
ORIGINAL ARTICLE

Diagnostic Yield of Endoscopy after Upper Gastrointestinal Tract Abnormality Found on Computed Tomography

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ABSTRACT

Introduction: The aim of this study was to evaluate the diagnostic yield of endoscopy after upper gastrointestinal (GI) tract abnormality was found on computed tomography (CT) scan.

Methods: Retrospective identification of upper GI endoscopy performed with an indication of “abnormal CT” in a 3-year period. Cases were grouped according to clinical suspicion of underlying GI tract pathology (“expected” or “unexpected”). CT report findings were categorised into one of four categories: dilatation, lymphadenopathy, mass lesion or mural thickening and compared with the main endoscopic finding. Where available, histology was included.

Results: Of 96 patients undergoing upper GI endoscopy after abnormal CT, 14 (15%) had normal examinations. 17 (18%) of 96 patients were found to have an underlying neoplasm (adenocarcinoma, squamous cell carcinoma or lymphoma) of which seven were unexpected clinically. Six (6%) of 96 patients were found to have Barrett’s oesophagus. In five (83%) of six patients with Barrett’s, there was no clinical suspicion for GI tract pathology. A correlative endoscopic abnormality was found in five (45%) of 11 masses where GI pathology was expected compared with eight (40%) of 20 masses when unexpected. Where thickening was reported on CT, a correlative endoscopic abnormality was found in 14 (63%) of 22 patients with expected GI tract pathology compared with 13 (62%) of 21 patients when unexpected.

Conclusions: The diagnostic yield of endoscopy for significant GI tract pathology performed after CT is high and merits further investigation.

Key Words: Adenocarcinoma; Barrett esophagus; Carcinoma, squamous cell; Endoscopy; Lymphoma; Tomography, X-ray computed; Upper gastrointestinal tract

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中文摘要

電腦斷層掃描中發現上胃腸道異常後內窺鏡檢查的診斷陽性率

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引言：本研究旨在評估在電腦斷層掃描（CT）中發現上胃腸道異常後內窺鏡檢查的診斷陽性率。

方法：回顧性分析3年內因「CT顯示異常徵狀」而進行上胃腸道內窺鏡的病例。根據臨床懷疑有潛在胃腸道病變與否（「預期內」或「意外」）對病例進行分組。CT報告的發現分為四類：擴張、淋巴結腫大、腫塊病變或壁增厚，並與主要內窺鏡檢查結果進行比較。在可能的情況下納入組織學結果。

結果：於CT檢查發現異常後接受上胃腸道內窺鏡檢查的96例中，14例（15%）的檢查結果顯示正常。17例（18%）發現患有腫瘤（腺癌、鱗狀細胞癌或淋巴瘤），其中7例屬臨床上意外診斷。此外，96個病例中6例（6%）被發現有Barrett食管，其中5例（83%）沒有臨床懷疑胃腸道病變。在預期有胃腸道病變的11個腫塊中，5個（45%）於內窺鏡發現相關異常。在意外病例中，20個腫塊中有8個（40%）於內窺鏡發現相關異常。當CT發現壁增厚，22例預期胃腸道病理中發現14例（63%）相關內窺鏡檢查異常，而21病例中則發現13例（62%）意外內窺鏡異常。

結論：內窺鏡檢查對CT術後胃腸道顯著病變的診斷陽性率較高，值得檢查。

INTRODUCTION

Computed tomography (CT) is increasingly used in elective and emergency abdominal assessment. The number of CTs performed in 5 years from 2010 to 2015 increased by 29% in the United Kingdom alone.¹ With improvements in scanning technology visualisation of bowel-related structures and in particular the upper gastrointestinal (GI) tract is improving, and increasingly, radiologists incorporate review of upper GI tract structures in CT reporting.

Abnormal imaging is an indication for performing diagnostic upper GI endoscopy.² In modern day practice most of these referrals are secondary to CT. This study aimed to assess the diagnostic yield and concordance with oesophagogastroduodenoscopy (OGD) findings of a range of reported CT abnormalities, also considering if upper GI pathology was clinically expected/unexpected from the imaging request form.

