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Radiological Appearance of Hiatal Hernias on Computed Tomography

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ABSTRACT

A hiatal hernia is the herniation of organs and structures in the abdominal cavity through the esophageal opening of the diaphragm. We aimed to present the tomographic findings of hiatal hernia types.

The computed tomography (CT) images and demographic characteristics of the patients diagnosed with hiatal hernias based on contrast-enhanced and/or non-contrast thorax-abdominal CT scan between January 2016 and December 2019 were retrospectively reviewed (Material & Method shortened in abstract.). Oral contrast material wasn't given to the patients. (Added) 210 patients with hiatal hernias, 126 (60%) were female and 84 (40%) were male. Among these patients, 124 (59 %) had type 1, 76 (36 %) had type 2, nine (4.2 %) had type 3, and one (0.4 %) had type 4 hiatal hernia. The most common complaints were cough (64%) and mild shortness of breath (34%). The most common clinical signs seen in the majority of patients were weight loss (73%) and loss of appetite (41%). All of the cases were mainly diagnosed based on radiological (CT) findings.

With the increase in the use of CT for thoracic and abdominal diseases, there has been an increase in the frequency of incidental detection of hiatal hernias. Hernia diagnosis is important for preoperative surgical planning. Radiologists should be aware that complications of hiatal hernia can cause morbidity and mortality. The best diagnosis method is considered as CT, which is also useful in determining the type of hiatal hernias.

Keywords: hiatal hernia; computed tomography; diaphragm

Introduction

A hiatal hernia (HH) is the herniation of abdominal organs and structures from the esophageal hiatus of the diaphragm to the thoracic cavity. There are four types of HH: sliding (type 1), paraesophageal (rolling) (type 2), mixed (type 3) and mixed type accompanied by the herniation of visceral organs (type 4) (1, 2). The sliding type constitutes 90% of HHs. In the paraesophageal type, the gastroesophageal junction is herniated into the thoracic cavity of the stomach without displacement. The paraesophageal type is seen in less than 10% of HH cases. In type 4 hernia, in addition to the stomach, the intestines and spleen may also be herniated from the hiatal region. Preoperative imaging is very important in surgical planning since it shows abnormally placed anatomical structures. Therefore, the classification of HH types and their complications should be well known. Early diagnosis is important for the proper treatment of HHs. Fluoroscopic evaluation, ultrasonography (US), and nuclear medicine imaging were previously used in diagnosis. With the development of cross-sectional imaging modalities, computed tomography (CT) and magnetic resonance imaging (MRI) have replaced US and fluoroscopic examinations in the diagnosis of HHs. The aim of the current study was to evaluate the types and imaging findings of HHs found incidentally on multi-slice CT, which is increasingly used as a thin collimation technique in thoracic and abdominal diseases, and to discuss the findings in light of the literature.

Material and Methods

After receiving the ethics committee approval from the Clinical Research Ethics Committee, the

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files of patients diagnosed with HHs based on thorax CT images obtained with a multi-detector 128-slice SOMATOM Definition AS Siemens (Siemens Healthcare, Erlangen) device from January 2016 to December 2019 were retrospectively analyzed. The CT images were re-evaluated by the same person to determine radiological features and classify HHs (types 1 to 4).

Thoracic and abdominal CT images of the patients, taken with and without contrast, were evaluated with a craniocaudal section thickness of 3 mm. It was considered that the evaluated images included GEJ of the stomach and other parts of the stomach if herniated.

The displacement of the GE junction to the thoracic cavity of 2 cm or more was considered type 1 HH. Type 2 HH was defined as displacement of the gastric fundus towards the thoracic cavity at the GE junction. If the GE junction and gastric fundus were displaced together towards the thoracic cavity, it was accepted as type 3 HH. In case of displacement of visceral organs towards the thoracic cavity with the GE junction, it was accepted as type 3 HH.

