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Assessing the Efficacy of Routine Computed Tomography in Detecting Colorectal Cancer

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ABSTRACT

INTRODUCTION: While colonoscopy and CT colonography are highly sensitive methods for detecting colorectal cancer, certain patients may find the necessary bowel preparation and insufflation of gas into the colon challenging. This study evaluates the efficacy of unprepared contrast CT scans in identifying colorectal cancer.

METHODS: A retrospective analysis was conducted on patients who underwent contrast CT scans of the abdomen and pelvis followed by colonoscopy at hospital

RESULTS: Among 96 identified patients who underwent CT prior to colonoscopy, the sensitivity of CT in detecting colorectal cancer was 100% (95% CI: 19.8–100%), with a specificity of 95.7% (95% CI: 88.8–98.6%). The positive predictive value was 33.3% (95% CI: 6.0–75.9%), and the negative predictive value was 100% (95% CI: 94.8–100%).

CONCLUSIONS: A negative non-targeted CT scan for colorectal malignancy typically provides reassurance, but decisions regarding further investigation should be individualized, considering the likelihood of underlying malignancy and patient comorbidities. Nonetheless, positive CT findings usually necessitate subsequent video colonoscopy for assessment.

Keywords: Colorectal neoplasm, X-ray computed tomography, Spiral computed tomography, Diagnosis

Introduction:

Colorectal cancer remains a significant public health concern, contributing to nearly 16,000 deaths in the UK in 2010, positioning it as the second leading cause of cancer-related mortality following lung cancer. Colonoscopy and CT colonography, when conducted by skilled professionals, stand out as the most effective diagnostic methods for colorectal cancer. CT colonography, in particular, demonstrates comparable efficacy to colonoscopy in detecting colorectal cancer and polyps larger than 10mm, with the added benefit of being less invasive and better tolerated by patients. However, the requirement for bowel preparation and colon insufflation poses challenges, especially for certain vulnerable patient groups such as the frail elderly. (Uzzaman et al., 2012)

The accessibility and image quality of CT scanners have notably improved over time, leading to a surge in abdominal and pelvic CT scans for various diagnostic purposes beyond colorectal cancer detection. Despite this trend, there has been limited exploration into the role of non-colonographic CT in identifying colorectal cancer and polyps. Notably, in 2010, Ozel et al. published findings on the efficacy of non-targeted CT, revealing an accuracy of 80.3% in detecting colon cancer and a sensitivity of 14.5% for polyps larger than 10mm. This underscores the need for further investigation into the performance of non-colonographic CT in diagnosing colorectal malignancies. (Phillips, 2009)

Hence, we conducted a retrospective analysis of non-colonographic CT scans conducted at a district general hospital to assess its efficacy in both detecting and ruling out colorectal cancers. (Cancer Research UK, 2013)

Methods

This study comprised a retrospective review of patients who underwent intravenous contrast CT scans of the abdomen and pelvis before undergoing colonoscopy at our National Health Service trust, which encompasses two district general hospitals. Patients were identified by querying the Picture Archiving and Communication System (PACS) to capture individuals who had CT scans of the abdomen and pelvis , as well as the Endoscribe (Mediboss, Adelaide, Australia) program to capture those who underwent colonoscopy during the same timeframe.

CT scans requested for any reasons other than an established diagnosis of colorectal cancer were included in the study. Patients with a duration exceeding 12 months between CT and endoscopy or those who failed caecal intubation during colonoscopy were excluded from the final analysis. Additionally, patients who had undergone complete colon excision before the CT scan were also excluded.

Data regarding patient demographics, CT scan details (including the use of intravenous contrast, indication for CT, reporting radiologist's name, identified pathology, and its location), were retrieved from PACS and the radiology information system. In the CT reports, any indication of potential colorectal malignancy, regardless of certainty level, was grouped together but distinguished from those reports definitively diagnosing colorectal malignancy.

