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Diagnostic value and potential clinical significance of duodenal lipoma based on computed tomography imaging data

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Abstract

Background: To explore the diagnostic value of computed tomography (CT) imaging for duodenal lipoma and the potential clinical significance of the findings.

Methods: Clinicopathological and CT data from 57 patients, who were diagnosed with duodenal lipoma at the first affiliated Hospital of Zhengzhou University (Zhengzhou, China) between June 2014 and March 2019, were retrospectively reviewed. Data collected included location and size of the tumor, morphological manifestations (shape, density, boundary), concomitant diseases, pathology and gastroscopy results, and follow-up. Follow-up was performed via telephone, and surgical patients were followed-up for recurrence, metastasis and tumor size, and morphological changes. The follow-up period was up to January 2019.

Results: Of the 57 patients with duodenal lipoma, contrast-enhanced scanning was performed in 7 cases. The tumor was located in the descending duodenum in 33 cases, the ascending in 4 cases, the horizontal in 16 cases, and the bulb in 4 cases. Mean tumor size was 13.0 ± 5.8 mm. CT morphological features of the tumor were as follows: tumor shape, round, quasi-round, or oval (n = 42); long strip (n = 3); nodular (n = 2); triangular (n = 1); and irregular lobulated (n = 9). Among the 57 patients, tumor density was homogeneous in 52 cases, inhomogeneous in 4 cases, and nodular with calcification in 1 case. The tumor boundary was classified as clear and with no capsule. Diseases concomitant with the tumor were as follows: gastritis (n = 23), gastric adenocarcinoma (n = 1), and gastric lymphoma (n = 1). Esophageal disease was found in 16 cases, including reflux esophagitis (n = 12) and esophageal cancer (n = 4). There were 13 cases of gallbladder and biliary disease, including cholecystolithiasis and cholecystitis (n = 9), common bile duct disease (n = 2), colorectal cancer (n = 4), lung cancer (n = 2), duodenal carcinoma with obstruction (n = 1), and ureteral space narrowing (n = 1).

Conclusion: CT was an effective, non-invasive method for diagnosis of duodenal lipoma. CT imaging could clearly discern location, size, shape, and nature of duodenal lipomas. Duodenal lipoma can be associated with digestive tract inflammatory diseases and tumors in different locations, and its diagnosis is potentially valuable for their prevention and treatment.

Abbreviations: CT = computed tomography, HU = Hounsfield Units, MSCT = multi-slice computed tomography.

Keywords: cancer, computed tomography, duodenal lipoma

1. Introduction

Duodenal lipoma is a rare benign tumor of the digestive tract. Few studies have investigated this disease, most of those were case reports.[1] In a study investigating 4000 cases of benign tumors of the digestive tract, duodenal lipoma accounted for only 0.16% of lesions.[1,2] Atypical and malignant lipomas account for approximately 20% of all sarcomas.[3] Some studies have reported cases of lipoma complicated with gastric cancer and gastritis. Although the disease generally does not cause clinical symptoms, submucosal type duodenal lipomas can cause gastrointestinal bleeding, acute and chronic intestinal obstruction, and/or intussusception.[4] Moreover, previous reports have described chemical lipoma complicated with gastric adenocarcinoma and signet ring cell carcinoma.[5–9] Therefore, attention should be devoted to lipoma in the clinic. However, duodenal lipoma is not easy to diagnose; as such, an effective diagnostic method(s) is needed. Therefore, the present investigation aimed to study the value of CT in the diagnosis of duodenal lipoma and to further study the relationship between duodenal lipoma and its concomitant diseases.

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Table 1

Basic characteristics of the patients n = 57.

Gender	
Male	17
Female	40
Location	
Descending part	33
Ascending part	4
Horizontal part	16
Bulb part	4
Shape	
Round, quasi-round, or oval	42
Long strip	3
Nodular	2
Triangular	1
Irregular lobulated	9

2. Methods

The present investigation was a retrospective cross-sectional study. This study was approved by the institutional review board of The First Affiliated Hospital of Zhengzhou University, and the requirement for written informed consent was waived for all patients in this retrospective study. Clinicopathological data and CT information from 57 patients, who were diagnosed with duodenal lipoma at the hospital between June 2014 and March 2019, were collected. There were 17 men and 40 women, with a median age of 61 years (range, 43–96 years). Patients were identified after abdominal CT examination to investigate abdominal pain, heartburn, acid regurgitation, anorexia, or for physical examination or other diseases. The patients and their families provided written informed consent for the relevant examination(s). Basic characteristics of the patients are summarized in Table 1.

