COMPUTED TOMOGRAPHY COLONOGRAPHY IN PREOPERATIVE EVALUATION OF COLORECTAL CANCER

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Computed tomographic colonography (CTC) has the potential to become an accepted technique for detecting of colorectal cancer.

The aim of the study was to evaluate usefulness of CTC in preoperative evaluation of colorectal tumors and the regions of colon endoscopically unavailable.

Material and methods. A total of 49 patients with colorectal tumors identified at conventional colonoscopy were included. In all these patients CTC was performed and results were compared with colonoscopy. In addition in CTC infiltration of surrounding tissues, organs, lymph nodes and liver were assessed. Findings were compared with contrast-enhanced CT of abdomen.

Results. Colonoscopy was completed to the caecum in 24 (48.9%) patients. CTC failed only in one patient. CTC was congruent with colonoscopy in evaluation of tumor location and morphological type. In CTC two additional tumors were found proximately to occlusive masses, it is in endoscopically unavailable regions. Sensitivity and specificity of CTC comparing to CT in diagnosis of fat tissue in filtration and surrounding organs infiltration at the site of tumor were 95.5% / 50% and 100% / 86.9% respectively. Concordance of results in evaluation of lymph nodes was 93.9% while sensitivity and specificity for CTC was 84.6% and 100% respectively. Concordance of evaluation of liver metastases was 78.8%, while sensitivity and specificity for CTC was 61.5% and 90% respectively.

Conclusions. CTC is a useful method in diagnostics of colorectal tumors. It allows to diagnose tumor, determine local tumor staging and detect synchronous lesions in endoscopically unavailable regions.

Key words: colonoscopy, computed tomography, tumor of colon, diagnostics

Conventional colonoscopy is still considered the gold standard for the detection of colorectal neoplasm as highly sensitive and specific diagnostic method. However it fails to show the entire colon in 0.6-20% examinations because of technical reasons as well as patient’s intolerance (1). From among newest radiologic modalities promising methods are CT colonography (CTC), MR colonography and PET colonography. Effectiveness of these techniques in the detection and evaluation of large bowel tumours, as well as in clinical staging, are currently undergoing vigorous research (2, 3, 4).

The purpose of this study was to assess the usefulness of CTC in preoperative evaluation
of colorectal tumors and the entire bowel including regions endoscopically unavailable.

MATERIAL AND METHODS

This prospective study recruited 49 consecutive patients (31 men, 18 women, ages 24 to 88 years; median age: 70 years) with colorectal tumors identified at conventional colonoscopy. All these patients were referred for CTC and contrast-enhanced CT of abdomen additionally in 33 (67.3%) patients was performed.

CTC was performed with 64-slice row CT (Siemens Sensation Cardiac 64, Siemens, Germany). Acquired CT data were transferred to a workstation Leonardo equipped with software (Software Version syngo CT 2006A, Siemens) adjusted to CTC evaluation. For interpretation of the results of examination three-dimensional volume rendering technique (VRT) reconstructions, three-dimensional endoluminal “fly-through” views and two-dimensional multiplanar reformatted images (MPR) were used. Both supine and prone image data sets were evaluated. CTDIvol amounted 3.9 mGy in supine and 2.3 mGy in prone and effective dose for average man or woman amounted adequately: 2.40 mSv or 3.71 mSv in supine and 1.44 mSv or 2.23 mSv in prone. All CTC images were interpreted by the same radiologist. Except colorectal findings regional lymph nodes, liver as well others organs were assessed and correlated with contrast-enhanced CT of abdomen. The adequacy of bowel cleansing was evaluated both in colonoscopy and CT colonography using 5-point scale, where “1” meant inadequate and “5” optimal bowel preparation. 4 and 5 point were considered as well bowel cleansing. Each patient subjectively assessed tolerancy of colonoscopy and CT colonography in 5-point scale, where 1 – meant total intolerance and 5 – very good tolerancy. In statistical analysis following tests were used: two fraction test, F Snedecor’s test, z-test, t-Student’s test and Cochran-Cox’s test. p values < 0.05 were considered significant.

