagitis of any grade was present in 84.0% of symptomatic patients compared with 20.0% of asymptomatic patients, although the difference in grade distribution did not reach statistical significance (p = 0.093). Barrett's esophagus, stenosis, and watermelon stomach were observed only or predominantly in symptomatic patients, but these comparisons were not statistically significant, likely because of the small number of events. These findings are detailed in Table 3.

Table 3. Endoscopic comparison between symptomatic and asymptomatic patients

Finding	Symptomatic [n = 25]	Asymptomatic [n = 5]	p value
Reflux esophagitis grade 1	6	1	0.093*
Reflux esophagitis grade 2	6	0	
Reflux esophagitis grade 3	3	0	
Reflux esophagitis grade 4	5	0	
Reflux esophagitis grade 5	1	0	
Reflux esophagitis absent	4	4	
Stenosis present	3	1	1.000
Barrett's esophagus present	3	0	1.000
Watermelon stomach present	2	0	1.000

*p value shown for the overall grade distribution of reflux esophagitis.

Manometric comparison showed lower mean lower esophageal sphincter pressure in symptomatic patients than in asymptomatic patients (11.21 +/- 4.11 mmHg versus 18.40 +/- 5.46 mmHg). Mean peristaltic values were also lower in the symptomatic group (81.92 +/- 10.94 versus 89.60 +/- 11.19). Distal latency below 4.5 seconds was observed in 68.0% of symptomatic patients compared with 20.0% of asymptomatic patients (p = 0.134). Most importantly, elevated integrated relaxation pressure above 15 mmHg occurred in 64.0% of symptomatic patients and in none of the asymptomatic patients, showing a

ISSN (O): 2687-5365; ISSN (P): 2753-6556

statistically significant association with symptoms (p = 0.033). Manometric findings are summarized in Table 4.

Table 4. Manometric comparison between symptomatic and asymptomatic patients

Manometric parameter	Symptomatic [n = 25]	Asymptomatic [n = 5]	p value
LES pressure, mmHg	11.21 +/- 4.11	18.40 +/- 5.46	0.039†
Peristalsis value	81.92 +/- 10.94	89.60 +/- 11.19	0.212†
Distal latency < 4.5 s	17 (68.0)	1 (20.0)	0.134
IRP > 15 mmHg	16 (64.0)	0 (0.0)	0.033

†p values for continuous variables were derived from the available group summary statistics using an independent-samples approach.

DISCUSSION

This study demonstrates a substantial burden of esophageal involvement in systemic sclerosis, with abnormalities detected across symptoms, endoscopy, and high-resolution manometry. The female predominance and clustering of patients in early to middle adult life are in keeping with the established epidemiology of systemic sclerosis.[4] A striking observation in the present cohort was the very high proportion of patients with GERD-related symptoms, together with the predominance of limited cutaneous disease. These findings reinforce the concept that clinically relevant esophageal dysfunction is not restricted to diffuse phenotypes alone and deserves attention across the systemic sclerosis spectrum.[2-4]

Endoscopically, nearly three-quarters of the cohort had reflux esophagitis, while Barrett's esophagus, stenosis, and watermelon stomach were detected in smaller but clinically meaningful proportions. These results align with prior reports showing that chronic reflux injury and its structural sequelae form a major component of gastrointestinal morbidity in systemic sclerosis.[10] The observation that some asymptomatic patients still had endoscopic abnormalities is important, because symptom burden alone did not fully capture mucosal disease. This pattern echoes the growing recognition that clinical silence does not exclude objective esophageal involvement in systemic sclerosis.[12-14]

The manometric profile observed in this study is also consistent with the known pathophysiology of distal smooth muscle dysfunction. Earlier high-resolution manometry studies by Roman et al., Kimmel et al., Raja et al., and Aggarwal et al. described reduced peristalsis, absent contractility, and lower esophageal sphincter abnormalities as common features of systemic sclerosis.[8-11] In the present series, symptomatic patients had lower LES pressure and numerically lower peristaltic values than asymptomatic patients. Distal latency abnormalities were more frequent in symptomatic individuals, although this difference was not statistically significant. This lack of significance resembles the inconsistent symptom-motility correlation described in some cohorts, particularly those with small subgroup sizes.[13,14]

The most clinically relevant discriminatory parameter in our data was integrated relaxation pressure. Elevated IRP above 15 mmHg was confined to symptomatic patients and showed a significant association with symptom status. This finding is compatible with prior work suggesting that detailed manometric metrics provide added value beyond symptoms alone, especially when identifying patients with more severe functional impairment.[9,10,14] Vettori et al. further emphasized that even asymptomatic patients can harbor early impedance-manometric alterations, supporting the rationale for objective testing in selected high-risk patients.[12] Overall, the present study supports a combined strategy in which symptom inquiry is supplemented by endoscopy for mucosal assessment and by high-resolution manometry for phenotyping motor dysfunction.

