CT Pre-Operative Imaging of the Esophagus: Is Inclusion of Abdomen Necessary?

Martin Ian Kamanda
MP Shah Hospital, Nairobi

Correspondence to: Dr. Martin Kamanda; Email: matoarchitect36@gmail.com

Abstract

Background: Esophageal carcinoma is the third commonest tumor in Kenya with one of the highest mortality rates. Locally, the 2019 Kenya National Cancer Treatment Protocols recommend CT chest and abdomen as the basic imaging tool. The aim of this study was to determine the necessity of including the abdomen while scanning patients with cancer of the esophagus. **Methods:** Fifty consecutive patients with esophageal cancer who underwent CT imaging were included. **Results:** 32 male patients (64%) and 18 (36%) female patients. 4 patients (8%) had a CT diagnosis of upper third cancer of the esophagus; 20 patients (40%) had middle third cancer; and 26 patients (52%) had lower third cancer. Patients with middle and lower third esophagus tumors had nodal and distant metastases to the upper abdomen. **Conclusion:** Preoperative CT with the inclusion of abdomen is essential for patients with middle and lower third tumors. None of the patients with upper third tumors had metastases to the abdomen. Further studies with a larger sample size are needed to assess the necessity of including abdomen in CT scan in these patients.

Keywords: Esophageal cancer, CT scan, Abdomen, Diagnostic yield
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Introduction

Esophageal cancer is among the 10 most frequent cancers in the world, and is the seventh leading cause of cancer death (1). Globally, according to GLOBACAN 2018 estimates, cancer of the esophagus accounts for 572,034 (3.2%) new cases and 508,585 (5.3%) deaths (2). In sub-Saharan Africa, it's the third commonest cancer with an estimated 19,400 cases and 17,500 deaths annually (3). In Kenya, esophageal cancer is the third commonest cancer with 4380 new cases annually (2).

The staging of cancer of the esophagus is based on the American Joint Committee on Cancer Tumor-Node-Metastasis (AJCC TNM) and Union for International Cancer Control Tumor-Node-Metastasis (UICC-TNM) guidelines. Recently, the 8th edition of the AJCC/UICC Cancer Staging Manual for esophagus and esophagogastric junction cancers was developed based on a wide database of patients (4). The AJCC/UICC system, recommends the inclusion of both the chest and abdomen when CT scanning patients with suspected esophageal tumors (4). Locally, the Kenya National Cancer Treatment Protocols (2019) recommend CT chest and abdomen as the basic diagnostic imaging tool (5). To the best knowledge of the author, few or no local studies have been done to evaluate the role of CT chest and abdomen in the preoperative staging of cancer of the esophagus. Most local studies have focused their attention on the incidence, prevalence and risk factors of cancer of the esophagus. The aim of the study was to determine the necessity of including abdomen in scanning patients with cancer of the esophagus. This is because the inclusion of abdomen carries the burden of added radiation dose and cost to these patients.

Methods

Patients

This was a retrospective descriptive quantitative study consisting of 50 consecutive patients with biopsy-proven cancer of the esophagus. Exclusion criteria included: emaciated patients, those in whom intravenous contrast

media was not administered, and patients with double primary tumors. The following parameters were studied: primary tumor, local lymphadenopathy, regional lymphadenopathy and distant metastases.

Scan protocol

All 50 patients were scanned using a Somatom Definition AS, 128 Slice, Siemens (Elargen, Germany). Patients were required to be nil per mouth two hours prior and requisition their creatinine level before the procedure. All patients signed an informed consent authorizing the use of intravenous use of contrast media after screening for previous history of contrast hypersensitivity and other contraindications of iodinated contrast media. The scan area included the chest and upper abdomen (lower poles of the kidneys). A biphasic scan was done at 23 seconds after iv contrast injection (Ultravist 370) for arterial phase and 31s for porto-venous phase, using a flow rate of 3.5 mL/s. Volumetric postprocessing using a slice thickness of 3mm (B20 smooth kernel, abdomen window) and multiplanar reconstructions (axial, coronal and sagittal) were performed before evaluating the images.

Results

The patients' age ranged between 33 and 84 years with a mean age of the 58.3 years. Out of 50 patients, 32 were male (64%) and 18 (36%) female (M: F 1.7:1). Four patients (8%) had a CT diagnosis of upper third disease; of these, 3 had local regional nodes while 1 had no local regional nodes.

Twenty (40%) patients had middle third disease; of these, 10 had local and distant nodes, 1 had a metastasis in the liver, and 9 had no local regional lymph nodes. Most patients (52%) had lower third cancer of the esophagus. Of these patients, 19 had distant nodes to the upper abdomen and 2 had metastatic liver deposits. Of the 50 patients sampled, none had metastatic deposits in the lungs.

Discussion

Esophageal cancer has two main subtypes: squamous-cell carcinoma and adenocarcinoma. Squamous cell carcinoma has a propensity for affecting the upper and middle third esophagus while adenocarcinoma typically affects the lower third of the esophagus. Although squamous-cell carcinoma accounts for about 90% of cases of esophageal cancer worldwide, the incidence of and mortality rates associated with esophageal adenocarcinoma are rising and have surpassed those of esophageal squamous cell carcinoma in several regions (6).

