Postoperative fluid collections after colon resection: the utility of clinical assessment

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**KEYWORDS:** Abscess; CT scan; Colon resection; Fluid collection

Abstract

**BACKGROUND:** Computed tomography (CT) scans often identify postoperative fluid collections of uncertain clinical relevance.

**METHODS:** Consecutive adult patients undergoing colorectal resection and postoperative CT scan from January 1, 2000 to December 31, 2008, at a university teaching hospital were identified from a prospective database. A host of clinical and CT findings were recorded. Fisher’s exact test and logistic regression with univariate and multivariate analysis were used to assess the predictive value of clinical and radiologic variables.

**RESULTS:** Nine hundred six patients had a colon resection during the study period. Fifty-four patients had a postoperative fluid collection, of which 36 were found to be abscesses. Only high clinical suspicion of an abscess predicted the presence of an abscess \( P = .009 \); of the radiologic criteria, only proximity to the anastomosis was predictive \( P = .05 \).

**CONCLUSIONS:** Clinical judgment is superior to radiologic and individual clinical parameters. This finding has the potential to prevent many unnecessary procedures.

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Percutaneous drainage of intra-abdominal abscesses occurring as a complication of colon resection has been a major advance in the management of surgical patients. However, with the ubiquitous use of computed tomography (CT) scanning in postoperative patients, many fluid collections are identified with uncertain clinical significance. Both clinical and radiologic criteria can be used to help determine the probability of infection and the need for the patient to undergo a drainage procedure.

On the one hand, prompt treatment of infectious complications is clearly desirable. On the other hand, overzealous use of percutaneous drainage for postoperative collections that would resolve spontaneously could increase cost, necessitate or prolong hospitalization, and delay return to a normal lifestyle. Further, percutaneous drainage is not without potential complications.

We hypothesized that clinical criteria and judgment could be used to determine which postoperative fluid collections truly require percutaneous drainage. The aim of this study was to determine which clinical and radiologic criteria best predict the probability that a postoperative collection will ultimately be considered to represent an abscess.

**Methods**

Consecutive patients between the ages of 18 to 100 undergoing surgical resection of the colon or rectum by a single surgeon from January 1, 2000, to December 30, 2008, at Fletcher Allen Health Care, the teaching hospital
of the University of Vermont College of Medicine, were identified from a prospectively maintained database. (This included Current Procedural Terminology codes 44140-44162 and 45110-45123.) This list was then cross-referenced against a database of patients who had undergone a CT scan of the abdomen or pelvis during the study to identify all patients who had a CT scan within 30 days of their surgical procedure. Only patients who had a CT scan to assess postoperative patients for the presence an abscess were included in this study. Patients who had a CT scan strictly for cancer staging, had a fluid collection or abscess identified on a preoperative CT scan, or had missing or ambiguous portions of the medical record were excluded from further analysis.

Age, sex, length of stay, admission temperature, maximum temperature within 24 hours of the CT scan, maximum temperature during the hospital stay, white blood cell count at the time of CT scan and on admission, and clinical suspicion of an abscess (high vs low) were recorded. This level of suspicion was assigned based on review of the first note by the surgical team cosigned by the attending physician after patient evaluation. The CT scan report was reviewed for the presence of a fluid collection and a variety of associated fluid characteristics. These included single vs multiple, uniloculated vs multiloculated, rim-enhancing vs nonenhancing, location, proximity to the anastomosis, and overall radiologic impression. If the fluid was drained, gross characteristics were noted (purulent vs not) as well as the bacteriologic result. Any follow-up CT scans were reviewed to determine resolution of the collection, and patients were followed up until clinically well.

Patients were then grouped based on whether or not they had a fluid collection on the CT scan and whether or not the collection was subsequently shown to be an abscess. Patients were deemed to have an abscess if the aspirate had bacterial growth or was described as purulent.

Fisher’s exact test was performed to assess the relationship of the clinical and radiologic variables to the ultimate diagnosis of an abscess. The study was approved by the institutional review board of the University of Vermont College of Medicine.

