

# Many unexpected abdominal findings on staging computed tomography in patients with colorectal cancer

Kim Holmsted<sup>1,2</sup>, Keld Nørring<sup>1</sup>, Lene Collatz Lastrup<sup>3</sup> & Per Jess<sup>1,2</sup>

## ABSTRACT

**INTRODUCTION:** Computed tomography (CT) was proven to be superior to preoperative abdominal ultrasound in the preoperative setting for detection of hepatic metastases from colorectal cancer (CRC). The higher sensitivity of CT has resulted in a number of unexpected abdominal findings of varying importance; an issue that was previously studied in relation to CT colonography, but not in relation to staging CT with intravenous contrast in CRC patients. The aim of the present study was to evaluate the number and significance of such unexpected findings on staging CTs in CRC patients.

**MATERIAL AND METHODS:** The study comprises a retrospective analysis of 247 consecutive patients who underwent colorectal cancer surgery at Roskilde Hospital, Denmark, in 2009. A preoperative abdominal staging CT was performed in 245 of these patients. All CT scans and patient records were reviewed by the authors. The unexpected CT findings were classified as being of high, moderate or low clinical importance according to whether they required treatment relatively promptly, later or did not require treatment at all, respectively.

**RESULTS:** Overall, 114 patients (47%) had unexpected findings. Nineteen of the 137 findings (14%) or 8% in all patients were considered to be of high importance. Three per cent of all patients had abdominal aortic aneurysms, 2% had CRC metastases to the adrenal glands, 2% primary kidney tumors and 1% gynaecologic tumours. Twenty per cent of the patients had findings of moderate importance and 29% findings of low importance.

**CONCLUSION:** Staging CT in CRC patients showed nearly 8% of unexpected abdominal findings of high clinical importance requiring relatively prompt treatment.

**FUNDING:** not relevant.

**TRIAL REGISTRATION:** not relevant.

Colorectal cancer (CRC) is predominantly a disease of the industrialized Western countries. In Denmark, there are approximately 3,900 new CRC incidences annually [1], and in 2006 it was the second most frequently occurring cancer in both men and women [2]. The majority of the patients are over 50 years of age when diagnosed with CRC and gender incidence is equal [1]. The five-year sur-

vival rates for patients with colonic cancer as well as patients with rectal cancer are approx. 45% [1].

Computed tomography (CT) was proven to be superior to preoperative abdominal ultrasound in the preoperative setting for detection of hepatic CRC metastases and has the advantage of being able to detect abnormalities in organs outside the liver such as the adrenal glands, the kidneys and the aorta [3]. The frequency of unexpected abdominal findings was examined in relation to CT colonography. In a systematic review of 17 studies of CT colonography involving 3,488 patients, Xiong et al [4] described the frequency and the types of incidental lesions found. In total, 40% of the patients had abnormalities and many had several abnormalities. Nearly 14% of the patients had further investigations performed and approximately 1% were treated immediately. In a study of patients undergoing abdominal-pelvic CT with oral contrast, clinically important unexpected findings were seen in 11% [5]. In a 2006 cross-sectional study of 3,259 patients, Lumbreras et al [6] found that 488 revealed unsuspected findings (15%) in an imaging test.

These findings may only be “the tip of the iceberg” as most of the CT examinations were performed without intravenous contrast enhancement and therefore presumably had an inferior image quality compared with CT with intravenous contrast as used in staging CT in patients with CRC [7]. To our knowledge, there are no studies of unexpected extracolonic findings on abdominal staging CTs in CRC patients and the aim of the present study was to examine the number and to evaluate the importance of such unexpected findings on staging CTs with intravenous contrast through a one-year period (2009) at the Department of Colorectal Surgery, Roskilde University Hospital, Denmark.