A total of 243 reports were reviewed. Thirteen patients were excluded due to images not being accessible and 20 were excluded because of the inadequate quality of images.

Patients who had undergone previous surgery were not included in the study. Traumatic diaphragmatic hernias that developed suddenly due to any mass effect or trauma were not included in the study. All patients who met the HH Tomographic criteria were included in the study (Material & Method detailed).

The remaining 210 patients were included in the sample. No randomization was applied.

Statistical Analysis: Descriptive statistics for continuous variables were expressed as mean, standard deviation, minimum and maximum values, and categorical variables were presented as numbers and percentages. SPSS software package (version 22) was used for statistical calculations.

Results

Of the 210 patients with HHs, 126 (60%) were female and 84 (40%) were male. The mean age was calculated as 56.8 ± 9.4 (41-79) years. The diagnoses of the patients were generally made incidentally, and the most common complaints were cough (64%) and mild shortness of breath (34%). The most common clinical signs seen in the majority of patients were weight loss (73%) and loss of appetite (41%). CT was performed upon suspicion of HH on chest X-ray in two cases and upon detection of retrocardiac lesions in chest radiography in four cases. All of the cases were mainly diagnosed based on radiological (CT) findings. The endoscopic results of the patients were not evaluated. HHs were classified as type 1 (Figure 1) in 124 (59%) of the patients, type 2 (Figure 2) in 76 (36%), type 3 (Figure 3) in nine (4.2%), and type 4 (Figure 4) in one (0.4%).

Discussion

HHs occur when abdominal contents herniate through the esophageal cavity of the diaphragm into the thoracic cavity. The main causes of HHs are diseases involving the lower esophageal sphincter and the crus of diaphragm, exposure of the distal end of the esophagus to acid, increased acid secretion of the stomach, prolonged gastric emptying time, and increased intraabdominal pressure. Smoking and alcohol consumption, irregular diet, and helicobacter pylori infection are also predisposing factors (3).

A diaphragmatic hernia may be misdiagnosed or overlooked. HHs is actually more common than previously thought and may be the cause of many clinical symptoms. In studies, endoscopic examination, manometric measurements and computed tomography imaging were indicated in the diagnosis of HHs (1, 4)(Added). Accurate diagnosis of hernia type and location both determines and facilitates hernia management and if surgery is required selection of surgical technique. Direct radiography is the imaging technique of the first choice, although in most cases it has limited findings. In our study, we did not use direct radiography in the diagnosis of a hernia. CT scan is the most effective imaging method due to its short acquisition time and easy application. Multislice CT scanning is a reliable tool in hernia diagnosis and has great advantages from other imaging modalities. It has a shorter imaging time than a standard CT scan. Multislice CT scan with sagittal, coronal reformat and 3D images more clearly reveals loss of integrity of the diaphragm and herniated organs through the diaphragm (5). (Added) All of our cases were diagnosed according to multislice CT findings. In our study, we used sagittal and coronal reformat images in addition to axial images in the typing of hernias. In particular, multislice CT is very useful in differentiating HHs from masses or esophagitis (6). (this sentence was moved to here).

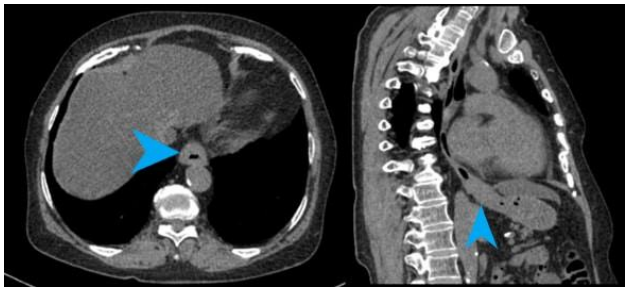

Fig. 1. Axial and coronal oblique non-contrast thoracic CT images showing a type 1 hiatal hernia

