DIAGNOSTIC ACCURACY OF MULTISPIRAL COMPUTED TOMOGRAPHY IN DETECTING AND STAGING OF ESOPHAGEAL AND GASTRIC CANCER

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Abstract

Background. The sensitivity and specificity of multislice computed tomography is of great importance in the detection of gastric and esophageal cancer, and also expands the possibilities of preoperative staging using computed tomography.

Materials and methods. A retrospective study at the A.N. Syzganov National Scientific Center of Surgery from 2022 to 2024, included 121 patients: 48 females (39.6%), 73 males (60.3%), with an average age of 60 years. Sensitivity, specificity were calculated to assess diagnostic accuracy. Esophageal and gastric cancer staging via computed tomography was done using the TNM classification and compared with esophagogastroduodenoscopy, pathohistological examination results.

Results. The sensitivity of computed tomography was 96.49%, the specificity was 85.71%. Esophagogastroduodenoscopy showed a sensitivity of 79.75%, specificity of 95.24%.

Conclusion. Computed tomography is highly informative, sensitive in detecting esophageal and gastric cancer, with superior diagnostic accuracy compared to esophagogastroduodenoscopy. Given the detection of esophageal and gastric cancer at T2 and T3 stages, along with the presence of distant metastases in some patients, implementing protocols for early diagnosis is advisable.

Introduction

(EC) is the eighth most commonly diagnosed cancer and is the sixth leading cause of cancer death worldwide. There is a significant statistical difference between males and females, with 418350 cases among males and 185750 cases among females. The main risk factors of EC are gastroesophageal reflux disease (GERD), Barrett'sesophagus, achalasia, tylosis, Plummer-Vinson syndrome, esophagus injuries, lifestyle and dietary habits.[1]

Gastric cancer (GC) is the fifth most common cancer and the third leading cause of cancer death worldwide.[1-3] The incidence of GC progressively increases with age; the average age at diagnosis in Kazakhstan is lower in men (63.1±0.1 years) than in women (65.1±0.1 years).[4] On average, the incidence of GC is two to three times higher in men than in women. The incidence rate is highest in East Asian countries (35 per 100 000 people)).[4,5] The incidence of GC in Kazakhstan is 23.6 ± 0.50/0000 in men and 13.9 ± 0.50/0000 in women.[4] The main risk factors of GC are genetic predisposition, HP-associated gastritis, peptic ulcer disease, precancerous conditions, lifestyle, and dietary habits.[1]

Multispiral computed tomography

(MSCT) in combination with esophagogastroduodenoscopy (EGD) is the standard imaging method for preoperative diagnosis and staging of EC and GC.[6] Recently, MSCT methods have improved the accuracy of determining the depth of invasion of the primary gastric tumor (T stage), as well as lymph node involvement (N stage) and distant metastases (M stage).[7-9] These studies have shown that EC and GC causes thickening of the gastric and esophageal wall with moderate or marked contrast enhancement in the early stages.[10-12] The sensitivity of CT in various publications ranges from 61% to 75%, the specificity - 61-75%, and for surrounding organs, it reaches 100%.[13-16] Nowadays, the gold standard for detecting EC and GC is upper endoscopy in combination with tissue biopsy. This method has sensitivity and specificity values of 69% and 96%, respectively.[10] Unlike colorectal cancer and other types of gastrointestinal cancer, GC demonstrates a variety of different pathological factors, including histological type, degree of differentiation, and infiltration pattern.

The most common histological subtype is adenocarcinoma.[10,17] Histological type is one of the most important factors, as it has a close relationship with tumor aggressiveness and the prognosis of GC patients.[18-20]

Two distinct histological subtypes predominatein EC, and should be considered biologically separate disease entities. These subtypes are esophageal adenocarcinoma (EAC) and esophageal squamous cell carcinoma (ESCC). Around 90% of worldwide cases are ESCC, which has particularly high incidence in South America and the Asian esophageal cancer belt. EAC is, by contrast, more prevalent in Europe and high income North America, where its incidence has increased fourfold over the past four decades.

The aim of the study is evaluate the sensitivity and specificity MSCT in the detection of EC and GC, alsothe possibilities of preoperative CT staging.

Materials and methods

Retrospective single-center study was performed at the Syzganov National Scientific Center of Surgery, based on the Department of Radiology, Endoscopy, and the Laboratory of Pathomorphology, in the period from 2022 to 2024 years.