## MATERIAL AND METHODS

### Material

All 247 patients scheduled for abdominal staging CT prior to colorectal cancer surgery at the Department of Colorectal Surgery, Roskilde Hospital, Denmark, in 2009 were retrospectively included in the study. The patients had either CRC verified by colonoscopic biopsy or were

## ORIGINAL ARTICLE

1) Department of Surgery, Roskilde Hospital,  
2) Faculty of Health Sciences, University of Copenhagen, and  
3) Department of Radiology, Roskilde Hospital

Dan Med Bul  
2011;58(9):A4308

highly suspected for the disease. Two patients were excluded: an 80-year-old man, who was operated acutely for an obstructing T4 colon tumour and died due to sep-

sis in the hospital prior to his staging CT, and a 91-year-old woman, also operated acutely for an obstructing T3 colon tumour, who then denied to have a staging CT performed afterward. Consequently, staging CT scans were performed in 245 patients. The characteristics of the patients are shown in **Table 1**.

TABLE 1

Patient characteristics.	Age, years, median (range)	71 (36-96)
<i>Gender, n (%)</i>		
Male		142 (58)
Female		103 (42)
<i>Cancer site, n (%)</i>		
Right colon		59 (24)
Transverse colon		10 (4)
Left colon		84 (34)
Rectum		72 (30)
No cancer		20 (8)
<i>Cancer dissemination, n (%)</i>		
Non-metastatic disease		194 (79)
Metastatic disease		51 (21)

TABLE 2

Unexpected abdominal findings of high importance on staging computed tomography in 245 patients with colorectal cancer.	Findings	Patients, n (%)
<i>Aortic aneurysm</i>		
	< 5.5 cm	5 (2.0)
	≥ 5.5 cm	3 (1.2)
<i>Adrenal mass ≥ 1 cm</i>		
	CRC metastasis	3 (1.2)
	Adrenal cyst	2 (0.8)
<i>Renal mass ≥ 1 cm</i>		
	Renal cell carcinoma	3 (1.2)
	Renal cyst	1 (0.5)
<i>Gynaecologic mass ≥ 1 cm</i>		
	Benign ovarian mass	1 (0.5)
	Benign uterine tumour	1 (0.5)
	Total	19 (8.0)

CRC = colorectal cancer.

TABLE 3

Unexpected abdominal findings of moderate importance on staging computed tomography in 245 patients with colorectal cancer.

Findings	Patients, n (%)	
	non-metastatic disease (n = 194)	metastatic disease (n = 51)
Gall bladder stones	13 (6.7)	0 (0)
Enlarged and thickened gall bladder	0 (0)	1 (2.0)
Intra/extra hepatic dilatation	0 (0)	5 (9.8)
Inguinal hernia without bowel	7 (3.6)	0 (0)
Arteriosclerotic disease	1 (0.5)	6 (11.8)
Renal stones	6 (3.1)	0 (0)
Hydronephrosis/hydroureter	0 (0)	5 (9.8)
Adrenal adenoma	2 (1%)	0 (0)
Horseshoe kidney	1 (0.4%)	0 (0)
Total	30 (15.5)	17 (33.3)

## Methods

All CT scans were performed with a multi (64) slice CT scanner (Philips Brilliance) with a 1-mm slice thickness. Patients were instructed to drink 1,000 ml of water within 15 minutes prior to the examination and were then placed in the scanner in the supine position. After positioning of the patient, a pre-contrast scan across the liver was performed followed by an examination of the entire thorax and abdomen using 70-100 ml intravenous contrast (Omnipaque 350 mg iodone/ml). Postprocessing was performed as reconstructions of 3-mm slice thickness in the axial, coronal and sagittal plane. All CT scans were evaluated by one of three radiologists. All the CT reports and patient records were reviewed by the authors. Unexpected findings in the lungs were not dealt with in the present study. The unexpected abdominal findings were classified as being of high, moderate or low clinical importance according to the definition used in what is currently the largest study of unexpected findings on CT colonography by Hara et al [8]: Highly important findings included indeterminate adrenal masses of any size, indeterminate masses of at least 1 cm in diameter in a solid organ (e.g. kidney, spleen), likely malignant masses, or lesions that would require relatively prompt medical or surgical treatment (e.g. abdominal aortic aneurysms or inguinal hernia containing bowel). Moderately important lesions included benign findings that may require medical or surgical intervention (e.g. renal stones, gallstones). Lesions of low importance were unlikely to require any future treatment (e.g. renal cysts, calcified granulomas, or indeterminate lesions in solid organs measuring less than 1 cm).