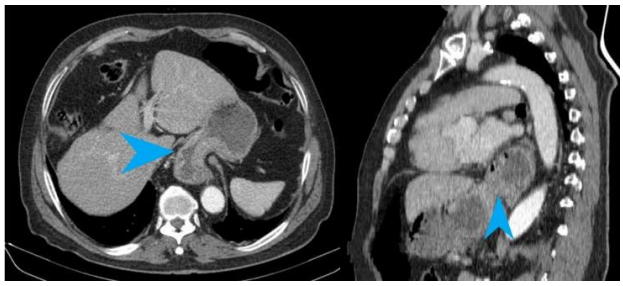

Fig. 2. Axial and sagittal contrast-enhanced thoracic CT images showing a type 2 hiatal hernia

The herniated region and herniated organs within the thorax can be clearly visualized in most cases, especially on reformat CT images. However, diaphragmatic integrity at the occult hernias, diaphragm dome, and costal attachment faces may not be evaluated on standard axial CT images. Multislice CT with sagittal, coronal and 3D reformatted images significantly increased the sensitivity of CT in hernia cases. CT scan of diaphragmatic hernia (especially coronal plane images) shows loss of diaphragmatic integrity, intrathoracic herniation of abdominal contents, and waist-like narrowing of the mesenteric folds ("collar sign"). If intestinal obstruction and strangulation occur, dilated bowel segments may be viewed as dilated bowel segments with air-fluid levels in the chest and abdomen. These findings are more pronounced on images with intravenous contrast. Gastroesophageal junction or gastric fundus displacement in hiatal hernias can be clearly visualized on CT images with oral contrast, especially during the valsalva maneuver (Added) (7). But in our study; in the retrospective CT examinations, the patients were not given oral contrast material and the valsalva maneuver was not performed.

HH is an important reason for the development of gastroesophageal reflux (GER), secondary to which Barrett's esophagus and/or esophageal adenocarcinoma may also develop. GER is seen in 10-20% of the western population (8). Three of our patients had esophageal adenocarcinoma. HHs

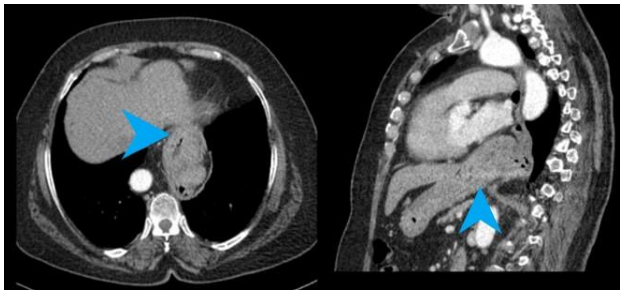

Fig. 3. Axial and sagittal contrast-enhanced thoracic CT images showing a type 3 hiatal hernia

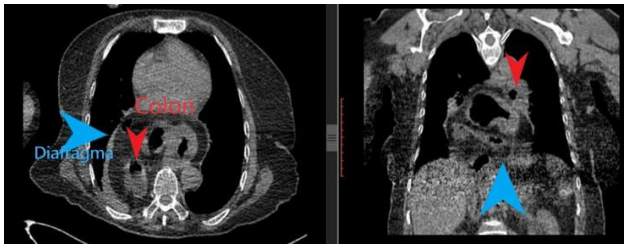

Fig. 4. Axial and coronal non-contrast thoracic CT images showing a type 4 hiatal hernia

are more common between the ages of 50-70 years and in the male population. Most of our cases were female, and the mean age range was 56.8 ± 9.4 (41-79) years. HH should be considered in geriatric patients with GER symptoms. Advance age, pregnancy, osteoporosis, and kyphosis are considered to be risk factors of HH (9). HHs involving the stomach can result in gastric volvulus, which manifests as an intestinal obstruction and can cause ischemia/infarction. Despite occurring very rarely, HHs can also cause respiratory failure and eventually cardiac arrest by leading to tension gastrothorax (stomach herniated from the diaphragm defect causing mediastinal shedding) (10, 11). Therefore, when classifying HHs, it should be clearly determined which tissues the hernia contains in order to prevent possible mortal complications.