METHODS

The OGD performed at a district general hospital from August 2010 to September 2013 with an indication of “abnormal CT” were identified retrospectively through an electronic database search. For inclusion, all patients had a CT study, prior to upper GI endoscopy, which described an abnormality in the upper GI

tract (oesophagus, stomach, duodenum, or regional lymph nodes). Cases were included if clinical notes, radiology images and reports on the Picture Archiving and Communications System/Radiology Information System (RIS), endoscopy reports and histology (where performed), were available for review.

CT examinations encompassed abdominal with or without pelvic CT, angiographic phase CT for suspected mesenteric ischaemia/haemorrhage, staging examinations of the whole body for patients with suspected or known cancer, CT pulmonary angiography (CTPA) for suspected pulmonary embolism, low-dose non-contrast colic studies (CT of kidneys, ureters and bladder [CT KUB]), contrast-enhanced CT urogram, and pancreatic protocol CT. Most, with the exception of CT KUB, involved the administration of intravenous contrast. CT and endoscopy studies were identified retrospectively and therefore reported/performed by a range of radiologists and endoscopists with differing specialist skills and experience, reflective of real-world conditions. As endoscopy was performed after a reported CT abnormality, the operator would not have been blind to the CT findings. At our institution radiologists may also access previous endoscopy reports.

Patient age, gender, CT, and endoscopy dates were

recorded. CT findings for each patient were classified on the basis of the written radiological report into four categories: suspected pathological luminal dilatation, lymphadenopathy in a distribution suggestive of a primary upper GI neoplasm (eg, coeliac axis or left gastric adenopathy), visible mass lesion, or suspected pathological mucosal thickening. The organ involved was also recorded (oesophagus, stomach, or duodenum). Pancreatic masses were included only if there was reported upper GI tract involvement, such as direct duodenal invasion or extrinsic compression. The small bowel post D1 is beyond the reach of conventional fibre-optic endoscopy so CT pathology in these areas was excluded.

Data were analysed using Microsoft Excel 2010 (Microsoft Corp., Redmond [WA], United States). Patients were grouped according to whether GI pathology was expected (Figure 1) or unexpected (Figure 2) based on details available to the reporting radiologist on RIS via a request form. For each category (dilatation, lymphadenopathy, thickening, and mass), diagnostic yield was examined. Direct correlation of endoscopy and CT was undertaken based on written reports. Where a mass lesion was found at endoscopy

in a CT reported mass, correlation was deemed to have occurred, a similar approach was pursued for CT reported thickening. For reported CT cases of dilatation or regional lymphadenopathy, comparison with OGD was made to evaluate the presence of an underlying explanatory lesion. Additional endoscopy findings were also examined, occult on CT, and categorised as insignificant, significant, pre-malignant, and malignant in both expected and unexpected upper GI pathology groups. Examples of insignificant pathology include mild inflammatory change or small hiatus hernias. Significant findings included severe inflammatory change, benign strictures, and ulcers. Pre-malignant disease encompassed Barrett's, tubulovillous adenomas, and larger polyps; malignant disease included adenocarcinomas, squamous carcinomas and lymphoma.

RESULTS

There were 96 patients in total, 49 women with mean age 76 (range, 36-94) years and 47 men with mean age 70 (range, 36-90) years. Elapsed time interval between CT and OGD varied from 1 to 45 days with a mean of 18 and a median of 15 days. There were no documented significant complications after endoscopy.

