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Computed tomography of esophageal carcinoma infiltrating adjacent structures

Esophageal cancer ranks as the sixth most common malignancy in the world and it constitutes 7% of gastrointestinal cancers. It remains one of the most lethal of all cancers, and its incidence is rising in the western world (3, 7). As the majority of patients with esophageal cancer present in an advanced stage, the prognosis is poor. The 5-year survival is 40% if tumor is confined to the wall (T1-T2) and only 4% if the tumor is spread outside the wall (T3-T4) (2, 3). The vast majority of primary malignant tumors of the esophagus are squamous cell carcinomas and adenocarcinomas. They account for more than 95% of esophageal tumors (3, 9). Although squamous cell carcinoma was traditionally considered synonymous with esopohageal cancer, over past two decades the incidence rates of squamous cell carcinomas have been decreasing, whereas the incidence of adenocarcinoma of the esophagus has been dramatically increasing (3, 9). The suggested mechanism of increased incidence of adenocarcinoma includes gastro-esophageal reflux disease (GERD), Barret's esophagus, dysfunction of esophageal motivation (9). The major risk factors include the consumption of tobacco and alcohol (3). Invasion of the adjacent structures makes the tumor non-operable – therefore precise detection of invasion is essential.

The aim of the study is presenting the esophageal carcinoma infiltrating adjacent structures in computed tomography.

MATERIAL AND METHOD

The material comprised a group of 53 patients with esophageal carcinoma. In all patients the CT examination was performed before and after iv administering of contrast agent, and after administering contrast agent orally. The examination was performed in patient's supine position, from the neck to the level of the kidney, involving the whole liver and celiac lymph nodes. On axial CT sections the esophagus was assessed as well as adjacent structures, lymph node. The presence of distant metastases was also noted.

RESULTS

In 14 patients the CT features of aorta infiltration were found. In 6 patients the angle of contact between the esophageal tumor and the aorta was above the 90° (Fig. 1), and in 10 of them the obliteration of the fat triangle between the esophageal tumor, aorta and the spine was found (Fig.2). In 2 patients the angle of contact between the aorta and the esophageal tumor exceeding 90° was accompanied by fat

Fig. 1. Esophageal carcinoma. The angle of contact between aorta and esophageal tumor 110° suggesting the aortic infiltration; A – Aorta; T – tumor

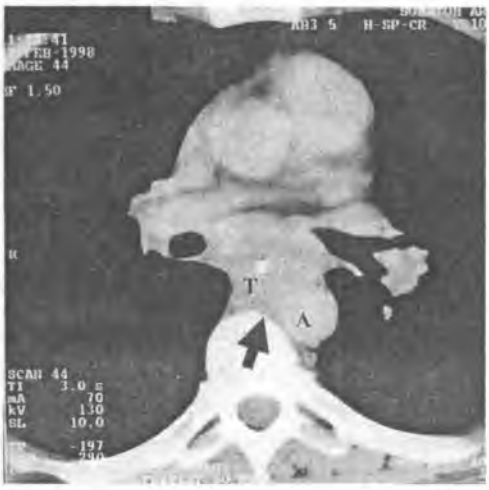

Fig. 2. Esophageal carcinoma obliterating of the triangle fat space between the aorta, tumor and the spine (arrow) suggesting the infiltration of the aorta; A- Aorta; T-tumor

obliteration (Fig. 3). The bronchi were infiltrating in 3 patients, in 2 of them the narrowing of the bronchi was seen (Fig. 4), in 1 the obliteration (Fig.5) with atelectatic lung lobe was found (Fig.6). In 5 cases the fat plane between the esophageal tumor and the heart was not seen on each slice, suggesting the pericardial infiltration (Fig. 7). In 2 cases the infiltration of the heart, aorta and trachea was found. In the rest 36 patients the fat triangle between the esophageal tumor, aorta and the spine was preserved (Fig. 8) as well as fat planes between esophageal tumors and the adjacent aorta and pericardium (Fig. 9).