2.1. Inclusion and exclusion criteria

Patients who fulfilled the following criteria were included in the present study: complete clinical data were available; mass was highly discernable on CT imaging, and size, boundaries, and characteristics were visible; and complete CT data before operation or before treatment were available.

Patients without a complete clinical dataset, those with poor-quality CT images, in which the shape of the mass could not be discerned, and those without preoperative or pretreatment CT data were excluded.

2.2. Diagnostic equipment and related parameters

Imaging equipment included the Somatom Force 64-layer multi-slice CT (MSCT) (Siemens, Erlangen, Germany), Somatom dual-source Flash 64-layer MSCT scanner (Siemens, Germany), GE Revolution 256-row MSCT scanner (GE Healthcare, Milwaukee, WI), Gemstone 75064 layer CT scanner (GE Healthcare), and the Somaton Sensation 64-layer (Siemens, Germany). All the 57 patients fasted for >8 hours before MSCT. Before the examination, patients consumed 800 to 1000 mL water and underwent breath-hold scan and routine MSCT scan of the upper, middle, or entire abdomen. The scanning parameters were as follows: tube potential, 120 kV; tube current, 250 mA; field of view, 250 mm × 250 mm, slice thickness of 1.5 mm, slice interval of 1.5 mm, rotation time of 0.5 to 0.6 seconds. The window width was 200 Hounsfield units (HU), and the window level was based on a 50 HU soft tissue window. Axial images were acquired and subsequently transmitted to a diagnostic workstation (ADW 4.7, GE Healthcare, Milwaukee, WI). Coronal and sagittal images were reconstructed using the Reformat software (ADW 4.7,GE Healthcare, Milwaukee, WI, USA). Contrast-enhanced CT was performed after injection of iohexol 320 mg/mL into the elbow vein at a dose of 1.5 mL/kg and a flow rate of 3.0 mL/kg. The arterial phase, portal venous phase, and parenchymal phase were scanned at 30, 70, and 120 seconds, respectively, after injection.

2.3. Imaging analysis

All images were analyzed by 2 deputy chief physicians with 15 to 20 years' experience in diagnostic abdominal CT imaging. The location and size of the tumor, CT morphology, and concomitant diseases were observed.

2.4. Follow-up information

The patients were followed-up by the outpatient service and through telephonic interviews. Recurrence and metastasis of the tumor were monitored using CT, while enlargement and morphological changes, and the improvement or progress of the concomitant symptoms, were observed using endoscopy during follow-up. The follow-up period was up to January 2019.

2.5. Statistical analyses

Statistical analyses were performed using SPSS version 25.0 (IBM Corporation, Armonk, NY), and measurement data that were normally distributed are expressed as $x \pm s$. Differences with $P < .05$ were considered to be statistically significant.

3. Results

The tumor was located in the descending duodenum in 33 cases, the ascending in 4 cases, the horizontal in 16 cases, and the bulb in 4 cases. The mean tumor size was 13.0 ± 5.8 mm. There were 23 cases of concomitant gastritis, 1 gastric adenocarcinoma, and 1 gastric lymphoma. There were 16 cases of esophageal disease, including reflux esophagitis (n = 12) and esophageal cancer (n = 4). There were 13 cases of gallbladder and biliary disease, including cholecystolithiasis and cholecystitis (n = 9), common bile duct disease (n = 2), colorectal cancer (n = 4), lung cancer (n = 2), and duodenal carcinoma with obstruction (n = 1) and with ureteral space narrowing (n = 1) (Fig. 1).