Recently, a joint commission of the American Joint Committee on Cancer (AJCC) and the Union for International Cancer Control (UICC) released the eighth edition of the staging manual for cancer in the esophagus and esophagogastric junction. It emphasized a multimodality approach towards staging cancer of the esophagus. This is because different modalities have inherent strengths and weaknesses in diagnosing and staging the disease (4). The main goal of the multimodal approach is to counterbalance the inherent strengths and weakness of each modality in order to increase sensitivity and specificity rates.

In this study, the mean age at diagnosis was 58.3 years. This is similar to a recent study done locally by Ojuka et al. which had a mean age of 57.7 years at diagnosis (7). Earlier studies by Patel et al. in 2013, White in 2007 and Wakhisi et al. in 2002 had similar findings (8,9,10). The male to female ratio for this study was 1.7:1. This ratio is similar to previous studies (9,10). However, the ratio of male to female in this study is lower than that of Ojuka et al. study in 2013 which had a ratio of 3.6:1(7). All studies show a higher preponderance of males, probably due to exposure to the known risk factors for cancer of the esophagus.

T stage

Most studies done have shown that CT has a lower sensitivity for assessing T stage than the endoscopic ultrasound (4). The exclusion of T4 disease is determined by fat planes preserved between the primary tumor and adjacent structures (4). Thus, this study did not focus on the preoperative T staging of the esophageal tumor, based on CT findings of increased wall thickness and loss of fat planes. However, data on the tumor location were recorded to show its relation to the regional lymphadenopathy and distant metastatic lesions.

In this study, most patients (92%) were diagnosed with middle third and lower third cancer of the esophagus. This is a slightly higher percentage compared with a study by Ndonga et al. in 2008 in which most patients (83%) had middle and lower third esophageal tumors (11). In Ojuka et al. study, most of the tumors occurred in the middle and lower esophagus. However, no percentages were provided in that study (7). A recent study by Hsu et al. in 2017 with a large sample of 3,399 patients revealed that 65.5% of patients had middle and lower third disease (12). This shows cancer of the

esophagus is predominant in the middle and lower third portions of the esophagus. However, these studies did not address the role of inclusion of abdomen in CT in staging cancer of the esophagus.

N stage

The N classification involves mapping regional lymph nodes. Patients with no regional lymphadenopathy have a better prognosis than those with neoplastic lymphadenopathy (4). Lymphatic spread is bimodal, transversally penetrating the esophageal wall and longitudinally spreading either cranially to the cervical lymph glands or caudally to the abdominal lymph glands. However, the longitudinal lymphatic flow is much more abundant than the transverse flow (13). For upper third cancer, lymphatic spread is to the upper mediastinal and cervical nodes. In patients with middle third and lower third, the lymphatic flow drains superiorly and inferiorly into the cervical, upper mediastinal, periesophageal and perigastric nodes (13).

Although CT has been used for preoperative evaluation of esophageal cancer, its major role has been to depict lymph nodes, distant metastases, or both, rather than evaluating the local status of esophageal cancer (14). In this study, most patients with middle third and lower third had local or regional lymphadenopathy, or both. However, to the best knowledge of the author, no local studies have been done to show the pattern of lymph node invasion by esophageal cancer.

M stage

Despite its limitations in assessing T and N stages, CT has become the most commonly used modality in the initial staging of newly diagnosed esophageal cancer (15). Liver metastases typically appear on CT as hypo-attenuating ill-defined lesions that are best visualized during the portal venous phase of liver enhancement (16,17). Pulmonary metastases usually are well-marginated, non-calcified lesions. However, radionuclide bone scans and PET/CT have a higher sensitivity in detecting osseous metastatic lesions (18).

Hematogenous spread of cancer of the esophagus is usually to the liver, next are lung, bone and brain (19). In a study of 3,218 patients with esophageal cancer, the most common site of distant metastasis was the liver, next were distant lymph nodes, lung, bone and brain. In that study, the liver was the commonest site of metastatic lesions (33.4%), next were distant (non-regional) lymph nodes, lung, bone, and brain (20). Another systematic review by Osama et al. in 2017 of 10,049 articles showed the most common pattern of esophageal cancer metastases is to the lymph nodes, lung, liver, bones, adrenal glands and brain (21).

The liver and lung are the most common sites for metastases in cancer of the esophagus. In this study, patients with middle third and lower third cancer of the esophagus had distant metastases and local lymphadenopathy to the abdomen. In patients with distant metastases, surgical intervention may be of limited beneficial value compared with other therapeutic modalities. Therefore, detection of distant metastases is not only useful for staging but also for prognosis.

Limitations

The study employed a non-probabilistic consecutive sampling method to obtain a sample. Therefore, the study findings should not be considered representative of the entire population or generalized to the entire population.

Conclusion

In the preoperative CT imaging, CT chest with the inclusion of abdomen is essential for patients with middle and lower third esophageal tumors. However, as this study shows, the inclusion of abdomen in patients with upper third tumors may not be essential. Further local studies with a larger representative sample size should be done to assess the necessity of including abdomen for patients with upper third esophageal tumors. This is concerning added unnecessary radiation dose and cost among these patients.

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