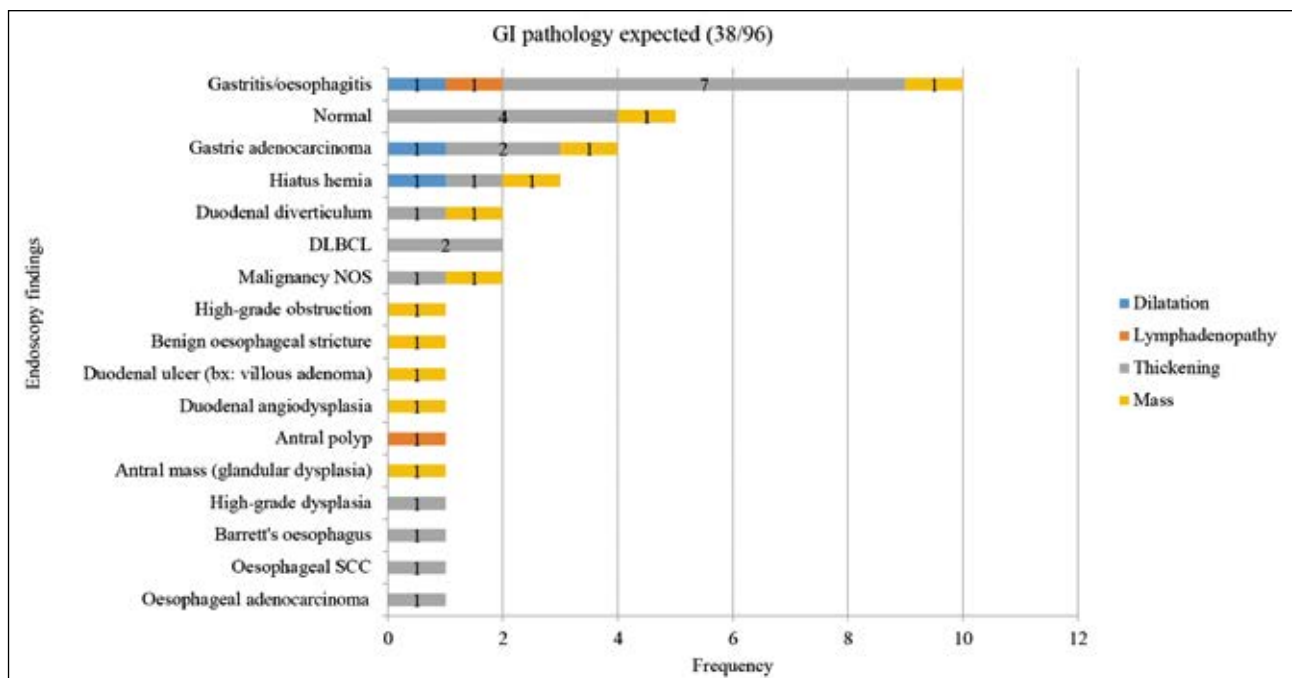


Figure 1. Diagnostic yield of endoscopy after an abnormal computed tomography scan. Gastrointestinal pathology expected based on written information provided by referring clinicians on the computed tomography report. Abbreviations: bx = biopsy; DLBCL = diffuse large B cell lymphoma; GI = gastrointestinal; NOS = not otherwise specified; SCC = squamous cell carcinoma.

Of the 96 patients, 14 (15%) had normal OGD: indications were CT reported dilatation (n = 1), lymphadenopathy (n = 3), mucosal thickening (n = 7), and mass (n = 3). Of the 96 patients, 17 (18%) were diagnosed with

a malignant neoplasm, and seven were clinically unsuspected. Within this subgroup, CT findings were thickening (n = 10) [Figures 3 and 4], mass (n = 6) [Figures 5 and 6], and dilatation (n = 1) [Figure 7].