3.1. CT imaging performance

Plain CT revealed that the edges of the tumors were regular and the boundaries were clear. The tumors were located in the descending duodenum in 33 cases, ascending in 4 cases, horizontal in 16 cases, and bulb in 4 cases. The tumor was round, quasi-round, or oval in 42 cases, long strip in 3 cases, nodular shape in 2 cases, triangular in 1 case, and irregular lobulated in 9 cases. Among the 57 cases, tumor density was homogeneous in 52 cases, inhomogeneous in 4 cases, and nodular with calcification in 1 case. The CT value of the tumor ranged from −106 to −40 HU, with a median of −72 HU. The boundaries of the tumors were clear, and the margins of the mucosa around the tumor were smooth. No obvious enhancement of the tumor was found on enhanced imaging (Fig. 2).

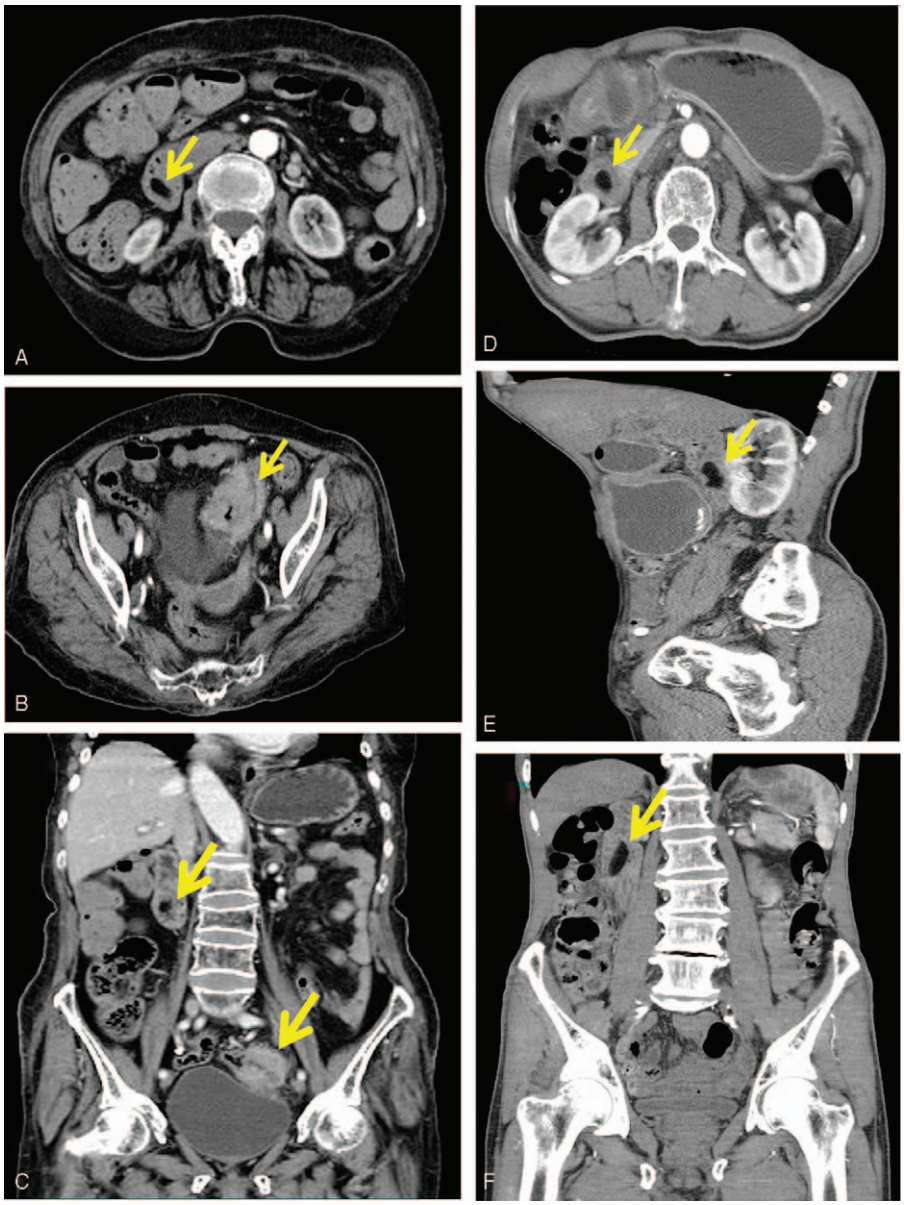

Figure 1. One case of duodenal lipoma with sigmoid colon cancer and 1 case of duodenal lipoma with duodenal obstruction. A. A fat-like low-density shadow (arrow) can be seen in the descending segment of the duodenum on the cross-sectional position. B. On the cross-sectional position, the wall of sigmoid colon thickened inhomogeneously, the lumen narrowed and the wall showed moderate enhancement (arrow). Postoperative pathology confirmed sigmoid cancer. C. The case of duodenal lipoma with sigmoid colon cancer was clearly demonstrated on the coronal position (arrow). D–F. The picture clearly shows the lipoma of the descending segment of the duodenum and duodenal obstruction from the cross-sectional, sagittal, and coronal position respectively (arrow); we can also see the thickening of the duodenal wall, suspected space-occupying lesions, pathology confirmed that the duodenum conforms to villous tubular adenocarcinoma, and the local focus is suspected of canceration.

