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

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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 retreived 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.

Objectif : Examiner et améliorer la production de rapports de pathologie portant sur des spécimens de cancer colorectal (CCR) dans un département de pathologie en soins tertiaires. **Méthodes :** Nous avons relevé les spécimens de CCR qui ont fait l'objet d'un rapport au cours d'une période de six mois avant et après les séances de formation et la mise en œuvre d'un protocole normalisé de production de rapports synoptiques sur le CCR. Nous avons analysé les descriptions macroscopiques et microscopiques en fonction des lignes directrices publiées pour les caractéristiques principales de la détermination du stade et du pronostic. Nous avons ensuite réexaminé ces paramètres pendant 6 autres mois 15 mois plus tard pour assurer que la qualité des rapports s'était maintenue. **Résultats :** Au total, nous avons a analysé 108 et 166 cas avant et après la normalisation, respectivement. Beaucoup de caractéristiques ont été décrites de façon appropriée, y compris la taille, le type et le grade de la tumeur, la profondeur de l'envahissement, l'état des ganglions et l'état des marges proximales et distales. Plusieurs caractéristiques sous-déclarées ont montré une amélioration importante après la normalisation, y compris l'atteinte de la séreuse (les rapports sont passés de 22 % à 84 %), la distance jusqu'à la marge radiale (de 14 % à 64 %), l'envahissement veineux extramural (de 18 % à 88 %), la réaction de l'hôte (de 19 % à 94 %) et le nombre moyen de ganglions extraits (qui est passé de 11 à 16). L'examen ultérieur effectué 15 mois plus tard a révélé une amélioration de longue durée continue dans ces domaines. **Conclusion :** La formation et la production de rapports synoptiques ont amélioré considérablement la production de rapports sur le CCR à notre 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

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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)[2] 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.[2] 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,[3] 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, redissection 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.[4]

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 χ^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 ($p < 0.001$, 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

Feature reported	Time relative to standardization; no. (and %)						*p* (2002 v. 2003)
	Before		After				
	Jun–Nov 2002 *n* = 108		Mar–Aug 2003 *n* = 116		Dec–May 2005–6 *n* = 113		
Tumour size	108	(100)	116	(100)	113	(100)	NA
Distance: tumour to proximal and distal resection margins	108	(100)	116	(100)	113	(100)	NA
Involvement of serosa	24	(22)	97	(84)	104	(92)	< 0.001
Distance: tumour to radial resection margin	15	(14)	74	(64)	88	(78)	< 0.001
Depth of mesenteric/ perirectal soft tissue	10	(9)	74	(64)	106	(94)	< 0.001

NA = not applicable

Table 2

Microscopic features reported before and after standardization

Feature reported	Time relative to standardization; no. (and %)						*p* (2002 v. 2003)
	Before		After				
	Jun–Nov 2002 *n* = 108		Mar–Aug 2003 *n* = 116		Dec–May 2005–6 *n* = 113		
Histological tumour type	108	(100)	116	(100)	113	(100)	NA
Histological grade of tumour	106	(98)	116	(100)	113	(100)	0.446
Depth of Invasion	108	(100)	116	(100)	113	(100)	NA
Lymph node status	108	(100)	116	(100)	113	(100)	NA
Proximal and distal margin status	108	(100)	116	(100)	113	(100)	NA
Lymphovascular invasion	87	(81)	113	(97)	113	(100)	0.002
Radial margin status	54	(50)	115	(99)	113	(100)	< 0.001
Extramural venous invasion	19	(18)	102	(88)	113	(100)	< 0.001
Perineural invasion	8	(7)	102	(88)	113	(100)	< 0.001
Host response	21	(19)	109	(94)	113	(100)	< 0.001

NA = not applicable

Table 3

Lymph node yield before and after standardization

Parameter	Before	After		*p* (2002 v. 2003)
	Jun–Nov 2002	Mar–Aug 2003	Dec–May 2005–6	
No. of lymph nodes, mean (and SD)	11 (7)	16 (8)	18 (10)	< 0.001
Percentage of cases with 12+ nodes	39	68	81	< 0.001

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 then 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.[6–8] 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.[4]

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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