RESULTS

Results of comparison between colonoscopy and CTC are presented in tab. 1.

In 24 (48.9%) patients colonoscopy was complete while in 25 (51.1%) patients examination of entire colon was impossible because of obstructive or occlusive masses. In CTC visualization of the entire colon was obtained in 44 (89.8%) patients. Incomplete examination because of inadequate bowel distention was in 5 (10.2%) patients in CTC and was caused by difficulties in air holding or occlusive tumor. In one patient CTC failed because of completely collapsed colon and no possibility of it’s evaluation. Therefore 48 patients were included to analysis in this group. In supine the worst cleansed bowel segments were: rectum and sigmoid colon / rectal junction. However the same segments were well-visualized in prone because residual fluid and feces moved to sigmoid and descending colon. Whilst in prone the worst cleansed and distended was transverse colon, well-visualized in supine. Evaluation of tumor size and volume in occlusive tumors during colonoscopy were impossible. CTC was congruent with colonoscopy in evaluation of morphological type of tumor. In colonoscopy untypical colon topography concerned dolichosigmoid. Whilst in CTC elongation of transverse colon, descending colon or dolichocolon were stated. Besides segmental sharp bending of descending colon, shortening of ascending colon, loop of ascending colon and high position of coecum. In CTC two additional tumors were found proximately to occlusive masses, it is in endoscopically unavailable regions. In one patient with occlusive tumor in transverse colon, the second large lesion (size: 7x6.5x6 cm) was found in caecum and confirmed in contrast-enhanced CT of abdomen.

Congruence of CTC and contract-enhanced CT in evaluation of infiltration of fat tissue was 78.8%. Among disagreements false positive results in CTC were stated in 5 (15.2%) of patients. In one patient (3%) result was false negative. While congruence both examinations in evaluation of surrounding organs infiltration was 87.9% and divergence of results concerned also overinterpretation of CTC results. Sensitivity of CTC in comparison with CT in diagnosis of infiltration of fat tissue and surrounding organs was 95.5% and 100% and specificity 50% and 86.9% respectively. In evaluation of lymph nodes criterion of > than 1 cm was assumed. Congruence in evaluation of enlarged lymph nodes was 93.9%. In 2 (6.1%) patients lymph nodes were not showed in CTC whilst were visible in CT. Sensitivity in
Computed tomography colonography in preoperative evaluation of colorectal cancer

**DISCUSSION**

Till recently there is a few studies assessing diagnostic value of CTC in complex preoperative evaluation of patients suffering from large bowel tumors, and this method did not find at present proper place in clinical diagnostics (4-9). The main reason of this situation is variety of results from different centers (10-17). Many doubt are connected with kind of the reference standard for comparison of results. In most centers the reference standard is colonoscopy, in some results of histopathological and intraoperative examinations, in individual double-contrast enema images (5, 7, 18, 19, 20). Necessity of introduction precise standards suggest many authors (8, 12, 21). Working Group on Virtual Colonoscopy suggested introduction of a uniform system of performing and interpreting the study, known as C-RADS (CT Colonography Reporting and Data System), modeling on the BI-RADS system (Breast Imaging Reporting and Data System) currently used in mammography (21). It seems to that reaching a consensus concerning methodology of examination and introduction of uniform study protocol might contribute to similar and comparable results (5, 12, 15, 21). According to radiologists evaluating examination proper bowel cleansing plays important role in assessing of results of CTC (12, 15, 16). Poor preparation of bowel is the most common cause of diagnostic errors (7, 14, 16, 22). Because of this, examination should be performed in two positions of patients. Contrary to CTC liquid content or fecal debris did not make a big problem during interpretation of results of colonoscopy. Consequently better bowel cleansing is necessary for CTC.

The time of examination was longer in CTC then in colonoscopy especially relating to interpretation part of the examination which is the longer the more lesions are in the large intestine. Increasing radiologists’ experience evaluating examination is also very important.

