Esophageal Transit Time Scintigraphy in the Assessment of the Esophagus Motility

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The esophagus is 25 cm long muscular tube, which acts as a passage of food from the mouth to the stomach. Many diseases affect the esophagus, which may affect its morphology and function. Hence, several diagnostic modalities are used to assess the esophagus abnormalities, such as endoscopy, manometry, barium contrast studies and gastroesophageal scintigraphy studies. Gastroesophageal scintigraphy is a simple, non-invasive and well-tolerated method used to assess mainly the upper GI tract motility.

We present a case of gastroesophageal adenocarcinoma where an esophageal scintigraphy was performed to assess the esophageal motility.

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Radionuclide esophageal transit time measurement was first described by Kazem in 1972[1]. This technique uses a low radiation exposure, which is equal to the dose used for CT chest; it is approximately five mrad and has a high sensitivity index as much as 97% in detecting esophagus motility disorders[2-3].

The aim of this study is to emphasize the importance of esophagus transient study as a safe and non-invasive alternative in assessing esophagus motility.

THE CASE

An eighty-three-year-old male with a known case of gastroesophageal adenocarcinoma presented with persistent vomiting and chest pain even after esophageal stent was inserted. Esophageal scintigraphy was performed to assess the esophagus motility. A 9995 micro-Curi Tc-99 m sulfur colloid with 15 ml water as bolus was used; immediately thereafter sequential dynamic images for the chest region in anterior projection were performed: one second per frame for 60 seconds, followed by 30 seconds per frame for 10 minutes while the patient took multiple dry swallows every 30 seconds. Images were compressed and displayed in five seconds per frame for initial 60-second images followed by two minutes per frame for the remaining 10-minute dynamic study. Time-activity curve for the whole esophagus and each of its upper, middle and lower thirds were generated.

The study revealed adequate active bolus propagation from the oropharynx to the esophagus followed by progressive slow tracer transit throughout the whole esophagus reaching down to the stomach with fair clearance from its upper and middle thirds, but with persistent tracer accumulation as its lower third until the end of the dynamic images. Time-activity curves of the third part of the esophagus showed fair curve descent in the upper and middle thirds, but with initial rising curve followed by plateau pattern in lower third. In summary, the study showed delayed esophageal transit mainly at its lower third, see figures 1 to 3.

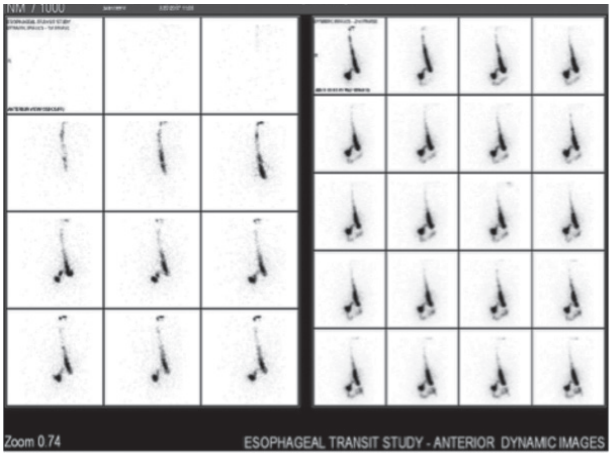

Figure 1: Sequential Dynamic Images for the Chest Region in Anterior Projection revealed Adequate Active Bolus Propagation from the Oropharynx to the Esophagus followed by Progressive Slow Tracer Transit Throughout the Whole Esophagus Reaching Down the Stomach with Fair Clearance from its Upper and Middle Thirds but with Persistent Tracer Accumulation at its Lower Third

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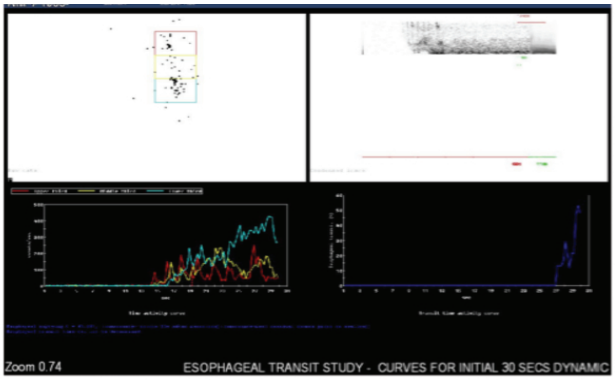