Imaging techniques. MSCT was performed on all patients with EC and GC using a 160-slice *Canon Aquilion* tomography scanner *(Tokyo, Japan).* Scanning parameters: slice thickness 0.5 x 80 mm, pitch 0.8, tube rotation speed 0.5 s, tube voltage 120 kV. After the native scanning phase, a water-soluble iodine-containing contrast iopromide *(Germany)* was injected intravenously using a pump injector at a rate of 1.2 ml per 1 kg of the patient's body weight, respectively, at a rate of 4-5 ml/s. After the bolus injection of the contrast substance, saline solution (40-50 ml) was administered at the same rate. Arterial, venous, and delayed scanning phases were obtained 8, 10, 15, and 120 seconds after the density in the aorta reached 100 Hounsfield units *(HU).*

To assess the stage of EC and GC, the international TNM classification *(AJCC, June 18, 2018)* was used.

To confirm the results of MSCT, a pathological and histological conclusion and EGD were compared. EGD was performed on 121 patients using an *Olympus video endoscope (Tokyo, Japan).* A pathohistological examination was conducted on 121 patients during the endoscopic examination with targeted biopsy. The biomaterial was delivered in a glass vial filled with 10% neutral buffered formalin, with appropriate labeling and a referral for research.

Ethical approval. This study was approved by the local ethics committee according to the protocol of meeting No.4 dated November 10, 2023.

Statistics. Data analysis of patients was presented as mean±standard deviation. Sensitivity and specificity were listed to assess the diagnostic accuracy of MSCT and EGD. The Kolmagorov-Smirnov test was used to determine the normal distribution of the sample, and the Mann–Whitney U test was used to determine a statistically significant difference in the prevalence of EC and GC between females and males. A p value<0.05 was considered to indicate statistical significance. Statistical analyses were conducted using SPSS software *(IBM corp., 28 version, US).*

Results

The research group included 121 pa-

tients: 48 women (39.6%) and 73 men (60.3%), with an average age of 60±11.8 years, ranging from 26 to 78 years. We did not find a statistically significant difference in the incidence of GC between females and males (p=0.264).

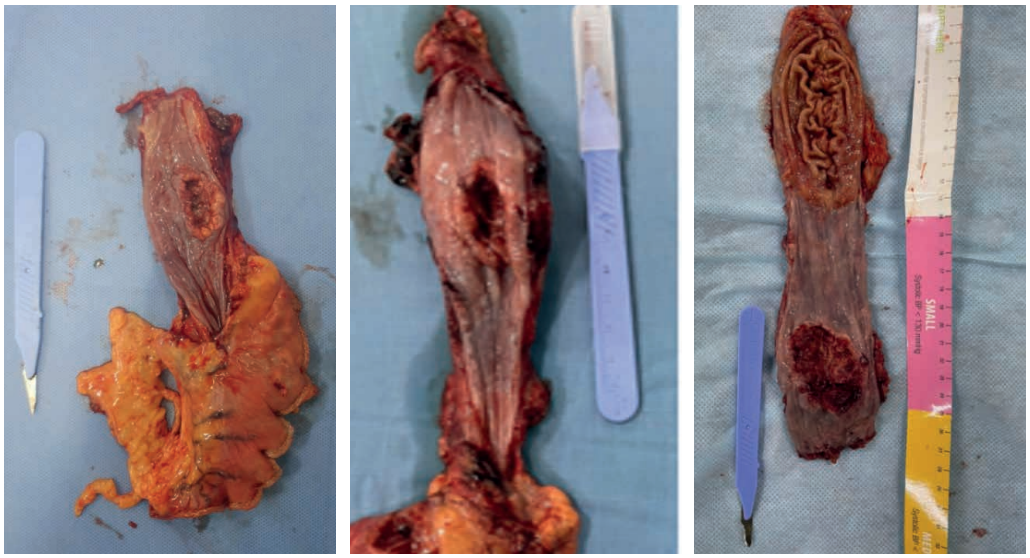
EC divided by localization into: upper esophagus - 12 (24.0%), mid esophagus - 13 (26.0%), lower esophagus - 25 (50.0%).

GC divided by localization into: cardioesophageal - 15 (21.1%), cardial - 13 (18.4%), fundus - 1 (0.7%), body - 22 (31.7%), antrum - 5 (7.0%), pyloric - 15 (21.1%).

MSCT compared with the pathological and histological conclusion showed a false positive result in 1 case (0.8%), a false negative result in 4 cases (3.3%), a true positive result in 110 (90.94%) casesand false negative 6 (4.96%) cases.

EGD showed a false negative result in 16 (13.2%) cases, a false positive result in 2 (1.6%) cases, a true positive result in 63 (52.1%) cases and false negative 40 (33.1%) casescompared to biopsy.

In the pathological and histological study: 48 patients (96%) had esophageal squamous cell carcinoma (ESCC), of which G1 - 12 (24%) patients, G2 - 13 (26.0%) patients, G3 - 25 (50.0%) patients; the remaining 2 patients (4%) had esophageal adenocarcinoma (EAC). Figure 1 – A, B, C.