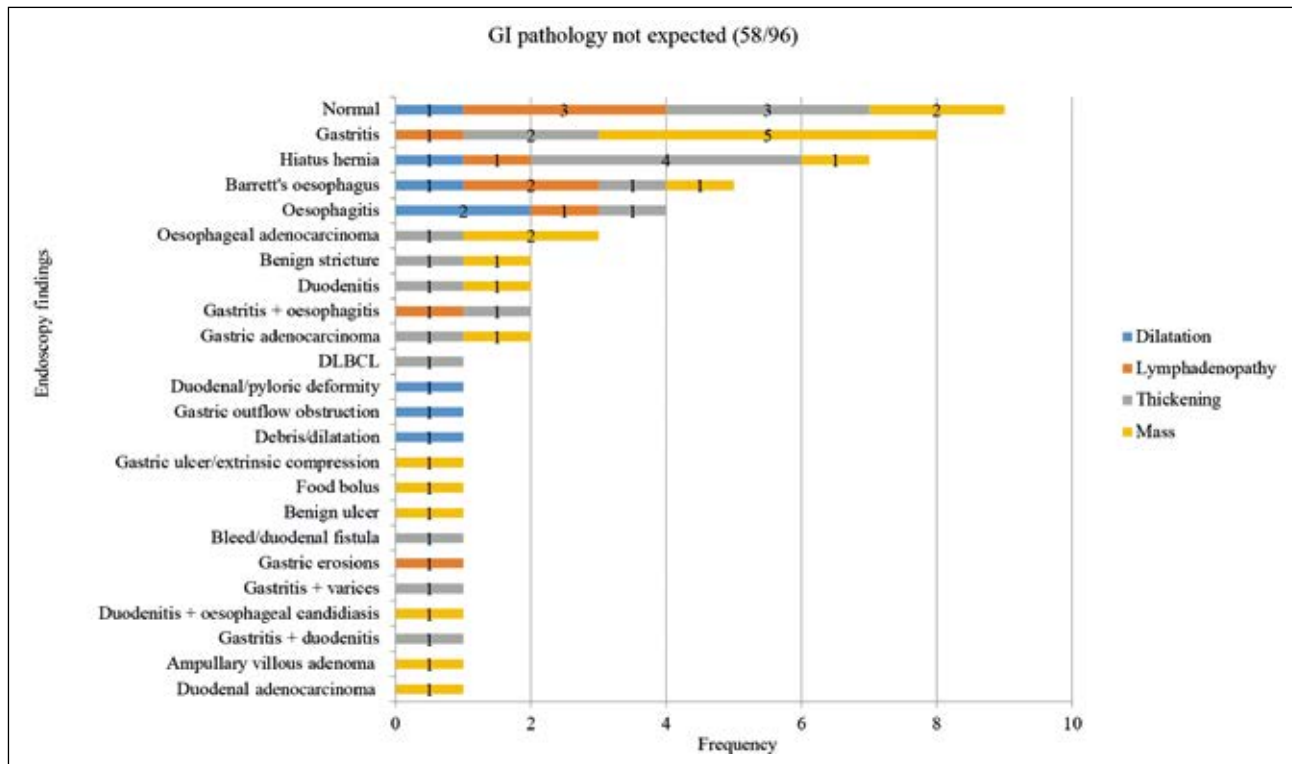


Figure 2. Diagnostic yield of endoscopy after an abnormal computed tomography scan. Gastrointestinal pathology unexpected based on written information provided by referring clinicians on the computed tomography report. Abbreviations: DLBCL = diffuse large B cell lymphoma; GI = gastrointestinal.



Figure 3. Thickening reported at computed tomography (gastrointestinal pathology unsuspected clinically): Mural thickening of the distal oesophagus (dashed arrow). Biopsy showing Barrett's oesophagus and adenocarcinoma. The patient also had small lung nodules (not shown) concerning for metastases.



Figure 4. Axial computed tomography in the portal venous phase. There was clinical suspicion for an upper gastrointestinal malignancy. Crescentic thickening of the posterior oesophageal wall (dashed arrow). Endoscopic biopsy revealed squamous cell carcinoma.

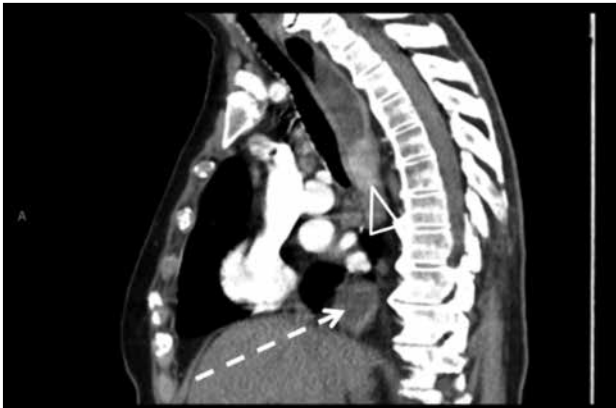


Figure 5. Sagittal reformat of a computed tomography pulmonary angiography. Mass reported, gastrointestinal pathology was unsuspected clinically. Enhancing mass measuring 33 × 11 mm in the posterior wall of the mid oesophagus (open triangle) with upstream oesophageal dilatation, suspicious for malignancy. Hiatus hernia (dashed arrow). Poorly differentiated invasive adenocarcinoma confirmed at endoscopic biopsy.



Figure 7. Axial portal venous phase computed tomography [CT] at T12 level. Dilatation reported, gastric neoplasm suspected clinically. Marked gastric dilatation (dashed arrow). No identifiable mass lesion at CT. Ill-defined liver hypodensity (solid arrow). Biopsy of a malignant-looking ulcer in the lesser curve of the stomach at upper gastrointestinal endoscopy confirmed adenocarcinoma. Ancillary signs such as liver metastases increase diagnostic confidence for an underlying neoplastic process in the appropriate clinical context.