Results

Nine hundred six patients underwent a resection of the large intestine during the study period. One hundred fifty-two patients underwent a CT scan of the abdomen and pelvis within 30 days of surgery; 72 met the study criteria. Thirty-seven patients were excluded because their CT scans were done for postoperative cancer staging. In 31 cases, the CT scan was ordered by an emergency department provider or nonsurgical physician to evaluate abdominal symptomatology not necessarily believed to represent an abscess (eg, to rule out a hernia or kidney stone). In 12 cases, the medical record was ambiguous or critical data points were missing.

Of the 54 patients with a fluid collection had a temperature greater than 37.5°C at some point during their hospitalization. Forty-three of them were febrile at the time of their CT scan, and 37 had a white blood cell count greater than 11,000 cells/mm³. In 51 patients, there was a high clinical suspicion for an abscess; 39 of these patients were found to have an abscess. Conversely, only 5 of 21 patients with a low clinical index of suspicion were ultimately diagnosed with an abscess.

With respect to the radiologic criteria, 26 were described as having rim-enhancing collections, 7 had no rim enhancement, and no comment was made in 21 cases. As noted in Table 1, 40% of rim-enhancing collections were sterile on aspiration; 29 patients had single fluid collections and 15 were diagnosed as abscesses, 23 patients had multiple collections, and 20 were found to have an abscess. Thirty-five patients had a collection near their surgical anastomosis; 27 of these were abscesses. Of 17 remote collections, only 8 turned out to be an abscess. In 39 of the 72 cases, the radiologist specifically used the word “abscess” in reference to the observed fluid collection(s); 12 of these patients had nonpurulent aspirates that had no growth on culture.

Of the clinical and radiologic criteria that could be used to predict an abscess, only a high clinical index of suspicion for an abscess (P = .009) and proximity of a fluid collection to the surgical anastomosis (P = .05) were associated with the diagnosis of abscess. On logistic regression analysis, clinical suspicion, proximity to the anastomosis, and white
blood cell count at the time of the CT scan were predictive (Table 2).

**Comments**

There is little disputing the value of CT scanning in assessing the postoperative patient for a surgical complication.7–11 Further, patients who suffer a postoperative abscess benefit greatly from the availability of radiologic drainage.12,13 But CT scans are ordered so frequently and the resolution of modern scanners is so good that there is a very real risk of overdiagnosis and overtreatment. Specifically, fluid collections may be identified and drained that would have resolved spontaneously without invasive intervention. Proper patient selection is critical for safe, cost-effective management.

This study revealed that approximately three quarters of patients undergoing a CT scan after colorectal resection to rule out a postoperative abscess will have 1 or more fluid collections identified. Two thirds of these collections were ultimately diagnosed as abscesses. Of the clinical and laboratory criteria, the clinician’s index of suspicion for an abscess was the best predictor of an abscess; white blood cell count at the time of the CT scan was also useful. Of the radiologic criteria, only proximity of the collection to the surgical anastomosis predicted the diagnosis of an abscess. Of note, 40% of rim-enhancing collections were not abscesses. In addition, approximately 30% of collections that were interpreted as abscesses by the attending radiologist were found to be sterile, nonpurulent collections when aspirated. Presumably, these patients could have been spared the pain and expense of an invasive procedure and catheter drainage.