We did not experience any diagnostic difficulty in our retrospective examination of HH cases, but HH typing was generally not found in the radiological reports of the patients. We consider that this may be due to both clinicians and reporting radiologists not being aware of the possible complications of HHs. Also, where surgery is required, emphasizing adjacent anatomical structures with multidetector CT can maximize the benefit of preoperative imaging and thus minimize surgical risks for the patient (12). (Added) Thus, we suggest that their awareness should be increased in this regard.

Type 1 hernia, referred to as sliding hernia, is the extension of the gastroesophageal junction toward the posterior mediastinum. It is seen in

approximately 95% of HH cases. Paraesophageal hernias constitute 5% of patients with HH. CT is highly demonstrative in revealing HHs based on multiplanar imaging. (5).

Type 1 is the common type that accounts for approximately 85-95% of all cases. Types 2,3 ve 4, generally called paraesophageal hernias, are less common, being observed in 5-15% of patients with HHs. In type 2, the gastroesophageal junction is in a normal position and the fundus of the stomach is herniated to the thorax. Type 3, on the other hand, is a combination of types 1 and 2 and refers to the herniation of the stomach and the upward orientation of the gastroesophageal junction. In type 4, the gastroesophageal junction is in the thoracic cavity, located higher than normal, and indicates the herniation of other visceral organs into the thorax in addition to the stomach. The rates of HH types we determined in our cases were similar to those reported by Abbara et al. (2). In radiological reporting, the terms sliding hernias or HHs were used, and no typing was made according to description of Abbara et al.

Patients with HHs may be asymptomatic or present with symptoms such as dysphagia, chest pain, abdominal pain, and shortness of breath secondary to pulmonary complications. The most common complaint of our patients was reflux, and some patients had chest pain and distension complaints in their files. These cases may include obstructive symptoms, mild nausea, bloating, or postprandial fullness and they may present with symptoms ranging from dysphagia, feeling of tension, and acute respiratory distress. Severe discomfort in the epigastric region or severe pain after meals usually subsides with vomiting (13). There is little information published on the history of untreated HHs. It has been reported that the risk of progression from asymptomatic to symptomatic paraesophageal hernia is approximately 14% per year (14, 15). Since we performed the evaluation in our cases retrospectively, we were not able to obtain all the data, and most of our cases had been detected incidentally; therefore, a contribution to the literature could not be made in this regard.

In the differential diagnosis of HH, if the patient has a diaphragm rupture, the stomach component that is herniated to the thorax as a result of the rupture may create non-type 1 HH-like appearance on CT. Other conditions that may mimic HHs in chest radiographs other than CT and should be considered in the differential diagnosis include epiphrenic esophageal diverticulum, retrocardiac lung abscess (accompanying air inside may cause false appearance), and gastric pull-up surgery performed for esophageal tumors (after operating on one part of the esophagus, anastomosis of the remaining part with the stomach pulled into the thorax) (16). Multislice (changed to multislice) CT plays a very effective role in distinguishing these lesions.

The limitations of our study include the retrospective design, which resulted in the inability to evaluate follow-up images, and the absence of an evaluation concerning the endoscopic diagnoses of the patients. Moreover, since we do not have follow-up images of the patients, we could not obtain information about whether the patients were operated during this period and what type of surgical operation they had if they were operated on. (Added)

We believe that HHs constitute a group of diseases that are frequently encountered in imaging and have high radiological recognition, but they are not sufficiently known in terms of typing and complications. We believe that our results will, in particular, guide radiologists but also other clinical physicians in considering the possibility of accompanying HHs in the differential diagnosis of patients presenting with non-specific upper gastrointestinal symptoms, increase awareness of this condition, and help prevent related mortality and morbidity.

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