Pathological reporting of colorectal cancer specimens: a retrospective survey in an academic Canadian pathology department

Nancy G. Chan, MD,* Anil Duggal, MD;† Michele M. Weir, MD;* David K. Driman, MBChB*

Objective: To survey and improve the pathological reporting of colorectal cancer (CRC) specimens in a tertiary care pathology department. Methods: We identified CRC specimens reported in a 6-month period before and after educational sessions and the introduction of a standardized CRC synoptic reporting protocol. Gross and microscopic descriptions were analyzed according to published guidelines for important staging and prognostic features. We then reexamined these parameters for a further 6-month period 15 months later to ensure that the quality of reporting had been maintained. Results: In total, 108 and 166 cases were analyzed before and after standardization, respectively. Many features were reported appropriately, including tumour size, type and grade, depth of invasion, nodal status and proximal and distal margin status. Several underreported features showed significant improvement after standardization, including serosal involvement (reporting increased from 22% to 84%), distance to radial margin (from 14% to 64%), extramural venous invasion (from 18% to 88%), host response (from 19% to 94%) and mean number of nodes retrieved (mean numbers retrieved increased from 11 to 16). The subsequent review 15 months later showed continued long-term improvement in these areas. Conclusion: Education and synoptic reporting significantly improved CRC reporting at our centre.

Colorectal cancer is the second leading cause of cancer-related deaths in North America, with over 19 000 new cases and 8000 deaths in Canada every year.1 The vast majority of patients undergo surgery with the intent for cure. The pathologist plays a critical role in the management of the colorectal cancer patient because accurate treatment decisions rest on the results of pathological examination of resected specimens.
specimens. Our objective in this study was to assess the pathological reporting of colorectal cancer specimens in a high-volume, tertiary care, academic pathology department, from the perspective of the recommendations of the College of American Pathologists (CAP) and to assess the effects of an educational program and introduction of standardized, synoptic-based reporting.

Methods

The initial retrospective review included all colorectal carcinoma specimens reported at our institution in a 6-month period ending in November 2002 and identified by a computer search. We analyzed the reports for the specific staging and prognostic features included in the CAP guidelines for the reporting of CRC. These parameters were classified as either gross (macroscopic) or microscopic, reflecting the 2 main stages of specimen processing. Gross features examined were tumour size, status of the serosa, measured distance of tumour to proximal, distal and radial margins and depth of mesenteric or perirectal soft tissue. Microscopic features assessed were histological type, histological grade, depth of invasion, serosal involvement, lymphovascular space (small vessel) invasion, extramural venous (large vessel) invasion, perineural invasion, host response, proximity of tumour to proximal, distal and radial resection margins and lymph node status.

Included in this list of parameters are some that are not specifically required by the CAP. We included some, such as host response, for the sake of academic completeness. We felt it was important to include others such as serosal status and depth of mesenteric or perirectal soft tissue. Because of the importance of accurate documentation of serosal involvement in colonic cancer, it is necessary to specifically target areas suspicious for this at gross examination so that appropriate histological sections can be made. Recording the depth of mesenteric or perirectal fat is a potentially useful gross descriptor that may correlate with lymph node yield.

After we evaluated these reports, educational sessions were given to pathologists, residents and pathologists’ assistants. Important aspects of gross examination and microscopic reporting as outlined in the CAP guidelines were reviewed. Anatomical diagrams showing the relation of the serosal coverings of the colon, checklists and grossing templates for CRC were placed at each prosector’s bench to act as visual aids. Continued reminders for reporting of various parameters were discussed at departmental rounds. To facilitate the reporting of microscopic findings, we constructed synoptic reports in which a checklist highlighted the important staging and prognostic features. Initially, the checklist was a paper document completed by the pathologist and then transcribed by the transcriptionist, who incorporated it into a synoptic form that was inserted into the pathology report. Our department has subsequently moved to an electronic synoptic reporting form incorporated into our laboratory information system.