Limitations

This study was conducted at a single tertiary care centre with a small sample size and a cross-sectional design. The asymptomatic subgroup was particularly small, which reduced precision in comparative analyses. Individual manometric tracings, pH-impedance data, and longitudinal follow-up were not available for deeper phenotype correlation. Histologic evaluation of reflux-related injury was not incorporated, which restricted pathological characterization.

CONCLUSION

Esophageal involvement was frequent in this cohort of adults with systemic sclerosis and extended beyond patients with overt reflux symptoms. Symptomatic disease was characterized by lower lower esophageal sphincter pressure, a heavier burden of reflux-related mucosal injury, and a significantly higher prevalence of elevated integrated relaxation pressure. Barrett's esophagus, stenosis, and watermelon stomach were less common but clinically relevant endoscopic findings. These results support routine clinical vigilance for esophageal disease in systemic sclerosis and highlight the complementary value of upper gastrointestinal endoscopy and high-resolution manometry in detecting both structural injury and functional impairment. Early objective assessment can assist risk stratification and guide timely therapeutic intervention.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

REFERENCES

1. Cutolo M, Soldano S, Smith V. Pathophysiology of systemic sclerosis: current understanding and new insights. Expert Rev Clin Immunol. 2019;15(7):753-764.
2. Carlson DA, Hinchcliff M, Pandolfino JE. Advances in the evaluation and management of esophageal disease of systemic sclerosis. Curr Rheumatol Rep. 2015;17(1):475.
3. Denaxas K, Ladas SD, Karamanolis GP. Evaluation and management of esophageal manifestations in systemic sclerosis. Ann Gastroenterol. 2018;31(2):165-170.
4. Li B, Yan J, Pu J, Tang J, Xu S, Wang X. Esophageal dysfunction in systemic sclerosis: an update. Rheumatol Ther. 2021;8(4):1535-1549.
5. van den Hoogen F, Khanna D, Fransen J, Johnson SR, Baron M, Tyndall A, et al. 2013 classification criteria for systemic sclerosis: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. Ann Rheum Dis. 2013;72(11):1747-1755.
6. Lundell LR, Dent J, Bennett JR, Blum AL, Armstrong D, Galmiche JP, et al. Endoscopic assessment of oesophagitis: clinical and functional correlates and further validation of the Los Angeles classification. Gut. 1999;45(2):172-180.
7. Kahrilas PJ, Bredenoord AJ, Fox M, Gyawali CP, Roman S, Smout AJ, et al. The Chicago Classification of esophageal motility disorders, v3.0. Neurogastroenterol Motil. 2015;27(2):160-174.
8. Roman S, Hot A, Fabien N, Cordier JF, Miossec P, Ninet J, et al. Esophageal dysmotility associated with systemic sclerosis: a high-resolution manometry study. Dis Esophagus. 2011;24(5):299-304.
9. Kimmel JN, Carlson DA, Hinchcliff M, Carns MA, Aren KA, Lee J, et al. The association between systemic sclerosis disease manifestations and esophageal high-resolution manometry parameters. Neurogastroenterol Motil. 2016;28(8):1157-1165.
10. Raja J, Ng CT, Sujau I, Chin KF, Sockalingam S. High-resolution oesophageal manometry and 24-hour impedance-pH study in systemic sclerosis patients: association with clinical features, symptoms and severity. Clin Exp Rheumatol. 2016;34 Suppl 100(5):115-121.
11. Aggarwal N, Lopez R, Gabbard S, Wadhwa N, Devaki P, Thota PN. Spectrum of esophageal dysmotility in systemic sclerosis on high-resolution esophageal manometry as defined by Chicago classification. Dis Esophagus. 2017;30(12):1-6.
12. Vettori S, Tolone S, Capocotta D, Chieffo R, Giacco V, Valentini G, et al. Esophageal high-resolution impedance manometry alterations in asymptomatic patients with systemic sclerosis: prevalence, associations with disease features, and prognostic value. Clin Rheumatol. 2018;37(5):1239-1247.
13. Arana-Guajardo AC, Barrera-Torres G, Villarreal-Alarcón MÁ, Vega-Morales D, Esquivel-Valerio JA. Esophageal symptoms and their lack of association with high-resolution manometry in systemic sclerosis patients. Reumatol Clin (Engl Ed). 2019;15(3):165-169.
14. Schutyser W, Cruyt L, Vulsteke JB, Lenaerts J, De Langhe E. The role of high-resolution manometry in the assessment of upper gastrointestinal involvement in systemic sclerosis: a systematic review. Clin Rheumatol. 2020;39(1):149-157

ISSN (O): 2687-5365; ISSN (P): 2753-6556