## Statistical analysis

Continuous data are presented as medians and ranges and categorical data are presented as percentages with 95% confidence limits.

*Trial registration:* not relevant.

## RESULTS

The staging CT scans revealed 137 unexpected findings in 114 of the 245 patients (47%, 95% confidence limits: 42-54%). Eighteen patients had more than one unexpected finding (7%, 95% confidence limits: 3-9%). Nineteen of the 137 findings (14%, 95% confidence limits: 8-20%) were considered to be of high importance, 47


 FIGURE 1

Renal cell carcinoma in the right kidney found on preoperative staging computed tomography for colonic cancer (marked with arrows). The colonic cancer at the hepatic flexure is also seen (marked with an asterisk).



(34%, 95% confidence limits: 27-43%) of moderate importance and 70 (51%, 95% confidence limits: 42-59%) of low importance.

The highly important findings were seen in 19 of the 245 patients (8%, 95% confidence limits: 5-12%) (Table 2).

Eight patients (3%) had asymptomatic abdominal aortic aneurysms. Five patients had aneurysms with a diameter below the size criterion of 5.5 cm usually used for surgery for asymptomatic abdominal aneurysms in Denmark [9]. Three patients had aneurysms with a diameter exceeding 5.5 cm. Only one of these patients had a vascular operation after the colonic cancer operation, while the two other patients were considered unfit for vascular surgery because of metastatic disease.

Five patients (2%) had an indeterminate mass > 1 cm in one of the adrenal glands, which in three cases were biotically verified CRC metastases and in two cases benign cysts. None of the patients with metastases underwent surgery due to disseminated disease.

Four patients (2%) had renal masses > 1 cm, which in three cases turned out to be renal cell carcinomas (Figure 1) and in one case a benign cyst. Two of the patients with renal cell carcinoma had a nephrectomy performed together with the colonic resection, while the third patient was found inoperable at the multidisciplinary cancer conference because of the location of the tumour.

There were two cases (1%) with a mass > 1 cm in the female reproductive system, one in an ovary and one in the uterus. Both patients underwent a gynecologic operation simultaneously with the colonic operation and both lesions turned out to be benign tumours at the histological examination.

Forty-seven of the 245 patients (20%, 95% confidence limits: 15-26%) had lesions which were classified as moderately important (Table 3). Some of these findings in patients with disseminated CRC must be interpreted as consequences of the advanced disease (hydronephrosis/hydroureter and intra/extra hepatic dilatation), while other findings such as gall bladder stones, inguinal hernias and renal stones appeared with frequencies in line with those observed in the normal population [10-12].

Seventy-one lesions in the 245 patients (29%, 95% confidence limits: 23-34%) were classified as being of low importance (Table 4).

It should be noted that none of the patients experienced a delayed or poorer treatment due to the unexpected CT findings.

## DISCUSSION

The liver is the most common location of metastases in CRC patients [13]. Ultrasound examination (US) was previously the preferred method for the detection of such metastases. CT has today replaced US as first-choice staging modality in CRC as it has proven to be superior [3]. Because of the greater sensitivity of CT, unexpected abdominal findings now occur in greater numbers than previously. The obvious benefit of this is the improved ability for an early diagnosis of other important diseases with potential cure such as malignant masses in other organs or abdominal aortic aneurysms. For example, the mortality associated with treatment of aortic aneurysm is much lower in elective than in acute surgery [9]. The frequency of unexpected abdominal findings has been examined before in relation to for example CT colonography, but to our knowledge not in relation to staging CT, which is supposed to be a more sensitive technique as intravenous contrast is used.