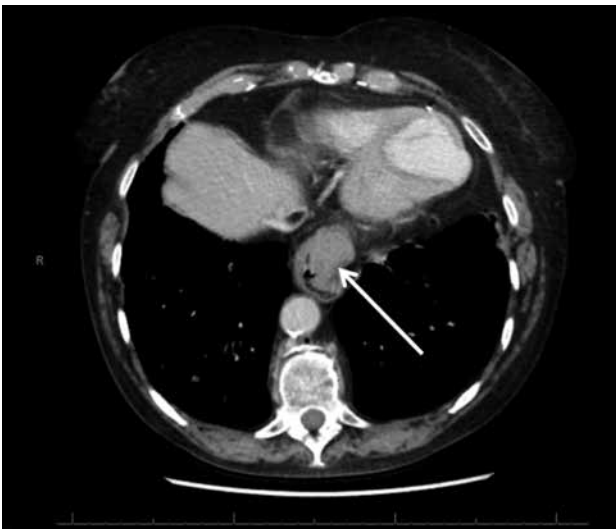


Figure 6. Axial computed tomography pulmonary angiography to follow up an area of left basal shadowing. Mass reported, upper gastrointestinal pathology unsuspected. A soft tissue mass (arrow) was reported at the gastro-oesophageal junction within a known hiatus hernia, but subsequent oesophagogastroduodenoscopy performed 45 days later was normal (false-positive computed tomography). Discordance may have resulted from a transient abnormality that resolved or a diagnostic overcall in the setting of an unprepared gastrointestinal tract (no oral contrast).

Of the 96 patients, six (6%) were found to have Barrett’s oesophagus, among whom this was unexpected clinically in five patients. The most common CT reported abnormality for patients with Barrett’s in our series was thickening (n = 3), with CT reported mass (n = 1), dilatation (n = 1), and lymphadenopathy (n =

1) also reported. Pre-malignant diagnoses at endoscopy encompassed glandular dysplasia (antral mass visually; CT reported mass), villous adenoma (ampullary mass visually; CT reported mass), high-grade dysplasia (CT reported thickening), and a gastric antral polyp (CT reported lymphadenopathy). Other significant findings included gastritis, oesophagitis, duodenitis, hiatus hernias, benign strictures, peptic ulcer disease, varices, angiodysplasia, villous adenomas, and a food bolus.

A correlative endoscopic abnormality was found in five (45%) of 11 CT masses where GI pathology was expected compared with eight (40%) of 20 CT masses when unexpected. Cases were classed as “expected” if there were relevant symptoms/clinical features such as dysphagia/anaemia on the written request form provided by the referring clinical team. Otherwise cases were classed “unexpected.” Where thickening was reported on CT, a correlative endoscopic abnormality was found in 14 (63%) of 22 patients with expected GI tract pathology compared with 13 (62%) of 21 patients when unexpected. Overall, of 74 patients with CT reported masses or thickening a correlative endoscopic abnormality was found in 40 (54%) patients. If GI pathology was expected, in this subgroup of patients with CT reported mass and thickening, a correlative endoscopic abnormality was found in 19 (57.5%) of 33 patients compared with 21 (51.2%) of 41 patients where GI pathology was not expected (Table).

Table. OGD findings.

| GI pathology expected | | | | |
|--------------------------|------------|-------|--------------------------|--------------------|
| OGD finding | CT finding | | | |
| | Dilatation | Nodes | Thickening (correlation) | Mass (correlation) |
| OGD normal | 0 | 0 | 4 (0/4) | 1 (0/1) |
| Abnormal (insignificant) | 2 | 1 | 9 (7/9) | 3 (0/3) |
| Abnormal (significant) | 0 | 1 | 0 (-) | 3 (2/3) |
| Pre-malignant | 0 | 0 | 2 (1/2) | 2 (1/2) |
| Malignant | 1 | 0 | 7 (6/7) | 2 (2/2) |
| GI pathology unexpected | | | | |
| OGD finding | CT finding | | | |
| | Dilatation | Nodes | Thickening (correlation) | Mass (correlation) |
| OGD normal | 1 | 3 | 3 (0/3) | 2 (0/2) |
| Abnormal (insignificant) | 3 | 5 | 10 (6/10) | 7 (1/7) |
| Abnormal (significant) | 3 | 0 | 3 (2/3) | 5 (2/5) |
| Pre-malignant | 1 | 1 | 2 (2/2) | 2 (1/2) |
| Malignant | 0 | 0 | 3 (3/3) | 4 (4/4) |

Abbreviations: CT = computed tomography; GI = gastrointestinal; OGD = oesophagogastroduodenoscopy.