Information regarding lower gastrointestinal endoscopy, including the date of the procedure, indication, extent of visualization, pathology encountered, and its location, was obtained from the Endoscribe database. If biopsies were conducted during endoscopy, the histopathology report was cross-referenced to verify the endoscopic diagnosis.

Computed Tomography:

Intravenous contrast-enhanced CT scans were performed using either a Somatom Sensation 64 scanner (Siemens, Erlangen, Germany) with 100ml of 64% weight/volume ioversol or a LightSpeed™ 16 scanner (GE Healthcare, Chalfont St Giles, UK) with 100ml of 61.2% w/v iopamidol. All scans were reconstructed at 5mm slice thickness in axial and coronal planes, with raw data available for multiplanar reconstructions when necessary. No positive oral contrast agents were administered. Bowel wall thickness on CT scans was utilized as the criterion for potential colorectal malignancy detection, particularly when there was a noticeable discrepancy in bowel wall thickness between adjacent segments.

Lower Gastrointestinal Endoscopy:

Colonoscopies were performed by fully trained endoscopists or closely supervised trainees, exclusively using Olympus standard and high-definition video colonoscopes during the study period. Bowel preparation primarily involved sodium phosphate (Fleet Laboratories, Lynchburg, VA, US), with macrogol (KleanPrep®; Norgine Pharmaceuticals, Uxbridge, UK) being the preferred alternative where osmotic laxatives were contraindicated. Other bowel preparation agents were occasionally used based on patient preference or specific circumstances.

Statistical Analysis:
The performance of non-colonographic CT in detecting colorectal cancer was assessed in terms of sensitivity, specificity, positive predictive value, and negative predictive value. The 95% confidence interval was calculated using an online statistics calculator (VassarStats; http://vassarstats.net/).

Results:
A total of 4,465 CT scans of the abdomen and pelvis were conducted at our institution between January 1, 2007, and December 31, 2010, alongside 13,488 lower gastrointestinal endoscopies during the same period. Among these, 96 patients underwent intravenous contrast CT followed by a subsequent colonoscopy within twelve months. Among these patients, 47 were female and 49 were male, with a median age of 67 years (range: 17–87 years).
The CT findings were interpreted by consultant radiologists, with the primary reason for CT requests being abdominal pain. Notably, 86% of patients presented with large bowel symptoms prompting the CT examination.
The median time interval between the initial CT scan and subsequent colonoscopy was 72 days (range: 1–365 days). The primary indication for lower gastrointestinal endoscopy was altered bowel habits.
Two cases of malignant lesions were identified, located in the sigmoid colon and rectum, respectively, both confirmed as colorectal adenocarcinoma through histological examination.
Detection of colorectal cancer with computed tomography: Among the 96 patients who underwent colonoscopy subsequent to CT, the CT findings of 6 patients were suspicious for colorectal tumors. Of these, two patients were confirmed to have colorectal malignancy at colonoscopy, while four patients had false-positive CT findings, with subsequent identification of polyps during colonoscopy. Notably, all 90 CT scans reported as negative for colorectal malignancy were accurate.
The sensitivity of CT in detecting colorectal cancer was determined to be 100% (95% CI: 19.8–100%), with a specificity of 95.7% (95% CI: 88.8–98.6%). The positive predictive value was calculated to be 33.3% (95% CI: 6.0–75.9%), and the negative predictive value was 100% (95% CI: 94.8–100%).

