



The predictive value of computed tomography in the detection of reflux esophagitis in patients undergoing upper endoscopy

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ABSTRACT

Background: Reflux esophagitis (RE) may mimic symptoms requiring cross-sectional imaging.

Methods: From 565 patients who had CT and esophagogastroduodenoscopy within four days apart, CT scans of 72 patients with RE confirmed by esophagogastroduodenoscopy and 108 matched patients without RE were evaluated for distal esophageal wall characteristics.

Results: In RE patients the distal esophageal wall thickness was greater (5.2 ± 2.0 mm) compared to patients without RE (3.5 ± 1.2 mm, $p < 0.0001$) with AUC of 0.78 and 56% sensitivity, 88% specificity for a 5.0 mm cut-off.

Conclusions: There is a moderate association between distal esophageal wall thickness on CT and RE diagnosed by esophagogastroduodenoscopy as the reference standard.

1. Introduction

Reflux esophagitis (RE) is a common condition affecting 1–15% of the population with increasing prevalence in developed countries [1–3]. Apart from heartburn and odynophagia, patients with RE may complain of other symptoms including chest pain or tightness that may mimic other more serious conditions such as acute coronary syndrome, acute aortic syndrome, or pulmonary embolism and require cross-sectional imaging [4,5]. The utilization of CT both in emergency departments and during a daily routine is increasing steadily [6]. Therefore, even more patients with esophagitis are likely to receive a CT scan. The distal esophagus is visualized not only in routine CT studies of the body but also in dedicated CT examinations such as CT pulmonary angiography, CT angiography of the aorta, and even coronary CT angiography. The esophagus is rarely the focus of the radiologist unless attention to it is drawn by clinical request or by conspicuous pathology, such as extensive dilation, evident wall thickening or large hiatal hernia. To the best of our knowledge, there were only a few studies that evaluated the CT findings in patients with RE with different conclusions [7–9].

The aim of this study was to evaluate imaging features of RE on CT examinations in correlation with esophagogastroduodenoscopy (EGD) as the standard of reference.

2. Material and methods

This retrospective study was performed in accordance with the Helsinki Declaration and informed consent was waived by the Institutional Review Board. We searched local clinical database between January 2015 and December 2016, where we identified 671 patients who had both CT and EGD less or equal to four days apart. In 106 patients the distal esophagus was not depicted (at least 5 cm), and from the remaining 565 examinations, 60% involved the abdomen, 23% whole body, 16% thorax; 79% examinations contained venous phase scans and 21% were unenhanced or arterial phase only. EGD showed RE in 72 patients. RE was classified according to the Los Angeles classification. Grade A was present in 36 patients, grade B in 13 patients, grade C in 11 patients, and grade D in 8 patients along with Barrett's esophagus in 4 patients. From the remaining 493 patients without RE or other conditions that might result in esophageal wall

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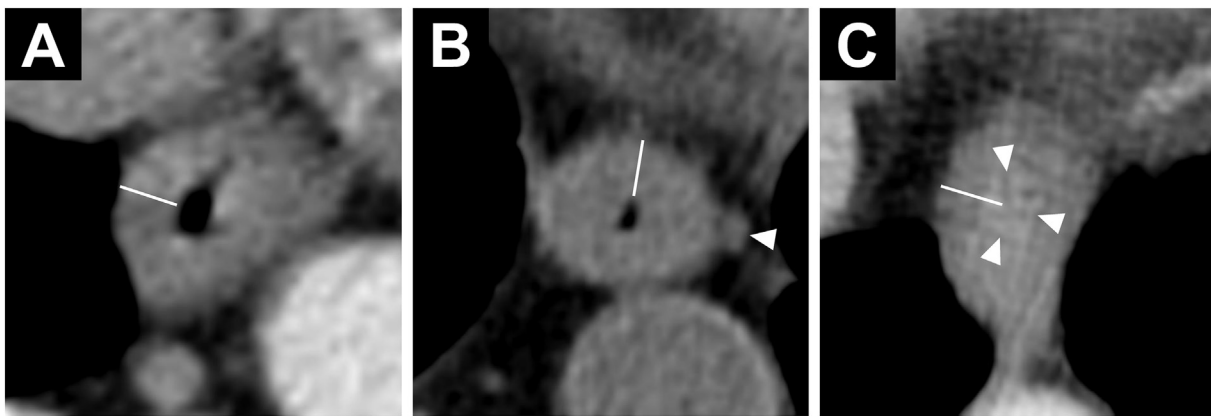


Fig. 1. CT of the distal esophagus in three patients with reflux esophagitis and measurement of wall thickness (white line). Thickening of the distal esophageal wall a) in a 61 years old female with esophagitis grade A (wall thickness, 5.9 mm); b) in a 59 years old male with reflux esophagitis grade B (wall thickness, 5.7 mm) with periesophageal lymph nodes (arrowhead); c) in an 85 years old female with esophagitis grade A (wall thickness, 6.9 mm) with increased density of the inner layer (target sign, arrowheads) and collapsed lumen.

thickening or compromise measurement of the distal esophageal wall (tumor of the esophagus or gastric fundus, gigantic hiatal hernia, varices, previous esophageal surgery, nasogastric tube), we selected a frequency matched cohort (age, gender) on a 1.5:1 basis (non-RE).

