European Journal of Radiology 84 (2015) 1694–1700

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Leiomyomas in the gastric cardia: CT findings and differentiation from gastrointestinal stromal tumors

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ARTICLE INFO

Article history:
Received 28 February 2015
Received in revised form 16 May 2015
Accepted 18 May 2015

Keywords:
Leiomyoma
Gastrointestinal stromal tumors
Computed tomography
Stomach neoplasms
Subepithelial tumors

ABSTRACT

Objective: To describe CT findings of leiomyomas and gastrointestinal stromal tumors (GISTs) in the gastric cardia and to identify their differentiating features.
Materials and methods: CT images of pathologically proven leiomyomas ($n = 26$) and GISTs ($n = 19$) in the gastric cardia were retrospectively reviewed for esophagogastric junction (EGJ) involvement, contour, surface, growth pattern, enhancement pattern and degree of the tumor, and the presences of intralesional low attenuation, calcification and surface dimples or ulcers. The long (LD) and short diameters (SD), LD/SD ratio, and attenuation value of each lesion were measured.
Results: EGJ involvement, homogeneous enhancement, intermediate or low enhancement, absences of intralesional low attenuation and surface dimples or ulcers, LD/SD ratio >1.2, and attenuation value ≤71.2 HU were significant findings for differentiating leiomyomas from GISTs ($P < 0.05$ for each finding). An LD/SD ratio of >1.2 and attenuation value of ≤71.2 HU yielded sensitivities of 84.6% and 61.5%, and specificities of 52.6% and 84.2%, respectively, on the receiver operating characteristic curve analysis. When at least five of these seven criteria were used in combination, the sensitivity and specificity for diagnosing leiomyomas were 100% (26 of 26) and 89.5% (17 of 19), respectively. When any six of these criteria were used, a specificity of 100% was achieved.
Conclusions: CT features including EGJ involvement, enhancement pattern and degree, presences of intralesional low attenuation and surface dimples or ulcers, LD/SD ratio, and attenuation value could help differentiating leiomyomas from GISTs in the gastric cardia, particularly in the manner of combination.

1. Introduction

Each type of gastric subepithelial tumors needs to be managed specifically according to its own biological behavior [1]. In cases of gastric leiomyomas, which are totally benign and usually asymptomatic [2], subtotal or total gastrectomy, which can cause functional deficits and morbidity, should be avoided and minimally-invasive procedures such as endoscopic or laparoscopic enucleation could be sufficient for curative resection [3,4]. In contrast, the malignant potential of gastrointestinal stromal tumors (GISTs) warrants a more-aggressive procedure including wedge resection or gastrectomy with an adequate resection margin [5].

Although some reports described imaging findings of various gastric subepithelial tumors, it has been reported that the preoperative differential diagnosis of gastric subepithelial tumors is quite difficult in imaging studies including EUS and CT [6–11]. Moreover, endoscopic biopsy using standard biopsy forceps usually cannot enable a definitive diagnosis of subepithelial tumor [12], and endoscopic ultrasound (EUS)-guided fine needle aspiration biopsy often provides inadequate tissue yield in up to 33.3% of samples [13,14]. Such uncertainty may lead to potential overtreatment of leiomyomas, as most guidelines recommend excision for gastric subepithelial tumors larger than 2 cm, regarding them as GISTs [15–19]. Besides, when the tumor is located close to the esophagogastric junction (EGJ), major gastrectomy is often applied instead of partial or wedge resection, due to high risk of stricture and leakage [3,4]. In order to avoid such an excessive management,

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http://dx.doi.org/10.1016/j.ejrad.2015.05.022
0720-048X/

it is important to assess whether the tumor in gastric cardia is a leiomyoma in the preoperative stage.

Therefore, the purpose of this study is to describe the CT findings of leiomyomas and GISTs in the gastric cardia and to identify their differentiating features.

2. Materials and methods

The institutional review board of our institution approved this retrospective study and waived the requirement for informed consent from patients.

2.1. Patients

We searched the pathologic database at our institution from May 2003 to December 2012 using the search terms "leiomyoma and stomach" and "GIST and stomach" and found 75 patients with gastric leiomyomas and 186 patients with gastric GISTs that were pathologically confirmed after surgery.

To develop a study group of suitable cases for comparison of the CT findings of gastric cardial leiomyomas and GISTs, the following inclusion criteria were used: (a) a leiomyoma or GIST in the gastric cardia, that was proximal 5 cm portion of the stomach [20]; and (b) a lesion larger than 1 cm and smaller than 7 cm in diameter (the criterion of tumor diameter larger than 1 cm was used because most small [less than 1 cm] gastric subepithelial tumors were incidentally detected on surgical specimen; the criterion of tumor diameter less than 7 cm was used because it was often impossible to determine whether tumors larger than 7 cm were truly located in the gastric cardia and such large tumors were usually GISTs); and (c) available preoperative contrast-enhanced CT images. Among the 261 patients extracted from the database, we excluded 48 patients with leiomyomas and 167 patients with GISTs according to inclusion criteria for size and location (Fig. 1). Also, one patient with leiomyoma was excluded because there were no available CT images. Finally, 26 patients with leiomyomas (mean age, 48.5 years ± 14.4 [standard deviation]; range, 23–69 years; 10 men [mean age, 51 years ± 14.4; range, 27–68 years] and 16 women [mean age, 46.9 years ± 14.6; range, 23–69 years]) and 19 patients with GISTs (mean age, 62.2 years ± 13.4; range, 29–75 years; 13 men [mean age, 62.4 years ± 12.4; range, 38–75 years] and 6 women [mean age, 61.8 years ± 16.5; range, 29–73 years]) were included in our study (Fig. 1) [21].

