Comparative Evaluation of Cine-Esophagogram with Esophageal Manometry in Assessing Esophageal Motility in Progressive Systemic Sclerosis

V Jayanthi, Vijaya Srinivasan, Vijaya M Nayak, V Krishnamurthi, Solomon Victor

Department of Digestive Health and Disease, Kilpauk Medical College Hospital, APAC Project, Voluntary Health Services, The Heart Institute, Madras and Department of Rheumatology, Government Stanley Hospital, Madras

Abstract
Background: Esophageal manometry is considered the gold standard in the diagnosis of esophageal motility disorders. Cine-esophagogram using barium is also a good investigation to screen patients for motor disorders of the esophagus. Comparison between these two investigations has not often been reported in patients with progressive systemic sclerosis (PSS).

Aim: To determine relative merits of cine-esophagogram and esophageal manometry in detecting esophageal motility dysfunction in PSS patients.

Methods: Thirty-five patients with PSS irrespective of esophageal symptoms underwent esophageal manometry and cine-esophagogram, results and their were compared.

Results: Sensitivity and specificity of cine-esophagogram as compared to manometry were 96.1% (95% CI 88.7%-100%) and 55.3% (95% CI 23%-97.9%) respectively. Its positive predictive value was 86%.

Conclusion: While esophageal manometry can identify esophageal motor disorder in PSS, cine-esophagogram can be resort to in doubtful situations, for confirmation of diagnosis.


Key words: Scleroderma, esophageal dysmotility.

Introduction
Cine-esophagogram provides a tool for evaluation of motility and bolus transit in the esophagus. Esophageal manometry, on the other hand, allows assessment of pressure patterns at different levels of the esophagus.

These two modalities have not often been compared for the diagnosis of motor dysfunction of the esophagus in patients with progressive systemic sclerosis (PSS).

We compared cine-esophagogram with esophageal manometry in assessing motor abnormalities of the esophagus in patients with PSS.

Methods
Thirty-seven patients with PSS who fulfilled the American Rheumatism Association criteria for the diagnosis of scleroderma were included in the study. After obtaining informed consent, all patients, irrespective of the presence of esophageal symptoms, underwent detailed clinical, manometric and radiological evaluation.

Esophageal manometry was done using a continuous water-infusion system (MMD-200, Narco Biosystem) with external transducers, by the slow pull-through technique. The manometer catheter had four recording ports, placed 5 cm apart and radially oriented at 90° to each other. The four microcapillary catheters were continuously perfused with distilled water at a constant rate (0.5 mL/min) by a low-compliance pneumohydraulic pump powered by compressed nitrogen. The lower esophageal sphincter was identified by the station pull-through technic as a high pressure zone, and its response to five swallows, each with 5 mL of water given at intervals of 30 seconds, was recorded. The motility of the body of the esophagus was assessed when the distal port hole was located 3 cm proximal to the lower esophageal sphincter. Peristaltic dysfunction was defined as anestesia when there was either no peristalsis in the distal two-thirds of the esophagus or when the contractions were simultaneous and of low amplitude (30-60 mmHg) with all the five swallows.

Cine-esophagogram using barium was done in the supine position to eliminate the effect of gravity (Diagnost C2, Philips). A median of five fluoroscopy sequences were recorded to eliminate temporary alterations in esophageal motility, at a fixed interval of one minute. All recordings were done in both frontal and lateral projections to determine intermittent motility changes, and these were stored on a videotape. The fluoroscope was swept over the entire length of the esophagus; in case of any...
suspected abnormality in any of the 5 swallows, it was positioned at the site of the abnormality and reconfirmatory observation for aperistalsis was made.

Cine recording was analyzed by slow motion and freeze-frame playback of the video recordings. Each swallow sequence was analyzed individually by one of the authors who was not aware of the manometry findings. Information on response of the upper and lower esophageal sphincters to swallow, abnormal esophageal contractions in the body of the esophagus, and stasis of the barium, if any, were noted.