3.2. Pathology and gastroscopy results

Among patients with complete pathological data, the tumors were located in the submucosa (n = 15), subserosa (n = 2), and gastric lamina propria (n = 1) (Fig. 3).

3.3. Follow-up results

In 45 patients with complete follow-up information, no recurrence or tendency of enlargement of the lipoma was found on CT or gastroscopy, and 2 patients died of other cancers.

4. Discussion

4.1. Histological and clinical features of duodenal lipoma

Although the pathogenesis of gastrointestinal lipoma remains unclear,[4] it may be related to the combined effect of inflammatory stimulation and fat accumulation, and/or abnormal secretion of gonadal hormones in the anterior pituitary.[10] Some studies have demonstrated that duodenal lipomas can occur in any part of the duodenum, of which the descending part is the most common, accounting for approximately 60% of the

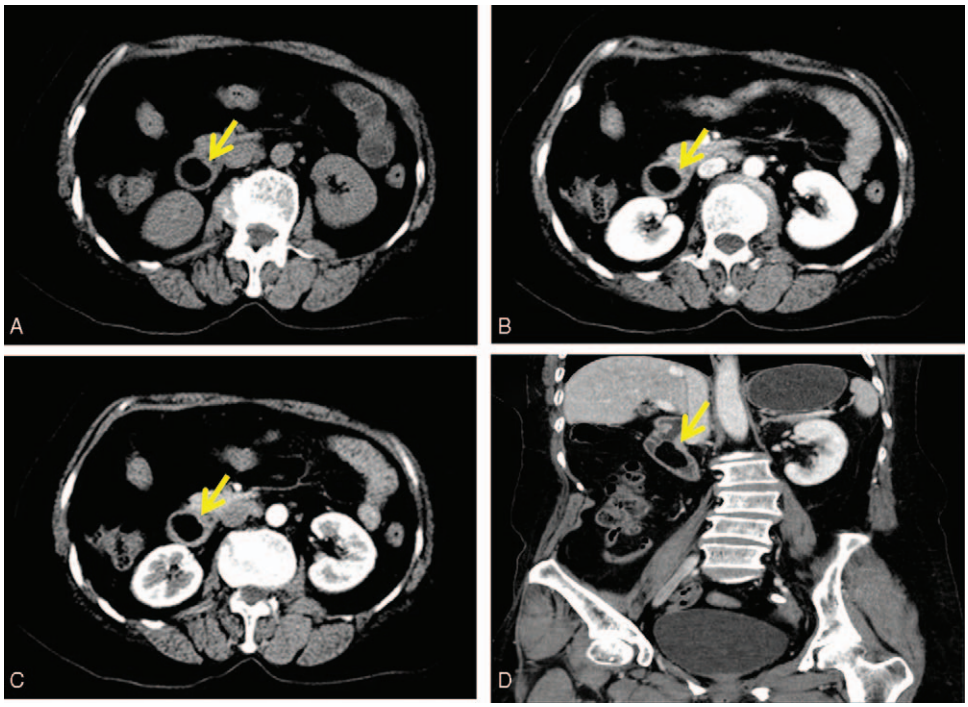

Figure 2. CT findings of duodenal lipoma. A. CT scan shows a circular fat-like density shadow of the descending duodenum (arrow) with a size of about 2.1 cm × 1.7 cm, and a CT value of –102 HU. B (arterial phase)–C (venous phase) enhanced scan arteriovenous phase tumors showed no significant enhancement (arrow). D. The coronal position visually shows a class of round lipoid tumors in the descending duodenum (arrow). CT = computed tomography.