Educational sessions also focused on the importance of finding as many lymph nodes as possible in a resection specimen; it was stressed that at least 12 nodes were needed to accurately predict regional node status. When fewer than 12 nodes were found, resection of the specimen by either the same or a different prosector was encouraged. A lymph node highlighting solution was also made available for use when fewer than 12 lymph nodes were found. This solution is used after formalin fixation and has been previously demonstrated to have low toxicity and good efficacy.

After implementing the standardization strategies, we reviewed CRC specimens in a subsequent 6-month period ending August 2003 for the same gross and microscopic features. Using $\chi^2$ analysis, we compared our findings with the original outcomes. Using a paired $t$ test analysis, we compared the mean number of lymph nodes found before and after standardization. We then repeated the process 2 years later (ending May 2006) to assess whether the quality of reporting had been maintained over time.

Results

For the 6-month period ending in November 2002, 108 cases of CRC were retrieved: 64 colonic and 44 rectal tumours. The gross examinations were performed by pathologists, residents and pathologists’ assistants. Although features such as tumour size and the distances of tumour from proximal and distal resection margins were well reported (in 100% of the cases), other features such as involvement of serosa (in 22%), distance of tumour from resection radial margin (in 14%) and depth of mesenteric or perirectal soft tissue (in 9%) were underreported (Table 1).

Microscopic features that were consistently well reported (in 98%–100% of the cases) included tumour histological type, depth of invasion, lymph node status, assessment of proximal and distal resection margins and histological tumour grade. Features that were underreported (in 7%–81%) included lymphovascular space invasion, extramural venous invasion, perineural invasion, host response and radial resection margin status (Table 2).

After standardization, 116 CRC cases were retrieved: 81 colonic and 35 rectal tumours. Gross examinations were performed by a similar mix of pathologists, residents and pathologists’ assistants. There were statistically significant improvements in all underreported gross parameters (64%–84%), which included involvement of serosa, distance of tumour to radial resection margin and depth of mesentery or perirectal soft tissue (Table 1). Statistically significant
improvements in reporting of microscopic features (88%–99%) included lymphovascular space invasion, radial resection margin status, extramural venous invasion, perineural invasion and host inflammatory response (Table 2).

Prior to standardization, the mean number of nodes recovered from each resection specimen was 11 (standard deviation [SD] 7); this increased to 16 (SD 8) \((p < 0.001)\) after standardization. The percentage of cases with 12 or more lymph nodes found was 39% before and 68% after standardization \((p < 0.001, \text{Table 3})\).

A subsequent 6-month review undertaken 15 months later revealed 113 cases, including 87 colonic and 26 rectal adenocarcinomas. Reporting of gross parameters continued to improve in comparison with results shortly after standardization (Table 1). An improvement in reporting of microscopic features was achieved, with 100% of cases meeting parameters on the synoptic report (Table 2). The mean number of lymph nodes recovered from each specimen increased to 18 (SD 10); in 81% of the cases, 12 or more lymph nodes were found.

**Discussion**

Pathologists play an important role in the care of colorectal cancer patients, since accurate staging, prognostic information and treatment decisions are based on the results of pathological examination and reports. Our study goals were to review colorectal cancer pathology reports at a high-volume, tertiary care academic pathology department, from the perspective of the CAP recommendations and to standardize CRC reporting.

Our results show that education and the use of grossing templates and synoptic reports significantly improved CRC pathology reporting. Gross features such as the presence or absence of serosal involvement, distance to the radial margin and depth of mesenteric or perirectal soft tissue were underreported. Appropriate sectioning for the detection of serosal penetration is important for accurate staging. Recording the depth of surrounding mesenteric or perirectal soft tissue provides a reflection of potential lymph node yield.