Among the 26 patients with leiomyoma, 8 had nonspecific gastrointestinal (GI) symptoms such as abdominal discomfort or nausea, and 2 had melena. The remaining 16 patients with leiomyoma were asymptomatic. Of the 19 patients with GIST, 5 had nonspecific GI symptoms, 5 had melena and 1 had obstructive symptoms like vomiting. The remaining 8 patients with GISTs were asymptomatic. None of the patients underwent neoadjuvant therapy with imatinib, a tyrosine kinase inhibitor.

2.2. Acquisition of CT images

Contrast-enhanced CT examinations were performed using 16- (n = 26), 64- (n = 17), or 256- (n = 2) detector-row scanners (Mx 8000, Brilliance 64, or iCT256; Philips Medical Systems, Cleveland, OH). Each patient was asked to drink 1000 mL of tap water for gastric distension 10 min before the CT examination. Intravenous nonionic contrast material (2 mL/kg; iopromide, Ultravist 370; Bayer, Berlin, Germany) or iomeprol, Iomeron 350; Bracco, Milano, Italy) was administered via the antecubital vein, using a power injector (Stellant D, Medrad, Indianola, PA) at a rate of 3 mL/s. Bolus-tracking software (Brilliance; Philips Medical Systems) was used to trigger the scanning 60 s after the aortic enhancement reached a threshold of 150-HU. Helical scan data were acquired using 16 × 1.5, 64 × 0.625, or 128 × 0.625 mm collimation; a rotation speed of 0.75 or 0.5 s; a pitch of 1.188, 0.644, or 0.993, and 120 kVp. Effective mA s ranged from 92 to 244 mA s using an automatic tube current modulation technique (Dose-Right; Philips

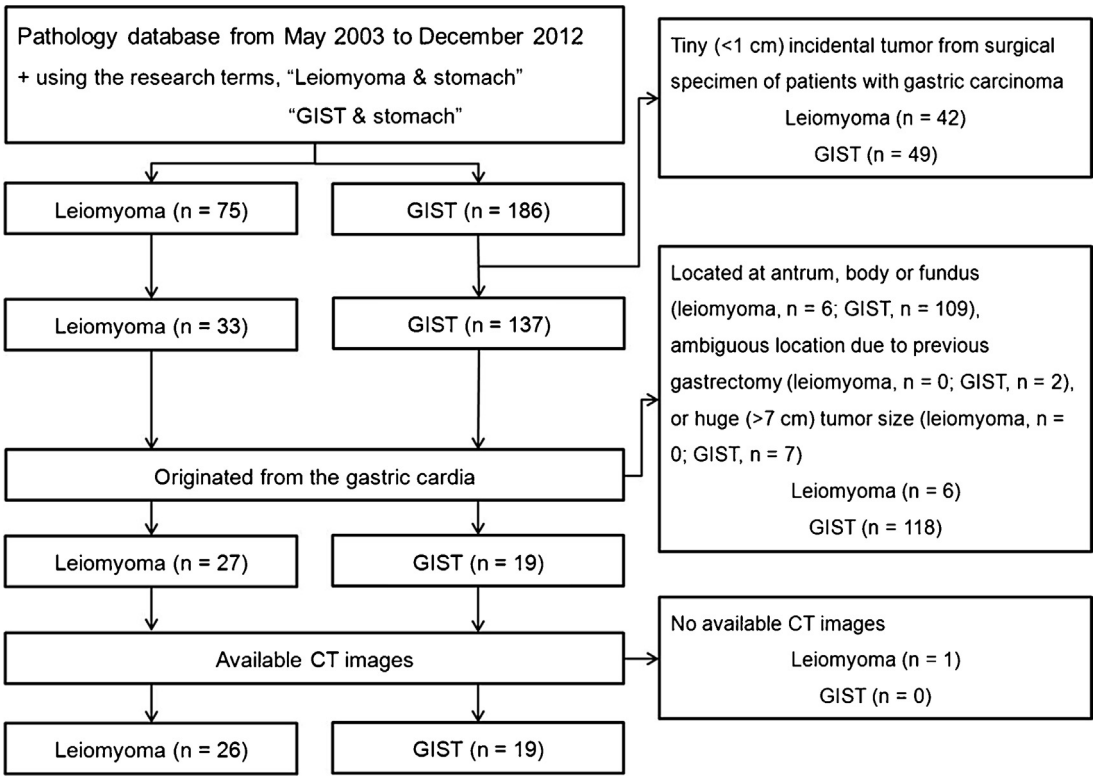

Fig. 1. Flowchart of study based on recommended standards for reporting diagnostic accuracy.