Introduction
Computed tomography (CT) imaging of the bowel and colon has become a mainstay in current radiology practice. In particular, because of its widespread availability and speed CT permits a time-efficient and accurate evaluation of the bowel and colon for both acute and non-acute clinical situations [1-4]. Several important advances have recently been made in the use of CT for evaluation of the colon. The rapid helical acquisition in CT colonography permits detailed evaluation of the air-distended, cleansed colonic mucosa [5]. Previous investigations have demonstrated promising performance of this technique in the detection of colorectal carcinoma and its precursor, the adenomatous polyp [6-9]. Recently, several investigators have made evaluations of CT colonography using a low X-ray dose technique, intravenous contrast, in addition to assessing its performance in the detection of subtle, low-lying polyps. These investigations are significant in their attempts to extend and document the applicability and usefulness of this rapidly evolving technique. In addition, recent work has suggested that the improved speed and slice thickness available with the multidetector technique may assist in staging bowel neoplasia.

CT for the evaluation of appendicitis has become widely adopted and has led to an improved accuracy in the pre-surgical diagnosis of this common entity [10-12]. As expected for a technique gaining acceptance, refinement of the diagnostic criteria of CT of the appendix is a sign of maturation for this examination. Recent work based in part on non-enhanced multidetector CT scanning has contributed to the diagnostic criteria used for evaluation of the appendix.

Colonoscopy and CT colonography have become mainstays in current radiology practice. In particular, because of their widespread availability and speed CT permits a time-efficient and accurate evaluation of the bowel and colon for both acute and non-acute clinical situations. Recent advances have been made in the use of CT for evaluation of the colon. Rapid helical acquisition in CT colonography permits detailed evaluation of the air-distended, cleansed colonic mucosa. Previous investigations have demonstrated promising performance of this technique in the detection of colorectal carcinoma and its precursor, the adenomatous polyp. Recently, several investigators have evaluated CT colonography using a low X-ray dose technique, intravenous contrast, in addition to assessing its performance in the detection of subtle, low-lying polyps. These investigations are significant in their attempts to extend and document the applicability and usefulness of this rapidly evolving technique. In addition, recent work has suggested that the improved speed and slice thickness available with the multidetector technique may assist in staging bowel neoplasia.

Colorectal neoplasms: prospective comparison of thin-section low-dose multidetector row CT colonography and conventional colonoscopy for detection


**Background.** The aim of this study was to compare prospectively thin-section, low-dose, multidetector row CT colonography with conventional colonoscopy for the detection of colorectal neoplasms. One hundred and five patients underwent CT colonography immediately before colonoscopy. Supine and prone CT colonographic acquisitions for imaging the region during a breath hold of 30 s were performed. The CT colonographic images were prospectively interpreted for the presence, location, size and morphologic features of polyps. The time of image interpretation was noted. The sensitivity, specificity and positive and negative predictive values of the CT colonography were calculated with 95% confidence intervals (CIs) by using the colonoscopic findings as the reference standard. The effective dose was calculated on the basis of measurements in a standard body phantom. The effective dose was calculated by using commercially available software. The median CT data interpretation time was 12 min. One hundred and thirty-two polyps in 59 patients were identified at colonoscopy and no polyps were detected in 46 patients. The sensitivities for the detection of polyps smaller than 5 mm, 6-9 mm and larger than 10 mm in diameter were 12% (11 out of 91 polyps), 70% (19 out of 27 polyps) and 93% (13 out of 14 polyps), respectively. The estimated overall specificity was 97.7% (515 out of 527 imaging results). The total weighted CT dose index for the combined supine and prone CT colonography was 11.4 mGy. The effective doses for the combined CT colonography were 5.0 and 7.8 mSv for men and women, respectively.

**Interpretation.** Low-dose, multidetector row CT colonography has excellent sensitivity and specificity for the detection of colorectal neoplasms of 10 mm and larger and by decreasing the radiation dose may lead to increased patient and clinician acceptance of the use of this examination.

**Comment.** This study demonstrated high sensitivity and specificity for the detection of colonic polyps using a very low X-ray dose technique and multidetector scanning. The performance statistics observed in this study were comparable to those obtained using much higher doses, as reported in previous single-detector CT colonography studies. Although limited by the relatively small cohort observed, the results suggested feasibility of performing CT colonography with a technique that...
minimizes radiation exposure to the patient. Reducing radiation exposure is important in the consideration of CT colonography as a possible non-invasive method for performing colon cancer screening. Even more so than for standard diagnostic CT, efforts at reducing the radiation dose for this examination are important as the intended screening population are otherwise healthy, asymptomatic individuals.