Two readers with expertise in abdominal CT imaging (12 years and 5 years) assessed the CT scans and measured wall thickness and luminal distension in the distal esophagus at least 15 mm above the presumed level of the gastroesophageal junction and below its retrocardiac course (up to the level of the coronary sinus) on axial images, where two opposite walls were best discernible (or the lumen was distended). The measurement was done across the shorter diameter of the esophagus to avoid oblique measurement of the wall (Fig. 1). Non-dependent (anterior or lateral) side of the wall was preferred to minimize error caused by imperfect distinction of the mucosa and residual intraluminal content.

The esophageal wall thickness was also corrected according to the statistical relationship between the esophageal wall thickness and distension in non-RE patients (Fig. 2). Furthermore, the presence and size of hiatal hernia and the number and size of periesophageal lymph nodes

surrounding the distal esophagus were assessed.

Statistical evaluation was performed in Medcalc (Medcalc software, Ostend, Belgium) using ROC analysis, *t*-test, F-test, Spearman's ρ , and kappa (κ) statistics as appropriate. Interobserver agreement between the two radiologists in the measurement of the distal esophageal wall thickness was calculated as an intraclass correlation coefficient. A *p*-value below 0.05 was considered significant.

3. Results

The patients were 64 ± 15 years old, 121 (67%) were males (Table 1). The distal esophageal wall thickness was greater in the RE group (5.2 ± 2.0 mm, 95%CI 4.8–5.6 mm) compared to the non-RE group (3.5 ± 1.2 mm, 95%CI 3.3–3.7 mm, $p < 0.0001$). There was no statistical difference in the distal esophageal wall thickness between the genders in the non-RE group (3.6 ± 1.3 mm in males vs. 3.3 ± 1.1 mm in females, $p = 0.11$). The relationship between the distension and wall thickness in the non-RE group is depicted in Fig. 2. In patients with esophagitis, the correlation between Los Angeles classification evaluated by endoscopy and distal esophageal wall thickness was weak ($\rho = 0.24$, 95%CI 0.00 to 0.44, $p = 0.047$).

The AUC for discrimination between RE patients and non-RE patients by distal esophageal wall thickness was 0.78 (95%CI 0.71 to 0.83, $p < 0.0001$), or 0.77 (95%CI 0.71 to 0.83, $p < 0.0001$) when the thickness was corrected to the luminal distension using linear approximation (Figs. 2 and 3). The sensitivity for a 5.0 mm cut-off value was 56% with a specificity of 88% and accuracy of 75%. For men the AUC was 0.74 (95%CI 0.65 to 0.81, $p < 0.0001$) compared with 0.84 (95%CI 0.74 to 0.91, $p < 0.0001$) for women. The interobserver agreement in the measurement of the distal esophageal wall thickness between the two radiologists was 0.76 (95%CI 0.62 to 0.84). The ring enhancement pattern was identified in 9% of the non-RE patients and in 15% of the RE patients, where scans in the venous phase were available ($p = 0.0033$). More periesophageal lymph nodes were identified in RE patients (median = 1, IQR = 4) compared to patients without RE (median = 0, IQR = 1, $p < 0.0001$) with an AUC of 0.64 (95%CI

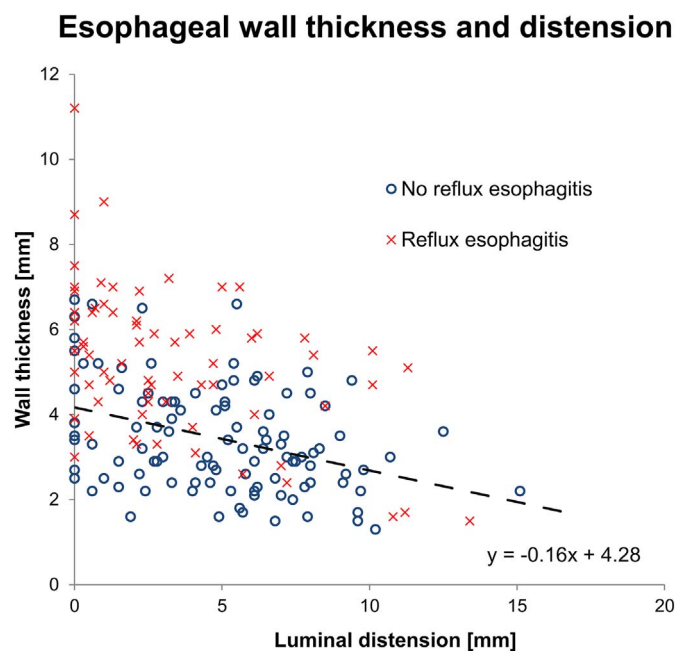


Fig. 2. The relationship between the luminal distension and esophageal wall thickness could be approximated by linear trend line ($R^2 = 0.17$) in patients without reflux esophagitis.

Table 1
Patients' characteristics.

	RE	Non-RE	<i>p</i>
Number	72	108	–
Age (years)	65 ± 16	64 ± 14	0.41
Gender (males)	48	72	1.0
BMI ($\text{kg}\cdot\text{m}^{-2}$)	26.5 ± 3.9	25.1 ± 3.8	0.039

RE patients with reflux esophagitis, non-RE patients without reflux esophagitis.

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