cases.[11] Among the 57 patients in this study, 33 duodenal lipomas were located in the descending part of the duodenum, accounting for approximately 58%, which was consistent with the findings of a previous report. Duodenal lipoma is more common in middle-aged and elderly individuals, and there is no significant difference in the incidence between men and women. In this study, the incidence ratio of males to females was 1:2.3, and the average age was 61 years. It has been reported that intussusception occurs easily when the tumor is large, especially when it is > 4 cm. Rare duodenojejunal intussusception may occur when duodenal lipoma causes intestinal wall peristalsis[12–15]; however, no cases associated with intussusception were found in this study, which may be related to the small tumor volumes observed.

4.2. Diagnostic value of MSCT in duodenal lipoma

In this study, plain MSCT of duodenal lipomas revealed that the edges of the tumors were regular and the boundaries were clear, the tumor CT value ranged from –106 to –40 HU, with a median of –72 HU, and the margin of the mucosa around the tumor was smooth. No obvious enhancement of the tumor was found on contrast-enhanced imaging, although calcification could be observed in a few cases. CT of duodenal lipoma generally revealed homogeneous fat-like density, and very few thin cord-like septa were observed. In this study, we found that when tumors were large and thick, it was feasible to differentiate liposarcoma using enhanced CT or magnetic resonance imaging. CT has the characteristics of short scanning time, is non-invasive, and adipose tissue can be easily identified; therefore, CT is a simple and effective method for screening and diagnosing duodenal lipomas.

4.3. Potential clinical significance of duodenal lipoma

The present investigation not only studied CT characteristics of duodenal lipomas but also examined its concomitant diseases. Most duodenal lipomas were associated with inflammatory diseases such as those of the gastrointestinal tract, esophagus, and gallbladder. A particular concern in this study was that as many as 14 cases of duodenal lipoma were complicated with cancer, accounting for 24.5% of the total number of examinations (Table 2). Previous studies have reported that gastrointestinal lipomas may be associated with early gastric cancer, although the number of cases is small. Lipoma is located between the mucosal layer and the muscularis propria, which is adjacent to the lesion of early gastric cancer, indicating that these are usually concomitant tumors.[5–7] Huang et al[8] reported a case of gastric cancer with gastrointestinal lipoma with simultaneous double-surface mixed gastrointestinal mucus phenotype, which suggests that the possibility of synchronous tumor should be considered in the clinic. In this study, we found 2 cases of duodenal lipomas with gastric cancer, which is consistent with previous studies. Nomura et al[9] reported a unusual case of gastric cancer metastasizing to neck lipoma. In their study, the authors found many nodules with homogenous features in a large fatty tumor, suggesting the possible of tumor-to-tumor metastasis to a typical lipoma. In addition to gastric cancer, this study also found cases of duodenal lipoma associated with esophageal, lung, and rectal cancers, which have not been previously reported. Whether the occurrence of these cancers is related to duodenal lipoma or the possibility of metastasis to lipoma needs further investigation. Another study explored the relationship between lipoma and genetic-related tumors, in which pleomorphic lipoma, cellular angiofibroma, and breast myofibroblastoma exhibited a deletion