**Contrast-enhanced CT colonography in recurrent colorectal carcinoma: feasibility of simultaneous evaluation for metastatic disease, local recurrence, and metachronous neoplasia in colorectal carcinoma**


**Background.** Contrast-enhanced CT colonography has the potential for detecting local recurrence, metachronous disease and distant metastases in patients with a history of invasive colorectal cancer. The purpose of this study was to determine whether colonic anastomoses prohibit adequate colonic distension on contrast-enhanced CT colonography and to estimate the performance of contrast-enhanced CT colonography in detecting recurrent colorectal carcinoma. Fifty patients with a history of resected invasive colorectal carcinoma underwent contrast-enhanced CT colonography and colonoscopy. Colonic distension was graded for different colonic segments. Two radiologists evaluated for the presence of local recurrence, metachronous disease and metastatic disease. The results were compared with colonoscopy, histology and clinical follow-up. Most patients had adequate colonic inflation (37 out of 50 or 74%). Eleven out of 13 patients with inadequate distension had collapse in the sigmoid colon, usually associated with ileocolic anastomoses. Contrast-enhanced CT colonography detected local recurrences with an accuracy of 94% (95% CI = 83–99%) and metachronous lesions greater than or equal to 1 cm was 92% (95% CI = 80–98%), but there was only one such lesion, which was missed on initial colonoscopy. Stools, granulation tissue and inflammation can mimic the CT appearance of local recurrence or metastatic disease and account for false-positive examinations. Contrast-enhanced CT colonography identified five patients with metastatic disease.

**Interpretation.** Suboptimal sigmoid distension can be seen on contrast-enhanced CT colonography, predominantly in patients with right hemicolectomies. Contrast-enhanced CT colonography is a promising method for detecting local recurrence, metachronous disease and distant metastases in patients with prior invasive colorectal carcinoma. The technique can also serve as a useful adjunct to colonoscopy by detecting local recurrences or metachronous diseases that are endoscopically obscure or by serving as a full structural colonic examination when endoscopy is incomplete.

**Comment**

This study demonstrated in a limited cohort that CT colonography can accurately depict local recurrence and metastatic disease in the setting of previously resected colon carcinoma using a multidetector technique and intravenous contrast. In addition, in most instances observed, adequate distension and image quality were obtained, despite the presence of surgical anastomoses. The study represents another exploration of the use of CT colonography in the staging and surveillance of colorectal carcinoma. The results suggested that adequate quality examinations and highly accurate assessments of staging and tumour recurrence can be made despite prior surgery. The study also illustrated the use of intravenous contrast for augmenting the standard CT colonography technique.

**Detection of flat lesions in the colon with CT colonography**


**Background.** The authors investigated whether flat lesions of the colon could be detected on CT colonography. CT colonography and conventional colonoscopy were performed on 547 consecutive patients. A subset of 22 polyps was described as flat on colonoscopy (n = 16) or CT colonography (n = 6) and was the basis of this report. CT colonography was performed with a standard technique (collimation 5 mm and reconstruction intervals 3 mm). The patients were scanned in supine and prone positions. Examinations were randomly assigned and reviewed in a blinded fashion by two out of three radiologists. Prospective interpretations were recorded. All patients had conventional colonoscopy, which served as the gold standard. Twenty-two flat lesions ranging from 0.4 to 3.5 cm were histologically classified as adenomatous (n = 8) or hyperplastic (n = 14). The sensitivities for detecting all flat lesions and flat adenomas by each reviewer were 43 and 100%, 65 and 100% and 15 and 13%, respectively. ‘Double reading’...
Comment

In this study the investigators demonstrated encouraging sensitivity and specificity for flat adenomas, that is lesions that do not impinge significantly into the distended colonic lumen. While much attention has been paid to the performance of CT colonography for the more common pedunculated and sessile lesions, this investigation was a well-designed initial evaluation for detecting lesions that are less well characterized and potentially much harder to detect by CT. Flat adenomas have been reported to have a higher than usual prevalence of dysplasia, making them potentially clinically important. In this study, the investigators demonstrated detection of these lesions by standard helical as well as multidetector CT colonography that contributes to the use of colonography in permitting non-invasive colorectal carcinoma screening. The clinical importance of these lesions remains a subject of active investigation, as their prevalence appears to vary considerably in different populations.

