



Clinical utility and cost-effectiveness of routine preoperative computed tomography scanning in patients with colon cancer

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Abstract

Background: The aims of this study were to assess the clinical utility of the practice of routine preoperative CT scanning and to determine its cost-effectiveness in colon cancer patients.

Methods: A 6-year database of colon cancer patients treated at a veterans affairs medical was reviewed to determine the influence of preoperative CT scanning on clinical management. Cost analysis involved comparison of the institutional cost of CT scanning with the cost savings provided by avoiding nontherapeutic operations.

Results: CT scans were obtained in 130 consecutive patients. CT scans provided information that was used in treatment planning in 43 (33%) patients and definitively altered the mode of treatment in 21 (16%) patients. The practice saved the institution \$24,018 over 6 years.

Conclusion: Routine preoperative CT scanning definitively alters treatment in a small number of cases and is cost-effective. © 2005 Excerpta Medica Inc. All rights reserved.

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Colorectal cancer is a major source of morbidity and mortality in the United States with an estimated annual mortality rate of approximately 55,000 deaths per year [1]. In the majority of cases, management includes surgical resection with regional lymphadenectomy and peritoneal exploration to assess for metastatic disease. The preoperative workup for colorectal cancer has evolved considerably over the last 10 to 20 years, particularly in regards to imaging. The use of a routine preoperative abdominal computed tomography (CT) scan and endorectal ultrasound is now the standard of care in rectal cancer [2]. In contrast, the routine use of CT scanning in the preoperative management of patients with cancer of the intraperitoneal colon remains controversial. In a previous report, we showed that routine preoperative CT scanning appears to provide information that assists in operative planning in a significant portion of cases [3]. However, the actual operative or treatment plan is changed in a

much smaller number of cases. The cost-effectiveness of such a strategy is not clear. The aim of this report is to describe the clinical utility and cost-effectiveness of routine preoperative CT scanning for patients with colon cancer.

Materials and Methods

This study was reviewed and approved by the University of Washington Human Subjects Review Committee. From November 1, 1997, to May 31, 2003, 140 consecutive patients were treated for colon cancer at VA Puget Sound Healthcare System (VAPSHCS), Seattle, WA. All patients were referred for preoperative CT scan of the abdomen and pelvis with oral and intravenous contrast as part of a disease-specific clinical pathway. Intravenous contrast was not used for patients with a creatinine ≥ 1.5 mg/dL. Patients were scanned at 5-mm intervals from the diaphragm to the pubic symphysis. CT scan findings used in the study were those dictated by the attending radiologist. Scans were interpreted as positive for hepatic metastases if they showed

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one or more low-attenuation or rim-enhancing solid masses. A scan that did not show any evidence of focal hepatic parenchymal masses, with the exception of simple liver cysts, was considered negative for significant hepatic pathology. At the time of the operation, an attempt was made to correlate all CT findings to intraoperative findings. The medical records and operative notes of these patients were then reviewed to determine the influence of the CT scan on operative planning and to determine if the CT scan qualitatively altered treatment, either by changing the operation, avoiding surgery, or directing the initiation of systemic chemotherapy without a surgical intervention. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Chicago, IL).

Cost analysis

The cost analysis involved a calculation of the total cost of routine CT scanning for each patient in the study and a comparison of this cost with the estimated cost savings provided by the preoperative information derived from CT scanning [4]. Savings were principally derived from avoiding nontherapeutic operations in patients with widely metastatic disease. All cost data were obtained from the Decision Support System, the institutional accounting system at VAPSHCS. The cost of a CT scan for each year between 1997 and 2003 was obtained and designated to each patient accordingly. Cases in which management was definitively altered, and thus resulted in reduction of hospital costs, involved either a palliative approach that eliminated surgery or concurrent resection of pathology discovered on CT scan. To estimate the cost of the operative procedure, three cost components were measured: the cost of nursing, the cost of the surgeon, and the cost to clean the operating room (OR). Each of these costs represented separate units of time and the time spent in the OR ultimately determined the operating room cost.

We also estimated the cost of a projected hospital stay after resection by multiplying the median postoperative stay of patients in the study (nine days) by the average per patient cost on the surgical ward at VAPSHCS. We did not include any intensive care unit care in this analysis. We calculated daily hospital costs by multiplying the cost of various items (basic bed day, acuity 1, acuity 2, acuity 3, acuity 4, and supplies) by their respective volume and dividing the sum of these products by the number of RN bed days. This calculation was performed for each year of the study. Together, the cost of the surgical procedure and the cost of postoperative care represented cost savings derived by avoiding surgical procedures in patients that would have had an operation without benefit of the preoperative CT scan. The total cost of CT scans was then subtracted from this estimate to determine the net cost (or savings) to the institution of routine preoperative CT scanning.

Table 1
Patient clinical characteristics (n = 130)

Clinical characteristics	Number/total (%)
Tumor location	
Cecum	22/130 (17)
Ascending colon	29/130 (22)
Hepatic flexure	13/130 (5)
Transverse colon	6/130 (5)
Splenic flexure	5/130 (4)
Transverse colon and splenic flexure	1/130 (1)
Descending colon	14/130 (11)
Sigmoid colon	39/130 (30)
Cecum and sigmoid colon	1/130 (1)
Pathologic stage	
Unstaged	4/130 (4)
Stage 0	4/130 (4)
Stage 1	20/130 (15)
Stage 2	45/130 (35)
Stage 3	33/130 (25)
Stage 4	24/130 (18)
Clinical presentation	
Obstructed	11/130 (8)
Near obstructed	13/130 (10)
Nonobstructed	106/130 (82)

Results

Patient demographics and clinical characteristics

Between November 1, 1997, and May 31, 2003, 140 consecutive patients were evaluated and treated for colon cancer at our institution. Of these patients, 130 received preoperative CT scans of the abdomen and pelvis per protocol. Ten patients did not receive preoperative CT scans for a variety of reasons including renal insufficiency (two), obstruction (two), and logistical constraints (six).

Of the 130 patients who received a preoperative scan, 126 were men and 4 were women. The mean age of the patients was 67 years. The distribution of anatomic locations and stage at presentation are detailed in Table 1. Two patients had synchronous lesions, one with tumor in the transverse colon and splenic flexure and the other with tumor in the cecum and sigmoid colon. The majority of patients were not obstructed at presentation, with 18% presenting with obstruction or near obstruction.

CT scan findings

The use of a preoperative scan showed a number of clinical characteristics previously unknown to the surgeon (Table 2). The preoperative scan showed clinically significant local extension of the disease in 9% of the cases, a few of which involved multiple organs. The most notable cases involved tumor extension into the duodenum and pancreas, Gerota's fascia, the inferior vena cava, the stomach, small bowel, and spleen. Other anatomic structures affected by local extension are also listed in Table 2. Metastatic disease

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