DISCUSSION

Over 3 years, seven cancers and six cases of Barrett’s oesophagus were diagnosed in patients for whom there was no clinical suspicion of GI tract pathology at the time of referral for CT. This is important and warrants further discussion. A previously published study examining endoscopy performed for incidental GI luminal wall thickening detected with CT in patients without GI complaints disclosed nine cancers in 31 (29%) patients in a 3-year period.³ Ours differs, in that only the upper GI tract was considered, whereas Tellez-Avila et al³ looked at the whole GI tract.

The indication for upper GI endoscopy for all included patients was an abnormality reported at CT. Patients with CT reported abnormality may not proceed to upper GI endoscopy for a number of reasons: refusal, contraindicative frailty/co-morbidity, and instances where clinical judgement overrides the radiologist’s impression. Given the large total number of CT performed at our institution, and the varied phraseology used in radiology reports, it was not feasible to retrospectively identify all cases where there was reported GI tract abnormality to find patients who did not proceed to upper GI endoscopy. In future, this may warrant prospective review.

In our series, 58 (60.4%) of 96 patients underwent upper GI endoscopy who would not otherwise have done so because of CT reports on scans performed for non-upper GI indications, including suspected pulmonary embolism, renal colic, and workup of angina (coronary CT angiography). Of these 58 patients, only nine (15.5%) had a completely normal upper GI endoscopy. GI tract pathology was suspected clinically in 38 (40%) of 96 patients, and of these 38, only five (13.2%) patients had a completely normal endoscopy.

Mural thickening was the commonest reported finding at CT in 43 (44.8%) of 96 patients, followed by mass lesions in 31 (32.2%) of 96 patients. The majority of endoscopically visualised (and biopsy proven) malignancies were found in these groups. Categorisation of an abnormality as an area of thickening or a mass can be challenging and affected by inter-observer variation and CT technique. Most CT at our institution does not involve pre-administration of oral contrast; hence the degree of luminal distension of the GI tract varies. Oral contrast is not warranted in CTPA for suspected pulmonary embolism. But, if pulmonary embolism has occurred in the setting of an underlying obstructing GI tract lesion, there may be sufficient luminal distension from the patient’s GI tract secretions for a radiologist to confidently assess the wall. Previously published literature advocates the use of oral water as a neutral contrast medium with effervescent granules to facilitate distension of the stomach in dedicated CT examinations (750 mL 15 minutes prior and 250 mL of water at the time of the examination).⁴ It is safer than barium in the setting of GI perforation, cheaper than hypo-osmolar iodinated contrast and given its comparatively low attenuation, it should not interfere with post-processing techniques. There is less risk of pseudo-lesions resulting from inadequate mixing between existing luminal fluid and positive oral contrast. In the setting of poor luminal distension, mass lesions may be regarded as thickening or may become imperceptible. Kim et al⁵ defined normal oesophageal wall thickness as <3 mm at CT when distended and considered any thickness >5 mm abnormal. However, CT is limited in determining depth of tumour infiltration and delineates T stage in oesophageal cancer less accurately than endoscopic ultrasound.⁵ Late arterial phase imaging (35 s) has also been described as optimal for visualisation of oesophageal cancer, but this was in a retrospective review of patients with a proven histological diagnosis of cancer rather than an unselected sample.⁶

Insko et al⁷ compared CT with double-contrast barium swallow, endoscopy, histopathological findings and identified a gastric wall thickness of ≥ 1 cm as 100% sensitive, but only 50% specific at detecting malignant or potentially malignant stomach lesions warranting further diagnostic evaluation. All patients in their series received oral contrast prior to CT. Differential considerations for mucosal thickening of the upper GI tract include neoplasm, infection, and inflammation.

To the best of our knowledge, with regard to assessment of upper GI mural thickening in unprepared CT (ie, without oral contrast media), there is no consensus. Classic imaging features for reporting radiologists are covered in a review article by Rakita et al.⁸ In this series, non-malignant findings such as gastritis, oesophagitis, and hiatus hernias were found across all categories of CT abnormalities.