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**Table 1. Results of comparison between colonoscopy and CT colonography**

<table>
<thead>
<tr>
<th></th>
<th>Colonoscopy</th>
<th>CT colonography</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of examination (SD)</td>
<td>3-25 min (15)</td>
<td>40-110 min (61)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Bowel cleansing (mean)</td>
<td>3.70-5 (4.66)</td>
<td>2.80-5 (4.29)</td>
<td>=0.001</td>
</tr>
<tr>
<td>Occlusive tumour</td>
<td>25/49 (51%)</td>
<td>3/49 (6.1%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Tumour size evaluation (1-2 diameters)</td>
<td>29/49 (59.2%)</td>
<td>48/48 (100%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Tumour volume (3 diameters)</td>
<td>15/49 (30.6%)</td>
<td>48/48 (100%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Wall thickening evaluation</td>
<td>0/49 (0%)</td>
<td>48/48 (100%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Tolerance of examination (mean)</td>
<td>2-5 (3.51)</td>
<td>3-5 (4.23)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Untypical colon topography</td>
<td>5/49 (10.2%)</td>
<td>24/49 (49%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Infiltrating tumour</td>
<td>30/49 (61.2%)</td>
<td>30/48 (61.2%)</td>
<td>= 1</td>
</tr>
<tr>
<td>Polypoid tumour</td>
<td>19/49 (38.8%)</td>
<td>18/48 (36.8%)</td>
<td>= 0.83</td>
</tr>
<tr>
<td>Synchronous polyps</td>
<td>22</td>
<td>44</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Synchronous tumours</td>
<td>4 (8.2%)</td>
<td>6 (12.2%)</td>
<td>-</td>
</tr>
</tbody>
</table>

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**Table 2. Results of comparison between CT colonography and contrast-enhanced CT of abdomen**

<table>
<thead>
<tr>
<th></th>
<th>CT colonography</th>
<th>Contrast-enhanced CT</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat tissue infiltration at the site of tumour</td>
<td>26/33 (78.8%)</td>
<td>20/33 (60.6%)</td>
<td>0.1</td>
</tr>
<tr>
<td>Surrounding organs infiltration at the site of tumour</td>
<td>12/33 (36.4%)</td>
<td>9/33 (27.3%)</td>
<td>0.43</td>
</tr>
<tr>
<td>Presence of enlarged (≥ 10 mm) abdominal and pelvic lymph nodes</td>
<td>11/33 (33.3%)</td>
<td>13/33 (39.4%)</td>
<td>0.61</td>
</tr>
<tr>
<td>Liver metastases</td>
<td>10/33 (30.3%)</td>
<td>13/33 (39.4%)</td>
<td>-</td>
</tr>
</tbody>
</table>
colonoscopy has been confirmed by many authors (2, 4, 7, 8, 15, 24, 26, 27, 28).

Preoperative precise evaluation of local infiltration, metastases to regional lymph nodes and distant organs is essential for the planning of optimal therapy (5, 13, 24, 26). Traditional colonoscopy does not able clinical staging. At present, this is done using spiral biphasic computed tomography encompassing abdominal cavity and pelvis (27, 29). The use on CTC of 2D reconstruction in any plane enable determination of both tumor size, thickening of bowel wall, degree of lumen stenosis, outline of external surface of bowel wall and relation to adjacent structures (2, 5, 7, 9, 25, 26, 30). Amin was the first who described the use of contrast-enhanced CTC in the detection and staging of colorectal cancer in few patients, presenting high accuracy in comparison with histopathological and intraoperative results (30). In CTC it is not possible to avoid false diagnosis (5, 7, 24, 26). Till now contrast-enhanced CT is necessary for the evaluation of adipose tissue and surrounding organs infiltration. Contrast-enhanced CTC enables simultaneous evaluation of abdominal organs, obviating the need for an additional classic computed tomography (5, 7, 13, 15).

In our study we have shown that CT colonography is useful method in diagnostics of colorectal tumors. It allows both to determine local tumor staging and detect synchronous lesions in large bowel including endoscopically unavailable regions. CTC is not able to completely replace colonoscopy but it has the potential to become an alternative method. Further multicenter randomized studies are necessary to determine the role of CT colonography in colorectal tumor diagnostics.

REFERENCES

A comparison of virtual and conventional colonography.