We do not wish to denigrate the value of CT scan as an imaging study in this setting or the benefit of percutaneous drainage of postoperative abscesses; in fact, they have indisputably been major additions to the armamentarium of surgeons who treat colorectal disease.14–21 Rather, the adage of “treat the patient, not the x-ray” still applies even today. Radiologic findings in isolation should not necessarily guide management decisions. In a recent study assessing the ability of radiologists to diagnose infection in intra-abdominal fluid collections based on multidetector CT scans, the sensitivity was 83.4% and the specificity was only 39.3%. Only fluid collections with gas or high attenuation fluid predicted infection on logistic regression; similar to this study, rim enhancement did not correlate with the diagnosis of an abscess. It has been concluded that the ability of even modern CT scans to predict infection is “limited.”22 Expectant management in many patients can prevent overuse of resources and avoid the disability that can be associated with catheter drainage.23

There are a number of limitations that are inherent in this type of analysis. Postoperative fluid collections actually represent a spectrum of clinical entities. How do we really define an “abscess”? If a postoperative collection is comprised of serosanguineous fluid with a few bacteria on Gram stain and culture, is it actually an abscess? Do we really know the natural history of this collection? Did it really need to be drained percutaneously?

In this study it was presumed that if the fluid collection identified on CT scan is an abscess, drainage was likely required. But it is clear that most smaller abscesses will

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**Table 1** Characteristics of the groups after computed tomography scan

<table>
<thead>
<tr>
<th>CT result</th>
<th>Fluid collection, abscess</th>
<th>Fluid collection, no abscess</th>
<th>No fluid collection</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>36</td>
<td>18</td>
<td>18</td>
<td>72</td>
</tr>
<tr>
<td>Mean age</td>
<td>54.9</td>
<td>55.3</td>
<td>50.2</td>
<td>53.8</td>
</tr>
<tr>
<td>Sex (m/f)</td>
<td>24/12</td>
<td>8/10</td>
<td>8/10</td>
<td>40/32</td>
</tr>
<tr>
<td>Number Undergoing percutaneous drainage</td>
<td>31</td>
<td>5</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Number with rim enhancement</td>
<td>22/23*</td>
<td>4/10†</td>
<td>N/A</td>
<td>26/33</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>16.9</td>
<td>25.8</td>
<td>22.3</td>
<td>20.3</td>
</tr>
</tbody>
</table>

*Thirteen not specified in report.
†Eight not specified in report.

**Table 2** Predictors of the diagnosis of an abscess (logistic regression)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Clinician*</th>
<th>Anastomosis†</th>
<th>CT wbc‡</th>
<th>Tmax§</th>
<th>CT temperature∥</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odds ratio</td>
<td>4.96</td>
<td>3.79</td>
<td>1.06</td>
<td>1.08</td>
<td>.92</td>
</tr>
<tr>
<td>P value</td>
<td>.006</td>
<td>.03</td>
<td>.04</td>
<td>.83</td>
<td>.76</td>
</tr>
</tbody>
</table>

CT = computed tomography.
*Clinician means attending surgeon suspicion that patient has abscess prior to CT.
†Anastomosis means proximity of fluid collection to anastomosis.
‡CT wbc means patient white blood cell count within 24 hours of CT.
§Tmax means patient maximum temperature during hospital stay.
∥CT temp means patient maximum temperature within 24 hours of CT.
resolve with antibiotics alone and even larger collections may remit spontaneously in a patient who is otherwise clinically well. In this context, interpretation of the literature regarding percutaneous drainage is extremely difficult, because the central question is really whether the collection would have resolved without a drainage procedure, rather than the character of the fluid aspirated. In other words, the patient might have had the same outcome without the discomfort, expense, and risk of an invasive procedure. Most patients go home with a drain in place, typically necessitating home health care visits and follow-up imaging studies, which may cause pain and considerable inconvenience.

Other specific limitations of this study include that it is a single center study involving a single surgeon, which limits generalizability. Further, there were a number of different radiologists involved without a standardized reporting template. As such, incorrect inferences in interpreting the radiologic reports may have been made. In addition, many other clinical, laboratory, and radiologic criteria could have been assessed for their predictive value.

Conclusions

It can be concluded that careful clinical assessment remains the key to managing postoperative fluid collection identified on CT scans in patients who have undergone colon resection. Surgeons and interventional radiologists should work collaboratively in deciding which patients require drainage, and reliance on radiologic criteria in isolation can lead to overuse of interventional procedures at substantial cost to the patient.

References