Eight per cent of the patients in the present study had extracolonic and extrahepatic findings on CRC staging CT classified as highly important. In a study of incidental extracolonic findings at CT colonography, Hara et al [8] found that 11% of the patients had unexpected


 TABLE 4

Findings	Patients, n (%)	Unexpected findings of low importance on staging computed tomography in 245 patients with colorectal cancer.
Hepatic cyst	55 (22)	
Hepatic haemangiomas	5 (2)	
Hepatic steatosis	4 (2)	
Enlarged Liver	2 (1)	
Uterine cyst	2 (1)	
Infarct in the kidney	1 (0.5)	
Infarct in the spleen	1 (0.5)	
Total	71 (29)	

findings classified as highly important. Hellstrom et al [14] found that 23% of the patients had extracolonic findings of major importance on CT colonography. Ginnerup et al [7] demonstrated that 65% had extracolonic abnormalities and that in approximately 12% of the patients, additional workup was indicated after CT colonography. Similarly, in a study of abdomino-pelvic CT using only oral contrast for suspected colorectal carcinoma in frail and disabled patients, Ng et al [5] found that 11% had extracolonic incidental findings that could be considered potentially significant and serious. In a study in which the same method was used, Robinson et al [15] reported that 17% had extracolonic findings of significant abdominal disease. Presumably, some of the differences in the figures from the different studies (8-23%) can be explained by the use of different definitions. For example, Hellstrom et al [14] included lymphadenopathy and liver metastases in their figure of 23% important findings. If they had used our definition of findings, their rate would have been 9% only. Another explanation could be that different patient populations were examined in the different studies.

In the present study we found that 3% of the patients had abdominal aortic aneurysms, which is similar to the findings of Ng et al, who reported 3% [5] and Hara et al 2% [8], though they used lesser sensitive techniques with a helical CT with oral contrast and a single sliced CT scanner without any contrast, respectively. Five patients (2%) had adrenal masses that required further examinations. The same incidence of adrenal masses was found by others [7, 8]. Four patients (1%) had highly important findings in the kidneys which is also similar to the findings in previous studies where CT colonography was used [16]. One per cent of the patients had clinically important findings in the female reproductive system that later turned out to be benign masses at operation. Ng et al reported clinically important findings in the ovaries in 0.3% of patients with CRC [5].

However, the majority of our findings were classified as being of low (51%) or moderate importance (34%) due to the fact that they were obviously benign and/or did not require further investigation or treatment. In comparison, Hara et al found that 52% and 41% of the findings were classified as being of low or moderate importance [8] and Hellstrom et al reported that 53% of the patients had findings of moderate importance [14].

The findings of similar incidences of unexpected abdominal findings in the different studies were somewhat surprising as CT examinations with a single sliced helical scanner with no intravenous contrast or only with oral contrast are supposedly less sensitive than the staging CT with multi-slice scanning and intravenous contrast used in the present study. However, with respect to the

most frequent unexpected important findings such as aortic aneurysms, adrenal, kidney and gynaecologic tumours, it seems that the value of contrast-enhanced CT lies more in its capacity to map the details and to determine the nature of the findings than in identifying them. For example, the capacity to determine whether an aortic aneurysm is undergoing dissection or not [17] and whether a tumour is benign or malignant [18-20].

## CONCLUSION

Staging CT in CRC seems to identify a number of unexpected extracolonic findings close to what other studies have shown using less sensitive CT techniques. Nearly 8% of the findings, mainly aortic aneurysms, adrenal CRC metastases, primary kidney tumours and gynecologic tumours, were of clinically high importance requiring relatively prompt treatment.