Frequency of visualization and thickness of normal appendix at nonenhanced helical CT

Benjaminov O, Atri M, Hamilton P, Rappaport D. Radiology 2002; 225(2): 400-6

Background. The aim of this study was to evaluate the frequency of visualization, thickness and features of the normal appendix at nonenhanced helical CT. Three radiologists blinded to patient surgical history retrospectively reviewed CT scans obtained for renal colic assessment in 187 consecutive patients. No contrast material was administered. The frequency of visualization and the two-wall thickness of normal appendices were recorded. The inter-observer agreement and effect of the adequacy of intraperitoneal fat on identification of the appendix were assessed. The prevalence of appendectomy was 10.7% (20 out of 187 patients). The means for the three reviewers’ sensitivity, specificity, positive and negative predictive values and accuracy of visualization of a normal appendix were 79% (CI = 73-84%), 90% (CI = 78-96%), 98% (CI = 97-99%), 34% (CI = 22-47%) and 80% (CI = 74-86%), respectively. There was no significant difference between the three reviewers (P > 0.05) according to conditional logistic regression and exact McNemar test results. The frequency of appendix visualization was significantly lower in patients with less intraperitoneal fat for all of the reviewers (χ²–test P = 0.01–0.001). The mean (± SD) thickness of the normal appendix if no intraluminal content was visualized was 6.6 ± 1.0 mm and the mean thickness, excluding the visualized intraluminal content, was 3.6 ± 0.8 mm. The non-weighted k-value for the inter-observer agreement for normal appendix visualization was 0.69–0.75 among the three reviewers, which indicated good to excellent agreement.

Interpretation. Most normal appendices are seen at non-enhanced helical CT. The thickness of the normal appendix, when the content is not recognizable, overlaps the values currently used for diagnosing appendicitis at CT but is similar to US values when the content is visualized and subtracted from the total thickness.
Comment
This study adds to our understanding of the normal range and appearance of the appendix during non-enhanced abdominal CT. While the size criteria for the normal appendix were derived initially by extrapolation from US and pathologic findings, this study provided a definition of normal and abnormal criteria based on CT, including multidetector scans. CT is widely used for establishing a pre-operative diagnosis of appendicitis non-invasively. There has been a movement towards performance of the examination without the use of oral or rectal contrast, a protocol that overlaps practically with the protocol for CT evaluation of renal colic. This paper provides useful background and added specificity to the size criteria for distinguishing normal from abnormal appendices.

Conclusion
Multidetector capability will continue to contribute to the speed and accuracy of CT evaluation of the bowel. Scans performed with a breath hold protocol, as is feasible using multidetector technology, demonstrate a reduction in breathing motion-related artefacts. In addition, it is possible to obtain images with narrower collimation, a technical factor that will contribute to improved spatial resolution, for both standard axially interpreted examinations, as well as those, such as CT colonography, that require multiaxial reformations.

As seen in CT colonography, the ability of faster scan protocols for reducing volume artefacts and radiation doses may contribute to the acceptance of this technique as a means of performing non-invasive colon evaluation. The combination of intravenous contrast with the thinner scan protocols promises to contribute to the more accurate depiction of subtle, flat lesions of the colon, which were previously difficult to detect and characterize. The use of the multidetector technique also shows promise in the more accurate characterization of bowel tumours and has contributed to a more complete evaluation of inflammatory conditions of the bowel, such as appendicitis.

References

<table>
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<tr>
<th>Table 3.3</th>
<th>Frequency of visualization of a normal appendix</th>
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<tbody>
<tr>
<td>Reviewer</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Reviewer 1</td>
<td>81 (135/167)</td>
</tr>
<tr>
<td>Reviewer 2</td>
<td>77 (128/167)</td>
</tr>
<tr>
<td>Reviewer 3</td>
<td>80 (133/167)</td>
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<tr>
<td>Mean</td>
<td>79</td>
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<tr>
<td>CI</td>
<td>73, 84</td>
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</tbody>
</table>

Note: Data are percentages. Numbers in parentheses are numbers of patients. There was no significant difference among these values for the three reviewers (P > 0.05). Accuracy = (TP + TN)/all cases, where TN is the number of appendectomies at which the appendix was not seen and TP the number of normal appendices seen. Positive predictive value = TP/(TP + PP), where PP is the number of appendectomies at which an appendix was seen. Sensitivity = TP/(TP + FN), Specificity = TN/(TN + FP).

<table>
<thead>
<tr>
<th>Table 3.4</th>
<th>Mean and range of the thickness of normal appendix</th>
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<tbody>
<tr>
<td>Appendix thickness</td>
<td>Reviewer 1</td>
</tr>
<tr>
<td>Without luminal content visualized</td>
<td>6.7 ± 1.6 (3.0–13.0)</td>
</tr>
<tr>
<td>With luminal content visualized</td>
<td>4.0 ± 1.1 (2.0–8.0)</td>
</tr>
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</table>

Note: Data are the mean thickness in millimetres, plus or minus the SD. Numbers in parentheses are the range.
* Mean values for the 117 appendices that were seen by all three reviewers.
† Reviewer 1 versus reviewers 2 and 3. For reviewer 2 versus reviewer 3, P > 0.05.
Source: Benjaminov et al. (2002).