### Table 1

**Gross features reported before and after standardization**

<table>
<thead>
<tr>
<th>Feature reported</th>
<th>Time relative to standardization: no. (and %)</th>
<th>(p) (2002 v. 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td></td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Distance: tumour to proximal and distal resection margins</td>
<td>108 (100)</td>
<td>116 (100)</td>
</tr>
<tr>
<td>Involvement of serosa</td>
<td>24 (22)</td>
<td>97 (84)</td>
</tr>
<tr>
<td>Distance: tumour to radial resection margin</td>
<td>15 (14)</td>
<td>74 (64)</td>
</tr>
<tr>
<td>Depth of mesenteric/perirectal soft tissue</td>
<td>10 (9)</td>
<td>74 (64)</td>
</tr>
</tbody>
</table>

**Table 2**

**Microscopic features reported before and after standardization**

<table>
<thead>
<tr>
<th>Feature reported</th>
<th>Time relative to standardization: no. (and %)</th>
<th>(p) (2002 v. 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>Histological tumour type</td>
<td>108 (100)</td>
<td>116 (100)</td>
</tr>
<tr>
<td>Histological grade of tumour</td>
<td>106 (98)</td>
<td>116 (100)</td>
</tr>
<tr>
<td>Depth of Invasion</td>
<td>108 (100)</td>
<td>116 (100)</td>
</tr>
<tr>
<td>Lymph node status</td>
<td>108 (100)</td>
<td>116 (100)</td>
</tr>
<tr>
<td>Lymphovascular invasion</td>
<td>87 (81)</td>
<td>113 (97)</td>
</tr>
<tr>
<td>Radial margin status</td>
<td>54 (50)</td>
<td>115 (99)</td>
</tr>
<tr>
<td>Extramural venous invasion</td>
<td>19 (18)</td>
<td>102 (88)</td>
</tr>
<tr>
<td>Perineural invasion</td>
<td>8 (7)</td>
<td>102 (88)</td>
</tr>
<tr>
<td>Host response</td>
<td>21 (19)</td>
<td>109 (94)</td>
</tr>
</tbody>
</table>

**Table 3**

**Lymph node yield before and after standardization**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before</th>
<th>After</th>
<th>(p) (2002 v. 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of lymph nodes, mean (and SD)</td>
<td>11 (7)</td>
<td>16 (8)</td>
<td>18 (10)</td>
</tr>
<tr>
<td>Percentage of cases with 12+ nodes</td>
<td>39</td>
<td>68</td>
<td>81</td>
</tr>
</tbody>
</table>

SD = standard deviation.
Underreported microscopic parameters included radial resection margin status, extramural venous invasion and host inflammatory response. Large venous invasion should be reported separately from small lymphovascular space invasion because venous invasion indicates risk for hepatic metastases, while lymphovascular invasion indicates risk for lymph node metastases. Perineural invasion reflects infiltrative growth and has been shown to be an independent indicator of poor prognosis. Host response, an indicator of good prognosis, includes lymphocytes at the edge of the tumour, Crohn-like lymphocytic aggregates and intratumoral lymphocytes.5

Prior to standardization, the number of lymph nodes collected from each specimen was just below the recommended minimum of 12; after standardization, this improved to a mean of 16 (and then 18) nodes, and the proportion of cases with 12 or more nodes found more than doubled. This parameter is of particular importance because studies have shown that a minimum of 12 nodes is needed to accurately predict regional node status.5–8 The detection of even a single positive lymph node is sufficient to refer the patient for adjuvant chemotherapy and is the most important determinant of survival.9 The variability in the number of nodes recovered may reflect specimen size, the amount of pericolic or perirectal tissue, individual anatomical variability, surgical technique and the skill of the prosector; however, many lymph nodes, particularly those 1–2 mm in size are often missed.10 The increase in lymph node yield was due to recognition of the minimum number of lymph nodes recommended for reporting, the re-examination of specimens with fewer than 12 lymph nodes and the use of a lymph node highlighting solution, a simple and inexpensive aid in this task.9

At our institution, the need for continued improvement in the reporting of some parameters, especially various gross features, is being addressed by continued education of staff through rounds, diagrams at each prosector’s desk and reminders to take a second look at all CRC resection specimens with fewer than 12 lymph nodes. A recent survey of Ontario pathologists (published in 2004)11 showed that only 57.9% of pathologists were aware of guidelines for lymph node retrieval in CRC specimens, with only 25.0% able to identify that a minimum 12 nodes are necessary to predict node negativity. Another report showed that 73% of 8848 CRC cases were designated as node-negative from the assessment of fewer than 12 nodes.12 Barriers specific to retrieval of greater numbers of lymph nodes in CRC specimens have included not only unfamiliarity with recommendations but also time pressures and shortage of personnel, as well as specimens with minimal mesenteric or perirectal soft tissue.11