Table 1 Reasons for computed tomography request

Reason	Frequency
Abdominal pain	50
Palpable mass	14
Intestinal obstruction	10
Altered bowel habits	9
Weight loss	9
Other follow-up	7
Abdominal distension	5
Fever/sepsis	4
Anaemia	3
Postoperative investigations	3
Ureteric obstruction	2
Rectal bleeding	2
Renal colic	2
Follow-up for abdominal aortic aneurysm	2
Follow-up for non-colorectal cancer	2
Follow-up for previous colorectal cancer	1
Intestinal fistula	1
Liver metastasis	1
Urine discolouration	1
Hernia	1
Claudication	1

Table 2 Reasons for colonoscopy request

Reason	Frequency
Abdominal pain	26
Altered bowel habits	23
Anaemia	14
Abnormal computed tomography	12
Follow-up for previous colorectal cancer/polyp	9
Rectal bleeding	6
Palpable mass	5
Unknown	4
Liver metastasis	3
Follow-up for diverticulitis	3
Follow-up for inflammatory bowel disease	2
Abscess	2
Metastasis in locations other than the liver	1
Family history of colorectal cancer	1
Obstruction	1
Pseudo-obstruction	1
Weight loss	1

Large bowel stricture	1

Table 3 Correlation between findings of colorectal cancer at computed tomography and those at colonoscopy

Finding	Frequency
True positive	2
True negative	90
False positive	4
False negative	0

Discussion:

The negative predictive value (NPV) of contrast-enhanced CT for colorectal cancer in our study, standing at 100% with a confidence interval of 95–100%, is comparable to that reported for CT colonography, which is approximately 98%. However, it's important to interpret this result cautiously, considering discrepancies in NPV reported in other studies. For instance, one study reported an NPV of 88.1%, indicating potential variability in the diagnostic accuracy of CT for colorectal cancer detection. Thus, while CT can be reassuring in ruling out colorectal malignancy, false negatives do occur, as evidenced by the proportion of patients with suspicious CT findings later confirmed to have cancer during colonoscopy, consistent with findings from prior studies. (Pickhardt et al., 2003)

Our study offers insight into the clinical utility of CT in a diverse range of patient presentations, reflecting its real-world application in demonstrating or excluding colorectal cancer. It's worth noting that our study population, comprised of patients progressing to colonoscopy, likely had a higher likelihood of colorectal cancer compared to those not requiring colonoscopy. (Dixon & Goldstone, 2002)

To date, only a few studies have investigated CT's performance in detecting colorectal cancer in unselected patient groups. However, these studies vary in design and sample size, with limitations such as reliance on clinical follow-up for diagnosis confirmation. Moreover, diagnostic accuracy can be influenced by the prevalence of colorectal cancer within the study population, underscoring the importance of context when interpreting study findings. (Ozel et al., 2010)

Observational studies have reported reasonably high sensitivities and specificities for CT in detecting colorectal cancer, ranging from 75% to 100% and 86% to 96%, respectively. Nonetheless, these studies often lack consistent use of colonoscopy as the gold standard and may utilize older CT scanners with limited image resolution and minimal bowel preparation. (Munikrishnan et al., 2003)

We opted to exclude patients undergoing endoscopy more than 12 months after the initial CT to minimize the possibility of de novo malignancy development during the interval between investigations. While "interval cancers" within a year of the index investigation are rare, they may signify missed lesions during the initial endoscopy. (Mizrahi et al., 2005)

Overall, our study contributes to the understanding of CT's role in colorectal cancer diagnosis, emphasizing the need for further research to refine its diagnostic accuracy and optimize patient management strategies. (Ganeshan et al., 2007)

Conclusions:

Non-targeted CT scans that yield negative results for colorectal malignancy typically provide reassurance; however, the decision for further investigations should be individualized. Factors such as the likelihood of underlying colorectal malignancy and the patient's underlying comorbidities should be carefully considered. This cautious approach is warranted, particularly in light of reported false negative rates in other studies, highlighting the importance of thorough clinical evaluation beyond imaging findings.

Conversely, any suspicion of malignancy raised by CT scans poses a significant risk of colorectal cancer and typically necessitates further investigation. Given the potential implications of a positive CT finding, prompt follow-up and appropriate diagnostic interventions are warranted to ensure timely detection and management of colorectal malignancies.

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