Normal peristalsis was defined as progressive aboral stripping wave that traversed the entire esophagus and completely cleared the barium from it. Abnormal motor activity was graded as a:
a) no indentation of the lumen
b) nonsegmental or partial lumen indentation and
c) segmental luminal obliteration, giving a rosary-bead appearance.

All the grades of abnormal nonprogressive contractions were grouped as aperistalsis.

Results
Manometry was possible in 35 of the 37 patients with PSS. In two patients, there was difficulty in positioning the manometry catheter; they were excluded from analysis. The remaining 35 patients consisted of 31 women and 4 men (age: mean ± SD = 36.3 ± 10.2 years); (age range 16-58 years).

Manometrically, 26 patients had typical aperistalsis in the distal two-thirds of the esophagus and a hypotensive lower esophageal sphincter (pressure < 10 mmHg). In nine patients, esophageal peristalsis was normal. Peristaltic co-ordination in the pharynx and proximal one-third of the esophagus was normal in all the patients.

On cine-esophagogram, peristalsis was normal in six

| Table: Comparative results of cine-esophagogram and manometry for detection of esophageal dysmotility in PSS |
|----------|-------------------------------------------------|-----------------|
| Manometry | Abnormal peristalsis | Normal peristalsis | Total |
| Cine-esophagogram | 26 | 9 | 35 |

| Sensitivity | 96.1 | 88.7 — 100 |
| Specificity | 55.5 | 23.0 — 87.9 |
| Positive predictive value | 86 |

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patients (Fig 1a). Sixteen patients had dilated esophagus with delayed emptying (absence of luminal indentation) (Fig 1b); 11 had abnormal partial luminal indentation (Fig 1c), and two had segmental luminal indentation (Fig 1d). Two patients had reflux probably related to a hypotensive lower esophageal sphincter. Thus, 29 of 35 patients had esophageal dysmotility on cine-esophagram. 

The Table shows the validity comparison of cine-esophagram and manometry.

Discussion
PSS is a generalized connective tissue disorder which can affect the motor function of the esophagus. Early detection and prompt management of esophageal involvement with prokinetics and acid-suppressive therapy may prevent some of the long-term complications, such as erosive esophagitis and esophageal stricture. In the present study, esophageal manometry and cine-esophagram detected motor dysfunction of the esophagus in 26 and 29 of the 35 cases, respectively.

Esophageal manometry has some advantages over cine-esophagram. Apart from recording temporal changes in pressure produced by contraction of the esophageal wall at fixed sites, it also quantifies the contractile segment and intrabolus pressure changes. Manometrically, in early stages of the disease, the smooth muscle shows normal peristalsis. With progression of the disease, the contractions are nonperistaltic and of low amplitude. Body dysfunction occurs before the loss of lower esophageal sphincter tone and reduction in contraction amplitude precedes aperistalsis. Presence of tertiary contractions may sometimes be a prominent finding. Garrett et al. reported diffuse esophageal spasm in 5 of 103 cases with PSS. Manometry is safe, acceptable, reliable and reproducible. Its end point is well defined and hence there are few inter- or intra-observer variations in interpretation. Also, it does not entail any radiation exposure.

Cine-radiography of the esophagus has also been claimed to be a sensitive method for evaluating esophageal motility in PSS and other motor disorders of the esophagus. It has an advantage in early stages of PSS when esophageal contractions are weak, infrequent and inconsistent; manometry is likely to be normal in these situations. It also provides details on bolus transport within the esophageal lumen and esophageal clearance time. Cost-wise, standard double-contrast swallow is cheaper than cine-radiography or manometry. However, among 30 cases in this study, we missed esophageal motility disorders in 12 patients (40%) on conventional barium swallow. Cine-esophagram has the limitation that it cannot quantitate the effective contractile pressure. Another disadvantage is the radiation exposure.

In conclusion, cine-radiography can be used in PSS patients as a confirmatory test for esophageal dysfunction detected by esophageal manometry.

References