Continued education regarding updated guidelines for proper assessment of surgical specimens is important; however, it may not always translate into altered or improved practices. If new guidelines are to be implemented successfully, physician and workplace factors necessary for their adoption must be considered.13 At our institution, we successfully implemented the new guidelines for reporting CRC by presenting them with supportive data, by continued reminders for reporting various parameters at departmental rounds and by introducing a user-friendly synoptic checklist. It is also possible that audits administered by Cancer Care Ontario (the provincial body through which the Ontario Cancer Registry collects data on cancer patients and cancer reporting) introduced during the second follow-up period further enhanced compliance.

Surveys of surgeons and oncologists at our institution have shown that the synoptic reports are well accepted as standardized reports because they provide easy access to all relevant information. Feedback from pathologists, residents and secretarial staff has also been favourable. The effectiveness of our educational program and the introduction of synoptic reporting has also been demonstrated by data from Cancer Care Ontario.14

In conclusion, for the processing and diagnosis of CRC cases, our data demonstrate the clinical value of implementing a standardized procedure including synoptic reporting and illustrate how education and workplace modifications play a role in improving cancer reporting.

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Competing interests: None declared.

Contributors: Drs. Duggal and Driman designed the study. Drs. Chan and Duggal acquired the data. All authors analyzed the data, wrote and reviewed the article and gave final approval for its publication.

References


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**Canadian Surgery FORUM canadien de chirurgie**

The Canadian Surgery FORUM canadien de chirurgie will hold its annual meeting from Sept. 11 to 14, 2008, in Halifax, Nova Scotia. This interdisciplinary meeting provides an opportunity for surgeons across Canada with shared interests in clinical practice, continuing professional development, research and medical education to meet in a collegial fashion. The scientific program offers material of interest to academic and community surgeons, residents in training and students.

The major sponsoring organizations include the following:

- The Canadian Association of General Surgeons
- The Canadian Society of Colon and Rectal Surgeons
- The Canadian Association of Thoracic Surgeons
- The Canadian Society of Surgical Oncology

Other participating societies include the American College of Surgeons, the Canadian Association of Surgical Chairmen, the Canadian Association of University Surgeons, the Canadian Hepato-Pancreato-Biliary Society, the Canadian Undergraduate Surgical Education Committee, Doctors Nova Scotia, the James IV Association of Surgeons, the Ontario Association of General Surgeons and the Trauma Association of Canada.

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**Canadian Surgery FORUM canadien de chirurgie**

La réunion annuelle du Canadian Surgery FORUM canadien de chirurgie aura lieu du 11 au 14 septembre 2008 à Halifax en Nouvelle Écosse. Cette réunion interdisciplinaire permet aux chirurgiens de toutes les régions du Canada qui s’intéressent à la pratique clinique, au perfectionnement professionnel continu, à la recherche et à l’éducation médicale d’échanger dans un climat de collégialité. Un programme scientifique intéressera les chirurgiens universitaires et communautaires, les résidents en formation et les étudiants.

Les principales organisations qui parrainent cette réunion sont les suivantes :

- L’Association canadienne des chirurgiens généraux
- La Société canadienne des chirurgiens du côlon et du rectum
- La Société canadienne de chirurgie thoracique
- La Société canadienne d’oncologie chirurgicale

Le American College of Surgeons, le Canadian Association of Surgical Chairmen, l’Association canadienne des chirurgiens universitaires, le Canadian Hepato-Pancreato-Biliary Society, le Comité canadien de l’éducation chirurgicale de premier cycle, Doctors Nova Scotia, l’Association des chirurgiens James IV, le Ontario Association of General Surgeons, et l’Association canadienne de traumatologie sont au nombre des sociétés qui appuient cette activité.

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