A B C

Figure 1.
A, B, C. Macroscopic view of the esophageal tumors

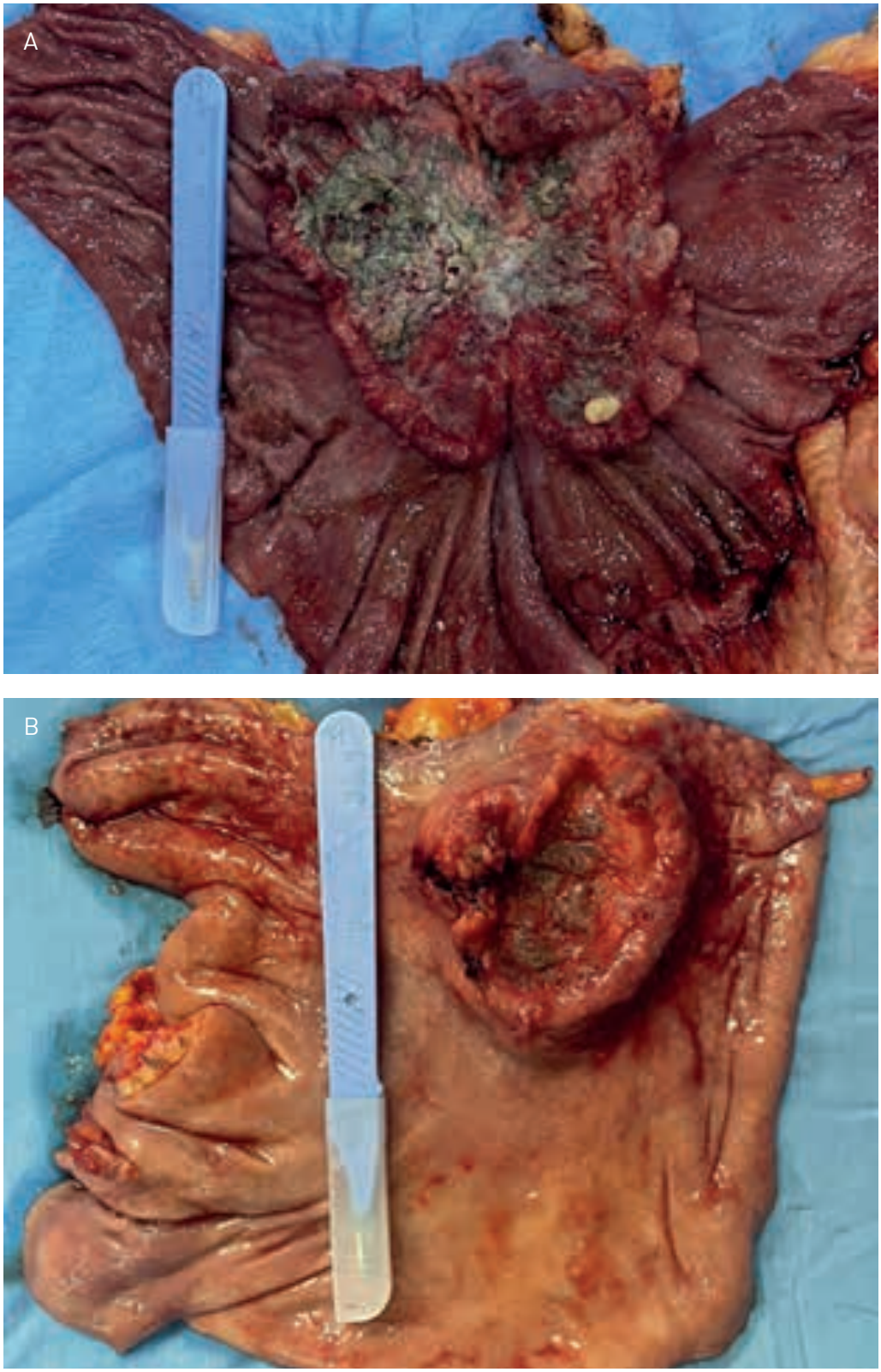
A. Ulcerative defect of the esophageal wall in the form of a circular ulcer with raised edges of cartilaginous density and dirty gray loose deposits at the bottom, the length of the defect in its largest dimension is 4.4 cm, depth - 0.6 cm, from the level of the unchanged mucous membrane (cT2)

B. ulcerative defect of the esophageal wall in the form of a circular ulcer with raised edges of cartilaginous density and dirty gray loose deposits at the bottom, the length of the defect in its largest dimension is 3.8 cm, depth - 0.5 cm from the level of the unchanged mucous membrane (cT2).