Direct correlation in our study was assessed for mass and thickening only. The extent to which CT and OGD correlated did not significantly differ according to whether GI pathology was suspected clinically or not (correlation in 19 [57.6%] of 33 cases where GI pathology was expected vs. 21 [51.2%] of 41 cases where GI pathology was not). For all cases in our series (expected and unexpected), a correlation was found in 27 (62.8%) of 43 cases of thickening compared with 13 (41.9%) of 31 masses. Not all masses are visible from the lumen, eg, submucosal abnormalities that are predominantly exophytic without causing extrinsic luminal narrowing. Ancillary findings, such as the presence of liver lesions or suspicious pulmonary nodules/masses, can increase confidence in diagnosing malignancy. Another potential cause for discordance is the imaged range. CT performed for renal colic would only include the lower part of the oesophagus, whereas the whole oesophagus is reviewed by the endoscopist, assuming there is no impassable lesion/stricture. There were also instances in this case series where the radiological and endoscopy findings correlated, but both ultimately disproved by a discordant histological diagnosis (eg, normal histology in the setting of a concerning lesion). Endoscopy is not necessarily a reference standard test for abnormalities depicted at CT and where possible less invasive means of securing a tissue diagnosis such as percutaneous ultrasound-guided biopsy should be pursued. Radiologist seniority was not examined, so we cannot comment on whether this affected the extent to which CT/upper GI endoscopy findings correlated. Reverse discordance, ie, cases where an abnormality at OGD was identified with a

recent normal upper GI tract appearance at CT was not examined. The corollary to this is that “normal” upper GI appearances at CT do not override existing clinical indications for pursuing OGD.

Lymphadenopathy (Figure 8) and dilatation (Figure 7) formed the basis for pursuing endoscopy in 11 patients each. Of 11 patients with lymphadenopathy reported at CT, eight had an identifiable endoscopic abnormality. Radiologists often erred on the side of caution, issuing reports with terms such as ‘probable lymphoma’ or recommendations to ‘exclude malignancy.’ In this sample of patients, no malignancies were revealed at endoscopy in patients who had lymphadenopathy, which with the benefit of hindsight was likely reactive, to other processes such as oesophagitis or gastritis beyond the resolution of CT. In addition, lymph node assessment is challenging at CT: morphology may be falsely reassuring and does not unequivocally differentiate neoplastic from reactive processes. Furthermore, there is not an absolute size threshold beyond which a node is definitely malignant, or below which it is benign. Pathological processes such as lymphoma without GI tract involvement may present as an abnormality at CT in the absence of a corresponding mucosal abnormality at direct visualisation as illustrated in the above case (Figure 8) where the correct diagnosis was made by an ultrasound-guided needle core biopsy of a neck node.



Figure 8. Computed tomography colon study, indication: suspected diverticulitis. Lymphadenopathy reported, upper gastrointestinal [GI] pathology unsuspected clinically. A 1.5-cm node (arrow) was reported as the largest of a group of coeliac nodes, with a suggestion to consider endoscopy if felt appropriate clinically. Lymphoma was offered as a possible cause. No upper GI abnormality was identified at endoscopy.

In summary, the number of endoscopies performed as a result of CT in 3 years at a busy district general hospital was relatively few. Indeed, patients are likely to have undergone endoscopic assessment in many cases regardless of CT findings. Our series shows that CT is a useful tool for detection of potentially significant GI tract pathology but not diagnostically specific. Aforementioned technical issues, relating to timing of image acquisition after intravenous contrast and luminal distension are key. In the absence of CTs reported as either completely normal or non-concerning from a GI point of view with endoscopically significant abnormalities, it is not possible to calculate sensitivity or specificity from our case series. But upper GI endoscopy performed on the basis of abnormal CT has previously been described as useful,³ and even as an absolute indication.⁹ Not all patients are sufficiently fit to undergo endoscopy. Alternatives include fluoroscopic contrast swallows, meals and followthrough which provide an opportunity to examine dynamic features such as peristalsis. It is unclear from our data whether there is any significant difference in the stage/grade at diagnosis and natural history of upper GI neoplasm identified incidentally compared with cancer identified in patients symptomatic at presentation. This merits further investigation, particularly given the current emphasis on early detection and diagnosis of cancer. These serendipitous pickups must be weighed against the impact upon patients and their families of overcalling where a radiologist reports likely malignancy, but

a benign entity is identified at follow-up endoscopy examination.

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