Fig. 3. Esophageal tumor. The angle of contact between aorta and esophageal tumor 122° with coexisting obliterating of the triangle fat space between the aorta, tumor and the spine (arrow) suggest the aortic infiltration; A – Aorta; T – tumor

Fig. 4. Esophageal tumor. Narrowing of the left bronchus (arrow); A – Aorta; T – tumor

Fig. 5. Esophageal carcinoma obliterating the triangle fat space between the aorta, tumor and the spine (long arrow) and obliteration of the left bronchus (short arrow); A – Aorta; T – tumor

Fig. 6. Esophageal carcinoma obliteration of the left bronchus resulting in atelectasis of the left upper lung lobe – L

Fig. 7. Esophageal carcinoma with no visible fat plane between the tumor and the pericardium, suggesting infiltration;
A – Aorta; T – tumor; H – heart

Fig. 8. Esophageal carcinoma with normal fat triangle between the tumor, aorta and the spine (arrow); A – Aorta; T – tumor

Fig. 9. Esophageal carcinoma without feature of adjacent structures infiltration. The fat plane between tumor and the pericardium clearly seen (arrowhead); A – Aorta; T – tumor

DISCUSSION

Carcinomas of the upper or midthoracic esophagus may invade the trachea or bronchus via direct extension. Preoperative assessment to exclude tracheobronchial tree infiltration is therefore essential to identify those patients who will benefit from a radical surgical approach (6). Patients with suspected esophageal carcinoma infiltrating the tracheobronchial tree are usually evaluated by endoscopy and CT. Bronchoscopy permits direct visualization of the tracheobronchial tree and an infiltrating tumor and can guide biopsies. CT provides information on the size and location of the tumor; moreover, it provides additional information on per-bronchial morphology, which is not available from endoscopy, such as lymph node metastases (5).

The presence of an esophageal mass that displaces the trachea of bronchus from the spine is diagnostic for invasion. Tracheobronchial invasion may also be detected by a discrete indentation on the posterior wall of the trachea or bronchus on CT images, especially on CT images obtained during the inspiration (3). CT is valuable in assessment of cancer invasion of mediastinal structures, and in revealing the tumor's relation to the tracheobronchial tree. Therefore, bronchoscopist should have a computed topographic scan available for review before the procedure in order to be able to take the biopsy specimens from the areas most suspicious with regard to tumor invasion (6). Spiral CT enables performing reconstruction of the airways inner surface, called virtual bronchoscopy, allowing simulations of real bronchoscopy on monitor with a simultaneous view of the axial sagittal and coronal planes of the actual position. Virtual endoscopy is a non-operator dependent method, witch permits an impression of the inner surface throughout the whole bronchial tree up to sebsegmental bronchi to be obtained. A further advantage is the ability to see beyond stenoses in patients with subtotaly occlusion (2, 5). Three dimensional images make it easier to appreciate the condition of the whole tracheobronchial tree than the relation of axial slices to one another. Narrowing or even stenoses of the bronchi may be seen in virtual bronchoscopy in patients with tracheobronchial infiltration (5).

An esophageal carcinoma that directly invades the aorta may increase the area of contact between the aorta and the esophagus. If the area of contact is greater than 90°, aortic invasion is assumed to be present. The CT accuracy in detecting aortic invasion by esophageal carcinoma is about 80%. Another

criterion for predicting aortic invasion is based on obliteration of the triangular fat space between the esophagus, the aorta and the spine (1, 3, 8). Movement of tumor relative to the aorta in prone position would increase the confidence of excluding invasion (3, 8).

CT detection of pericardial invasion is based on the obliteration of fat planes and the presence of mass effect. If a fat plane separates the esophageal mass from the pericardium at all CT sections, the tumor is considered to be noninvasive. Another criterion for predicting pericardial invasion is the presence of mass effect with a concave deformity of the heart and loss of the normal fat planes in this region (3). The preservation of fat planes between the esophageal cancer and adjacent structures is useful in determination of invasion (3).

According to clinical staging, the invasion of adjacent structures without distant metastases and with presence of metastases constitutes stages III and IV, respectively (1).