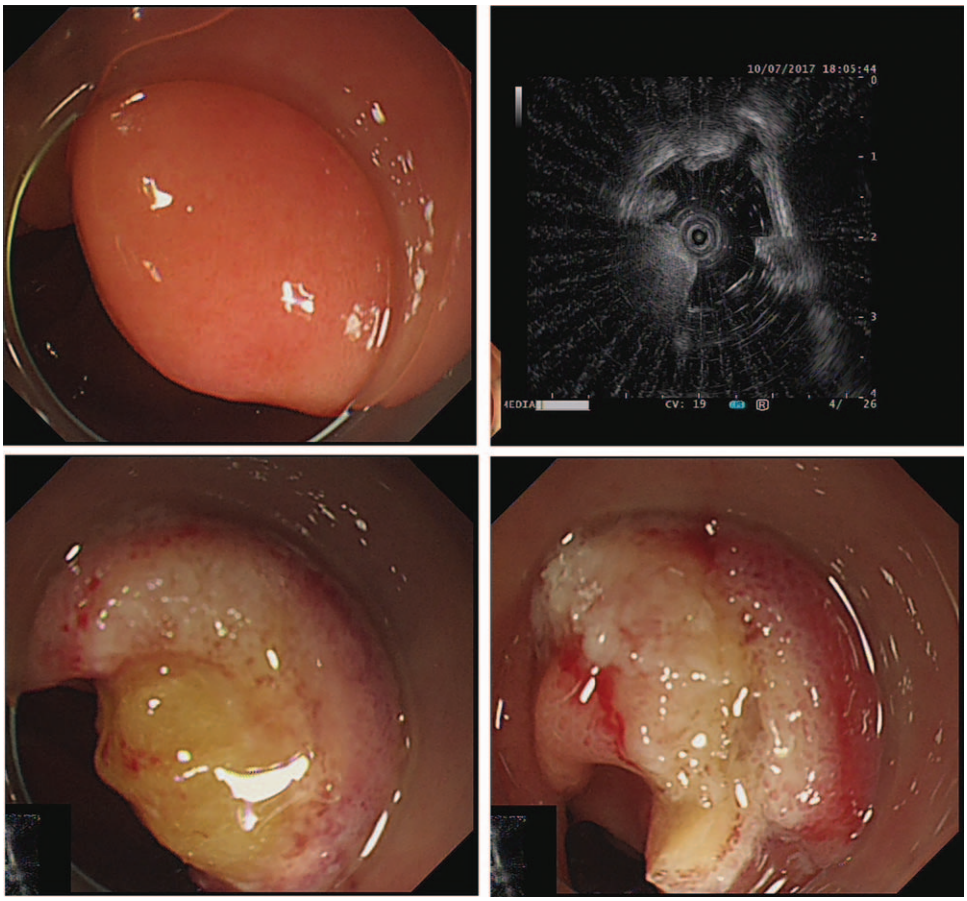

Figure 3. Results of gastroscopy (descending duodenum). A large number of mature mature adipose tissues are seen in the submucosa.

of a single allele at chromosome 13q14. Due to similar histological and immunohistochemical characteristics, they are expected to have a common pathogenic mechanism.[16] No hereditary-related duodenal lipoma was found among the clinical data and follow-up in this study. Most previous studies investigating duodenal lipoma focused only on the lipoma itself or whether it can become cancerous, and most were case studies. In the present study, as many as 14 of 57 patients were complicated with cancer, accounting for 24.5% of the total. These data should attract attention. The occurrence of this situation may not be accidental; however, due to the relatively small number of cases, we cannot draw statistical correlations between duodenal lipoma and malignant tumor. However, such a high incidence can provide meaningful potential value for clinical screening and treatment of duodenal lipoma. The existence of the clinical manifestation of duodenal lipoma complicated with cancer may be related to the pathogenesis of duodenal lipoma or its gene deletion. This, however, will require more data from the research center and more in-depth analysis.

There were limitations to the present study, the first of which were subjective and objective deviations in the data, which were collected from a single research center. Second, duodenal lipoma is relatively rare, and the number of cases with accompanying clinical and imaging data was relatively small.

Table 2

Patients with tumors n=14.

Gastric cancer	2
Esophageal cancer	4
Rectal cancer	4
Lung cancer	2
Duodenal cancer	1
Ureteral tumor	1

5. Conclusions

In summary, CT was an effective method for non-invasive diagnosis of duodenal lipoma. CT could clearly discern the location, size, shape, and nature of duodenal lipomas. Duodenal lipoma can be associated with digestive tract inflammatory diseases and tumors in different locations. The effective diagnosis of duodenal lipoma may provide potential value for clinic.

Author contributions

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