**CORRESPONDENCE:** Per Jess, Kirurgisk Afdeling, Roskilde Hospital, 4000 Roskilde, Denmark. E-mail: pjss@regionsjaelland.dk

**ACCEPTED:** 9 June 2011

**CONFLICTS OF INTEREST:** none

## LITERATURE

1. Danish Colorectal Cancer Group. Annual report 2009 (Årsrapport 2009. Landsdækkende database for kræft i tyktarm og endetarm). Danish Colorectal Cancer Group, 2011. www.dccg.dk (20 May 2011).
2. National Danish Board of Health. (Cancer Registry 2005 and 2006 – new figures from the National Board of Health.) Copenhagen: Sundhedsstyrelsen, Sundhedsdokumentation, 2008.
3. Olivia MR, Saini S. Liver cancer imaging: role of CT, MRI, US and PET. *Cancer Imaging* 2004;4(Spec No A):S42-6.
4. Xiong T, Richardson M, Woodroffe R et al. Incidental lesions found on CT colonography: their nature and frequency. *Br J Radiol* 2005;78:22-9.
5. Ng CS, Doyle TC, Courtney HM et al. Extracolonic findings in patients undergoing abdomino-pelvic CT for suspected colorectal carcinoma in the frail and disabled patient. *Clin Radiol* 2004;59:421-30.
6. Lumbreras B, Gonzalez-Alvarez I, Lorente MF et al. Unexpected findings at imaging: predicting frequency in various types of studies. *Eur J Radiol* 2010;74:269-74.
7. Ginnerup PB, Rosenkilde M, Christiansen TE et al. Extracolonic findings at computed tomography colonography are a challenge. *Gut* 2003;52:1744-7.
8. Hara AK, Johnson CD, MacCarty RL et al. Incidental extracolonic findings at CT colonography. *Radiology* 2000;215:353-7.
9. Lindholt JS. Abdominal aortic aneurysms. *Dan Med Bull* 2010;57(12):B4219.
10. Jørgensen T. The epidemiology of gallstones. *Ugeskr Læger* 2005;167:2610-13.
11. Bay-Nielsen M, Kehlet H, Strand L et al. The Danish Hernia Data Base – four years' results. *Ugeskr Læger* 2004;166:1894-8.
12. Osti P, Holm-Bentzen M, Schultz A et al. Renal calculi in the County of Copenhagen. Epidemiological conditions in a hospital material. *Ugeskr Læger* 1987;149:241-3.
13. Isoniemi H, Österlund P. Surgery combined eighth oncological treatments in liver metastases from colorectal cancer. *Scand J Surg* 2011;100:35-41.
14. Hellstrom M, Svensson MH, Lasson A. Extracolonic and incidental findings on CT colonography (virtual colonoscopy). *AJR Am J Roentgenol* 2004;182:631-8.
15. Robinson P, Burnett H, Nicholson DA. The use of minimal preparation computed tomography for the primary investigation of colon cancer in frail or elderly patients. *Clin Radiol* 2002;57:389-92.
16. Yee J, Kumar NN, Godara S et al. Extracolonic abnormalities discovered incidentally at CT colonography in a male population. *Radiology* 2005;236:519-26.
17. Park GM, Ahn JM, Kim DH et al. Distal aortic intramural hematoma: clinical importance of focal contrast enhancement on CT images. *Radiology* 2011;259:100-8.
18. Yip L, Tublin ME, Falcome JA et al. The adrenal mass: correlation of histopathology with imaging. *Ann Surg Oncol* 2010;17:846-52.
19. Leveridge MJ, Bostrom PJ, Koulouris G et al. Imaging renal cell carcinoma with ultrasonography, CT and MRI. *Nat Rev Urol* 2010;7:311-25.
20. Iyer RB, Balachandran A, Devine CE. PET/CT and cross sectional imaging of gynecologic malignancy. *Cancer Imaging* 2007;7:S130-8.