CONCLUSIONS

CT is an accurate technique for evaluating aortic invasion by esophageal tumors. The presence of potential invasion may be accurately assessed, although in ambiguous cases the additional examinations with pathological evaluation may be necessary. The preservation of fat planes between the esophageal cancer and adjacent structures is useful in determination of invasion.

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SUMMARY

The aim of the study is presenting the esophageal carcinoma infiltrating adjacent structures in computed tomography. The material comprised a group of 53 patients with esophageal carcinoma. In all patients the CT examination was performed before and after administering a contrast agent, and after administering a contrast agent orally. The examination was performed in patient's supine position, from the neck to the level of the kidney, involving the whole liver and celiac lymph nodes. On axial CT sections the esophagus was assessed as well as adjacent structures, lymph node. The presence of distant metastases was also noted. In 14 patients the CT features of aorta infiltration were found. In 6 patients the angle of contact between the esophageal tumor and the aorta was above the 90°, and in 10 of them the obliteration of the fat triangle between the esophageal tumor, aorta and the spine was found. In 2 patients the angle of contact between the aorta and the esophageal tumor exceeding 90° was accompanied by the fat obliteration. The bronchi were infiltrating in 3 patients, in 2 of them the narrowing of the bronchi was seen, in 1 the obliteration with atelectatic lung lobe was found. In 5 cases the fat plane between the esophageal tumor and the heart was not seen on each slice, suggesting pericardial infiltration. In 2 cases the infiltration of the heart, aorta and trachea was found. In the rest 36 patients the fat triangle of between the esophageal tumor, aorta and the spine was preserved as well as fat planes between esophageal tumors and the adjacent aorta and pericardium. CT is an accurate technique for evaluating aortic invasion by esophageal tumors. The presence of potential invasion may be accurately assessed, although in ambiguous cases the additional examinations with pathological evaluation may be necessary. The preservation of fat planes between the esophageal cancer and adjacent structures is useful in determination of invasion.

Rak przełyku naciekający sąsiednie narządy w tomografii komputerowej

Celem badania jest przedstawienie cech nacieku sąsiednich narządów przez raka przełyku w tomografii komputerowej. Materiał stanowi grupa 53 pacjentów z rakiem przełyku. U wszystkich pacjentów wykonano badanie TK przed i po podaniu iv bolusa środka kontrastowego oraz po doustnym zakontraktowaniu przewodu pokarmowego. Badanie wykonywano u pacjentów ułożonych na wznak, od poziomu szyi do poziomu nerek, obejmując wątrobę i krezkowe węzły chłonne. Na przekrojach osiowych TK oceniano przełyk, narządy sąsiednie oraz węzły chłonne. Oceniano również obecność przerzutów odległych. U 14 pacjentów stwierdzono cechy nacieku aorty. U 6 z nich kąt kontaktu guza z aortą przekraczał 90°, a u 10 stwierdzono obliteracją trójkąta tłuszczowego miedzy aortą, przełykiem i kręgosłupem. U 2 pacjentów stwierdzono zarówno kąt nacieku powyżej 90° jak też obliterację trójkąta tłuszczowego. Naciek oskrzela stwierdzono u 3 pacjentów, u 2 z nich stwierdzono przewężenie światła oskrzela, a u jednego zamknięcie oskrzela z niedodmą płata górnego płuca lewego. U 5 pacjentów stwierdzono obliterację warstwy tłuszczu oddzielającej osierdzie od przełyku, co sugeruje naciek osierdzia. W dwu przypadkach stwierdzono naciek zarówno oskrzela, aorty, jak i osierdzia. U pozostałych 36 pacjentów trójkąt tłuszczowy był zachowany, kąt nacieku nie przekraczał 90°, a osierdzie na wszystkich przekrojach było oddzielone od guza przełyku warstwą tłuszczową. TK jest dokładną metodą oceny nacieku sąsiednich narządów przez raka przełyku. Obecność nacieku może być dokładnie oceniona, choć w wątpliwych przypadkach konieczne są dodatkowe metody diagnostyczne. Zachowanie warstw tłuszczu oddzielających guza przełyku od otaczających struktur jest wiarygodnym objawem wykluczającym obecność ich nacieku.