Figure 2: Time Activity Curve for Initial 30 Seconds for the Whole Esophagus and its Upper, Middle and Lower Thirds

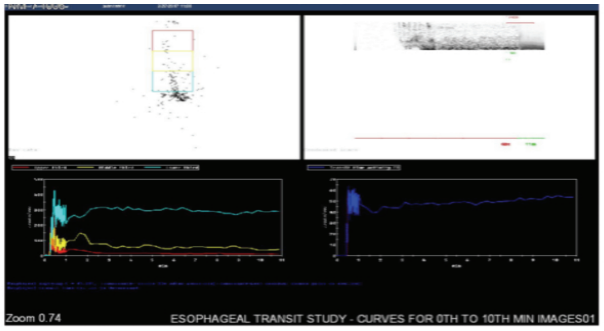

Figure 3: Time Activity Curve for or 0-10 Minutes for the Whole Esophagus and its Upper, Middle and Lower Thirds Were Generated, which Showed Fair Curve Descent in the Upper and Middle Thirds with Initial rising Curve Followed by Plateau Pattern in Lower Third

DISCUSSION

Manometry is considered the gold standard modality to assess upper GI tract motility. However, the presence of the probe could alter the physiology and quantification volume of the retained solid and liquid. Esophageal scintigraphy yields unique and useful physiologic information of motility in patients with scleroderma, stricture and achalasia that impair transit of esophageal contents from the pharynx to the stomach. It is not commonly used due to the lack of single standardized method for performing the test. No consensus guidelines have been established; therefore, each facility should validate its own normal range for its specific technique or should closely follow a validated technique and normal range. Fasting 4 hours before the test is mandatory. In esophageal transit studies, the preferred position of the patient is usually the supine position to avoid gravity affecting the radioactive bolus. Although some authors claim that position does not alter the result of the study, patients with severe dysphagia and high risk of aspiration have their studies performed in an upright/sitting position to prevent aspiration[4-6].

The simplest measure of esophageal transit is the time required for a liquid bolus of 15–30 ml of water containing 3.7–11 MBq (0.1–0.3 mCi) of either 99 m Tc-diethylenetriaminepentaacetic acid or 99 m Tc-sulfur colloid to transit the esophagus after a single swallow. Dynamic images are recorded at a rapid rate of 0.25 to 0.5 second per frame for up to 30 seconds to capture both regional and total esophageal transit. Either single anterior or single posterior views of the chest have been used for esophageal transit scintigraphy. Serial dry swallows every 30 seconds for 10 minutes were acquired. Time activity curves are created from upper, middle and lower esophagus, which shows how fast the radiotracers travel through successive parts of the proximal GI tract. From the time activity curves, the useful and repeatable esophageal transit time ETT and esophageal emptying time (EET) are calculated. ETT is the time between the appearance of 50% of radioactivity in the upper esophagus and clearance of 50% of activity from the entire esophagus, while EET is the time between the appearance of 50% of the radioactivity in the upper part of the esophagus and clearance of 100% of activity from the entire esophagus[7-11].

ETT is reproducible, with a reference range of 6–15 seconds and in normal conditions, after 10 minutes of serial dry swallows, the esophagus empties more than 82% of its contents.

Reviewing cinematic computer display for the 10-minutes of multiple swallow method could detect any episodes of gastroesophageal reflux. Jørgensen et al described and summarized esophageal scintigraphy: reproducibility and normal ranges in a study in 1992[12].

Esophageal scintigraphy study provides an accurate qualitative assessment of the function of the esophagus; it is of short duration, safe and acceptable; it has lower dose radiation compared to barium swallow study[13]. Esophageal scintigraphy has a poor role in assessing the morphological abnormalities as it has poor anatomic visualization, which makes structural pathologies difficult to detect[14].

CONCLUSION

Esophageal transit scintigraphy is a safe, non-invasive and efficient procedure to assess the upper GI tract motility. Our study showed delayed esophageal transit mainly at its lower third.

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