C. ulcerative defect of the esophageal wall with raised edges of cartilaginous density and dirty gray loose deposits at the bottom, the length of the defect in its largest dimension is 6.0 cm, depth - 0.5 cm, from the level of the unchanged mucous membrane (cT2).

In the pathological and histological study: 68 patients (95.7%) had adenocarcinoma, of which G1 - 12 (17.6%) patients, G2 - 25 (36.8%) patients, G3 - 31 (45.6%) patients; the remaining 3 patients (4.2%) had metaplasia, MALT lymphoma and ulcerative defect. Figure 2 – A and B.

Figure 2.
A and B. Macroscopic view of the gastric tumors



A. Stomach tumor (type 3 according to Borrmann) with defect dimensions of 8.5 x 10.0 cm, depth in the central part - up to 0.5 cm from the level of unchanged mucous membrane (cT3).
B. Stomach tumor with ulceration in the center (type II according to Borrmann) with defect dimensions 7.0 x 5.5 cm and growth to the serous membrane (cT3).

Radical surgical interventions were performed in 84 (69.4%) patients, of which: subtotal distal resection was performed in 15 (12.3%), combined subtotal distal resection - 1 (0.8%), combined gastrectomy - 11 (9.0%), standard gastrectomy - 16 (13.2%), subtotal distal gastrectomy - 1 (0.8%) patient, Ivor Lewis esophagectomy – 32 (26.4%), McKeown esophagectomy – 8 (6.6%). The remaining 37 (30.5%) patients underwent palliative surgical treatment.

The sensitivity of MSCT is 96.49%, relative to 95%CI [91.26%; 99.04%], the specificity is – 85.71%, relative to 95%CI [42.13%; 99.64%], and the accuracy is 95.87%, relative to 95%CI [90.62%; 98.64%].

The sensitivity of EGD is 79.75%, relative to 95%CI [69.20%; 87.96%], the specificity is 95.24%, relative to 95%CI [83.84%; 99.42%], and the accuracy is 85.12%, relative to 95%CI [77.51%; 90.94%].

Discussion

This study analyzed the gender, age of the patients, location and prevalence of EC and GC, the types of surgical interventions performed. It was determined that the number of men prevailed in the entire group of patients, the average age at the time of diagnosis was 60 years which corresponds to the indicators of literature.[21,22]

The most common types of surgical intervention were standard gastrectomy, Ivor Lewis esophagectomy and palliative surgical treatment. As a rule, cancer in the early stages is asymptomatic, so the key to reducing the burden of advanced cancer is its timely detection. [23]

MSCT is a highly informative and sensitive method for detecting EC and GC. The possibility of detecting EC and GC was 96.49% and the specificity of the method was 85.71% in the entire group of patients, which exceeds the indications of literature data and confirms the high quality of the virtual image of MSCT.

The sensitivity of EGD was 79.75%, specificity – 95.24%, which is close to the indicators of review articles. This method of early diagnosis of EC and GC is also highly informative, and it allows you to clarify preoperative histological types and morphological characteristics. However, it is an invasive method of research, and it also cannot assess the damage to lymph nodes, the presence of metastases in other organs, the involvement of vessels and other adjacent anatomical structures in the process, nor can it assess the degree of tumor invasion, especially in early EC and GC with a small lesion, which are significant disadvantages compared to MSCT.[10,17]

A limitation of this research is that it was conducted in a single center with a small sample of patients, and therefore further larger-scale research on this topic is necessary. It should be noted that there are no screening programs in Kazakhstan for earlier detection of esophageal and gastric cancer in people at risk, that's why it is necessary to develop some screening protocols. Such screening methods would lead to early detection of EC and GC, ultimately increase overall survival.[24,25]

Modern MSCT technology facilitates not only the accurate staging ofesophageal and gastric cancer, but also serves as a valuable tool for the primary diagnosis of the disease.

Limitations: of this research are that it was conducted in a single center with a small sample of patients, and therefore further larger-scale research on this topic is necessary; also not less important are difficulties in exchanging data with medical organizations at various levels for the analysis of instrumental research methods in the primary diagnosis of EC and GC.

What's known? The sensitivity of CT in various publications ranges from 61% to 75%, the specificity 61-75%. Upper endoscopy in combination with tissue biopsy has sensitivity and specificity of 69% and 96%, respectively.

What's new? In our single center study, high sensitivity of computed tomography was determined - 96.49% and the specificity - 85.71%, while esophagogastroduodenoscopy showed similar sensitivity of 79.75% and specificity of 95.24%.

Conclusion

Computed tomography is highly informative, sensitive in detecting esophageal and gastric cancer, with superior diagnostic accuracy compared to esophagogastroduodenoscopy. Given the detection of esophageal and gastric cancer

at T2 and T3 stages, along with the presence of distant metastases in some patients, implementing protocols for early diagnosis is advisable.

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