The value of pre-operative computed tomography scanning for the assessment of lymph node status in patients with colon cancer

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Abstract

Aim: Our aim was to determine the value of a pre-operative computed tomography (CT) scan for the assessment of lymph node status in patients diagnosed with colon cancer by comparing radiological N-stage to histopathological N-stage.
Patients and methods: We performed a retrospective cohort study at the Sint Lucas Andreas Hospital in Amsterdam, the Netherlands. Between 2008 and 2010, two radiologists independently reviewed all pre-operative CT scans of patients diagnosed with colon cancer. The scans were examined for signs of regional lymphatic spread (N+), defined as lymph nodes exceeding 1 cm, clusters of ≥3 lymph nodes or a combination of the two. The results were compared with the histopathological N-stage. Inter-observer agreement, positive predictive value (PVV), negative predictive value (NPV), sensitivity, specificity, and accuracy were calculated.
Results: We included 106 patients in our study. PVV, NPV, sensitivity, specificity, and accuracy of detecting regional lymph nodes metastases were 47%, 66%, 71%, 41% and 54%, respectively. Inter-observer agreement was 74.5% (κ = 0.48).
Conclusion: Although our study group was relatively large and newer techniques were used in comparison to previous studies, our results demonstrated that the value of a pre-operative CT scan for the assessment of regional lymph nodes remained poor and unreliable. Therefore we question if a radiologist should assess regional lymph nodes on a pre-operative CT scan in colon cancer. Before treatment decisions are made on the appearance of lymph nodes in colon cancer patients, its diagnostic accuracy needs strong improvement.
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Introduction

Annually, more than 10,000 patients are diagnosed with colon cancer in the Netherlands. In men colorectal cancer has the third highest incidence after prostate- and lung cancer. For women, the incidence of colorectal cancer is even the second highest incidence after breast cancer.[1] The pre-operative work-up of colon cancer patients includes computed tomography (CT) scanning for the presence of distant metastases (especially liver metastases) and assessment of the primary tumour. Theoretically, the pre-operative CT scan can be used to predict lymph node involvement. Previous studies reported sensitivity for detecting malignant regional lymph nodes ranging from 13% to 92%.[2−11] A meta-analysis of 19 studies of colorectal tumours in 2010 by Dighe et al.[3] revealed relatively good results for assessment of tumour invasion grade (T-stage) but poor sensitivity, specificity, and diagnostic odds ratios for assessing nodal status (N-stage). Inter-observer agreement regarding the N-stage was poor. A systematic review by Leufkens et al.[12] found a sample-size-weighted sensitivity, specificity, and accuracy of 76%, 55%, and 69%, respectively and considered CT scanning for N-status reasonable. This finding is in contrast with rectal cancer where CT scanning proves to be more accurate.[13] Most

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studies concerning this topic, however, are more than 10-year-old and involve relatively small patient groups.[2–11] Newer CT techniques and larger study populations might change these results. Our aim was to determine the value of the pre-operative CT scan in colon cancer patients for predicting the N-stage in terms of inter-observer agreement, positive predictive value (PVV), negative predictive value (NPV), sensitivity, specificity, and accuracy. Put differently, can CT scanning predict the histopathologically N-stage reliably?

Patients and methods

Retrospective cohort study

This study was performed at the Departments of Surgery and Radiology of the Sint Lucas Andreas Hospital in Amsterdam, the Netherlands. Between 2008 and 2010, 211 patients underwent resectional curative surgery for colorectal cancer. The exclusion criteria for our study were rectal cancer, neo-adjuvant radiotherapy and/or chemotherapy and patients who were not scanned pre-operatively. Subsequently, two radiologists (both more than 15 years experience in reading abdominal CT scans) independently reviewed all the pre-operative CT scans. Apart from being told the endoscopic location of the primary tumour, the radiologists received no other information about the patients. The radiologists each filled in a case record form: the presence of either regional lymph nodes of >1 cm and/or clusters of ≥3 lymph nodes was scored as N+ while the absence of enlarged or clustered lymph nodes was scored as N0, being the definition for a radiological positive nodal status in most previous studies.[4–10,13,14] In addition, they recorded information about the use of either oral or intravenous contrast. In case of disagreement between the two radiologists, they discussed the case together until reaching agreement prior to statistical analysis. The histopathological analyses of the resected colon specimen were used as the reference standard. Identification of the lymph nodes was done thorough inspection, palpation and dissection of the specimen without any fat clearing techniques. Lymph nodes were found positive (N+) in case the pathologist found metastatic tumour in one or more lymph nodes. Distinction between pN1 and pN2 (for subgroup analysis) was done conform the 6th edition of TNM classification system.

CT scanning

CT scanning was performed with a 4-slice Toshiba Aquilion CT scanner (FOV 24 cm, slice thickness 0.5 mm, reconstruction matrix 512, pixel size 0.47, ideal voxel size 0.103, real voxel size 0.110, deviation 6.7%). All CT scans were viewed on 3 mm axial sliced images. Maximum short axis in the axial plane was measured. No reconstructions were done.

Statistical analysis

Statistical analysis was performed with SPSS. True positive (TP), true negative (TN), false positive (FP), false negative (FN), inter-observer agreement, positive predictive value (PVV), negative predictive value (NPV), sensitivity, specificity, and accuracy were calculated after the two radiologists had reached agreement on all cases.

Results

Study population

Between 2008 and 2010, 211 patients underwent a resection of a colorectal tumour in our hospital. Out of these 211 patients, after excluding those with rectal cancer (N = 68), those who did not have a pre-operative CT scan (N = 30), and those who had neo-adjuvant therapy (N = 7), 106 patients remained who met our inclusion criteria. Of these, 56 (52.8%) were female and the median age was 70 years (ranges 29–87 years). Two patients did not receive intravenous contrast and nine patients did not receive oral contrast. Another two patients had not received contrast at all. In Table 1 we summarise patient and tumour characteristics.

Tumour

After histopathological confirmation, one tumour was staged as T1, 14 tumours were staged as T2, 83 as T3, and eight as T4. Most tumours were located in sigmoid colon (39.6%). Out of the 106 patients, 10 had distant metastasis at the time of presentation.

Table 1
Baseline characteristics.

	No. of patients (N = 106)
Female	56 (52.8%)
Age (median)	70.5 (29–87)
Location	
Coecum	23 (21.7%)
Ascending colon	21 (19.8%)
Transverse colon	11 (10.4%)
Descending colon	9 (8.5%)
Sigmoid	42 (39.6%)
T-stage	
T1	1 (0.9%)
T2	14 (13.2%)
T3	83 (78.3%)
T4	8 (7.5%)
N-stage	
N0	61 (57.5%)
N1 or N2 (= N+)	45 (42.5%)
N1	29 (27.4%)
N2	16 (15.1%)
M stage	
M0	96 (90.6%)
M1	10 (9.4%)