Available online at www.sciencedirect.com

ScienceDirect

EJSO 42 (2016) 1315–1321

EJSO the Journal of Cancer Surgery

www.ejso.com

Review

Staging laparoscopy in gastric cancer to detect peritoneal metastases: A systematic review and meta-analysis

R.F. Ramos [a,b,*], F.M. Scalon [b], M.M. Scalon [b], D.I. Dias [b]

[a] *Universidade Federal Fluminense, Niterói, RJ, Brazil*
[b] *Universidade Estácio de Sá, Rio de Janeiro, RJ, Brazil*

Accepted 23 June 2016
Available online 9 July 2016

Abstract

Several imaging tests are used to stage gastric cancer; however the accuracy in the detection of peritoneal metastases is still low. Staging laparoscopy in gastric cancer has shown good results compared to imaging tests, particularly in patients with locally advanced disease signs. A search was conducted on electronic databases, and the studies were selected by methodological quality, inclusion and exclusion criteria. Data were analyzed using the Meta-Disc software version 1.4 to: describe primary results and explore homogeneity; explore threshold effect; calculate the sensitivity and specificity, negative and positive likelihood ratios; calculate the diagnostic odds ratio (DOR); and the summary ROC (sROC) curve. Five primary studies with a total of 240 participants were obtained. The overall sensitivity was 84.6%, and the overall specificity was 100%. The sensitivity and specificity homogeneity tests showed a Q value of 2.51 ($P < 0.6434$) with $I^2 = 0$, and $Q = 0\%$ ($P = 1.0$), $I^2 = 0\%$, respectively. The DOR was 291.31 and positive and negative likelihood ratios were 0.197 and 49.711, respectively; while the AUC obtained by sROC was 98%. Staging laparoscopy shows good accuracy in the detection of peritoneal metastases and is an important diagnostic tool in the staging of gastric cancer.

Keywords: Stomach neoplasms; Neoplasm staging; Laparoscopy; Meta-analysis

Introduction

Nearly one million new cases of gastric cancer were estimated to have occurred in 2012, becoming the fifth most common malignancy and the second in cancer mortality in the world.[1] It is estimated that in Brazil it is the third malignancy in incidence in men and the fifth in women, with 12,870 new cases in men and 7520 in women in the year 2014.[2]

Gastric cancer has poor prognosis, and the ratio mortality/incidence is considered high worldwide. This is because these tumors are diagnosed in advanced stages, with only 50% of patients being candidates for curative treatment at diagnosis.[2]

Several imaging methods are employed in the staging of gastric cancer. A recent meta-analysis showed that computed tomography (CT) has good accuracy in staging gastric cancer, but the detection of peritoneal metastases has still low sensitivity and specificity.[3]

The staging laparoscopy for gastric cancer has been used, in particular, in patients with locally advanced disease, candidates for neoadjuvant therapy and peritoneal implants suspected.[4] Besides being more accurate in the detection of peritoneal metastases compared with imaging tests,[5] it avoids unnecessary laparotomies.[6]

Although several studies have demonstrated the superiority of laparoscopy over conventional imaging tests for detection of peritoneal metastases,[7,8] the scientific evidence on this issue remains uncertain, since most of those studies

* Corresponding author. Department of Surgery, Universidade Federal Fluminense (UFF), Rua Marquês do Paraná 303, 3o andar, Niterói, RJ, CEP: 24033-900, Brazil.
E-mail address: rofelippe@terra.com.br (R.F. Ramos).

http://dx.doi.org/10.1016/j.ejso.2016.06.401

have low methodological quality as well as excessively small samples.

The aim of this study is to bring more scientific evidence on this issue through a systematic review and meta-analysis of studies related to diagnostic tests in patients undergoing laparoscopy for staging of gastric cancer.

Methods

Information sources and search

The search for scientific articles was performed in the databases MEDLINE, LILACS, and EMBASE, using the terms "Stomach Neoplasms (MeSH)", "Neoplasm Staging (MeSH)", and "Laparoscopy (MeSH)". There were no language nor publication date limitations.

Criteria for inclusion and exclusion

The inclusion criterion was studies of diagnostic test and accuracy in laparoscopic staging of gastric cancer confirmed by histopathologic examination with evaluation for possible peritoneal metastases. The exclusion criteria were studies that used no standardized technique of staging laparoscopy, patients with early gastric cancer, complications (stenosis, bleeding), and patients with tumors in the gastroesophageal junction. A methodological selection was also applied, for example, the exclusion of studies without sufficient data to calculate at least the sensitivity and specificity. In studies of accuracy comparing laparoscopy with imaging methods for the staging of gastric cancer, only the data relating to laparoscopy were analyzed.

Study selection and quality assessment

The selection and the analysis of methodological quality of the primary articles were assessed by the protocol QUADAS 2[9] by two independent observers. In cases of disagreement, the qualitative analysis was performed by a third observer. The prevalent opinion was used for analysis.

Statistical analysis

Data collection was done using a specific form to be filled in with the following information extracted from the primary articles: name of author, year of publication, origin country of the study, number and age of participants, tumor staging; true positive, false positive, true negative, and false negative values; sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, and negative likelihood ratio in the detection of peritoneal metastases. The global accuracy was assessed by diagnostic odds ratio (DOR) through random effect.

The chi-square test was used for heterogeneity and I^2 for inconsistency of primary studies. A value of I^2 higher than 50% was considered indicative of inconsistency among studies.[10]

Different thresholds can be used in the included studies to define a positive result of a test due to lack of standardization. The threshold effect may be the reason for detectable difference in sensitivities and specificities related to studies of accuracy. The representation of estimates of accuracy from each study was analyzed through a flat receiver operating characteristic (ROC) curve. To estimate the threshold effect, the Spearman correlation coefficient between the log (SEN) and log (1-SPE) was calculated. A typical pattern of "shoulder arm" plot in a ROC curve and strong positive correlation suggest the presence of threshold effect.[11]

The pooled sensitivity and specificity results were presented in forest plots and summary ROC (sROC) curve. The homogeneity test, the review of threshold effect, pooled sensitivity and specificity, sROC curve, and sensitivity analyses were performed using the software Meta-Disc version 1.4.[12]

Results

Eligible studies

Using search strategy in electronic databases and manual search, 377 articles were retrieved, of which 107 were selected only by title assessment. Based on the abstracts of such 107 articles, 44 were selected and read in full. Then, after inclusion and exclusion criteria, only 12 articles were considered. Finally, after qualitative analysis for the methodology applied, only five primary studies were kept.[6,13–16] The diagram flow of the article analyses is presented in Fig. 1. The characteristics of the five articles selected as primary studies are shown in Table 1.

Patients' characteristics

A total of 240 patients with gastric cancer and submitted to laparoscopy for staging purposes in order to detect peritoneal metastases were included in this study. It was not possible to establish the correct tumor staging of participants due to lack of data in the primary studies and because the studies have different periods, not allowing an efficient standardization, since the classification TNM has suffered changes over the years. However, the studies indicate that most patients were already in advanced stages of the disease, with an average resectability after laparoscopy of only 68.75%.

Meta-analysis

The overall sensitivity was 84.6% with 95% confidence interval from 0.747 to 0.918, while the overall specificity was 100% with 95% confidence interval from 0.977 to 1.00. The sensitivity and specificity forest plots of all five