Concordance with national guidelines for colorectal cancer care in New South Wales: a population-based patterns of care study

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ABSTRACT

Objective: To investigate predictors of evidence-based surgical care in a population-based sample of patients with newly diagnosed colorectal cancer.

Design, patients and setting: Prospective audit of all new patients with colorectal cancer reported to the New South Wales Central Cancer Registry between 1 February 2000 and 31 January 2001.

Main outcome measures: Concordance with seven guidelines from the 1999 Australian evidence-based guidelines for colorectal cancer; predictors of guideline concordance; the mean proportion of relevant guidelines followed for individual patients.

Results: Questionnaires were received for 3095 patients (91.6%). Between 0 and 100% of relevant guidelines were followed for individual patients (median, 67%). Concordance with individual guidelines varied considerably. Patient age independently predicted non-concordance with guidelines for adjuvant therapy and preoperative radiotherapy. Adjuvant chemotherapy was more likely if a patient with node-positive colon cancer was treated in a metropolitan hospital or by a general surgeon. Surgeons with a high caseload or specialty in colorectal cancer were more likely to perform colonic pouch reconstruction, prescribe thromboembolism or antibiotic prophylaxis, and were less likely to refer patients with high-risk rectal cancer for adjuvant radiotherapy. Bowel preparation was less likely among older patients and in high-caseload hospitals.

Conclusion: Effective strategies to fully implement national colorectal cancer guidelines are needed. In particular, increasing the use of appropriate adjuvant therapy should be a priority, especially among older people.

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Colorectal cancer is the commonest internal malignancy and second most common cause of cancer death in New South Wales.[1] Surgery is the mainstay of treatment, with adjuvant chemotherapy and radiotherapy for specific subgroups of patients.

In 1999, the National Health and Medical Research Council (NHMRC) released evidence-based clinical practice guidelines for colorectal cancer.[2] It was anticipated that adopting the guidelines would reduce variations in care and improve clinical outcomes and quality of life.

Release of guidelines does not guarantee their adoption. To develop strategies to promote guideline uptake, a detailed understanding of variations in clinical practice and their determinants is needed. This study was undertaken to provide a population-based description of care for people with colorectal cancer in NSW in the 12 months after the release of the 1999 guidelines. For the first 3 months, data were collected throughout Australia.[3-5] This article presents multivariable analyses of the 12 months of NSW data, aiming to identify factors that predict the provision of care in accordance with recommendations.

METHODS

All new patients with colorectal cancer reported to the NSW Central Cancer Registry between 1 February 2000 and 31 January 2001 were included.[6] As each patient was registered, a questionnaire was mailed to their surgeon to obtain clinical information and referral details. Medical and radiation oncologists were then asked to complete a questionnaire about adjuvant therapy.

The questionnaires addressed 23 of 46 recommendations in the NHMRC guidelines.[2] Of these, 13 that were supported by Level I (meta-analyses of randomised controlled trials) or Level II (randomised controlled trial) evidence were considered for this study. Where several guidelines related to the same aspect of care, the guideline with the most direct consequences for patient care was selected. For example, two guidelines pertained to thromboembolic prophylaxis; one recommended thromboembolic prophylaxis, and one stated that unfractionated heparin, low molecular weight heparin, and intermittent calf compression are all effective. In this case, only the guideline recommending thromboembolic prophylaxis was included.

Overall, seven guidelines that addressed different aspects of surgical care and had direct implications for patient outcomes were selected for specific study:

- Colonic pouch reconstruction is recommended following resection of low rectal cancer;
- Patients with resected node-positive colon cancer should be offered adjuvant therapy;
- Combined modality therapy or radiotherapy is indicated for patients with high-risk rectal cancer;
- Preoperative radiotherapy is indicated for patients with fixed or tethered rectal cancer if it is felt that down-staging will enable successful resection;
- Preoperative prophylactic antibiotics are recommended;
- Deep venous thromobosis (DVT) prophylaxis is recommended; and
- Routine preoperative mechanical bowel preparation is not supported.

For guidelines relating to adjuvant therapy, care was considered concordant if a patient was referred for consideration of chemotherapy or radiotherapy, or declined referral. For other guidelines, care was considered concordant only if the guideline was actually followed.

Analysis

Surgeons were identified as specialist colorectal surgeons if they were members of the Colorectal Surgical Society of Australia and New Zealand. Other surgeons were considered general surgeons. Surgeon and hospital caseloads were calculated as the number of patients entered into the study who had a surgical procedure, both for any colorectal cancer, and for rectal cancer separately.

Bivariate associations between guideline concordance and the following patient, surgeon and hospital characteristics were assessed: patient age, patient sex, presentation type (screening or symptomatic), admission type (elective or emergency), can-

1 Characteristics of 2984 colorectal cancer patients who had surgery

Characteristic	*n*	(%)
Age (years)		
< 60	667	(22.4%)
60–69	794	(26.6%)
70–79	994	(33.3%)
⩾ 80	529	(17.7%)
Sex		
Male	1709	(57.3%)
Female	1275	(42.7%)
Accessibility to health services		
Highly accessible	2490	(83.4%)
Accessible	425	(14.2%)
Moderately accessible	47	(1.6%)
Remote/very remote	22	(0.7%)
Number of primary cancers		
1	2811	(94.2%)
2	155	(5.2%)
> 2	18	(0.6%)
Dukes classification*		
A	811	(27.2%)
B	827	(27.7%)
C	827	(27.7%)
D	477	(16.0%)
Unknown	42	(1.4%)
Mode of presentation		
Elective	2494	(83.6%)
Emergency	352	(11.8%)
Screening	138	(4.6%)
Specialty of surgeon		
Colorectal surgeon	1211	(40.6%)
General surgeon	1765	(59.1%)
Gastroenterologist	8	(0.3%)
Type of hospital		
Principal referral	987	(33.1%)
Other public	811	(27.2%)
Private	1135	(38.0%)
Unknown	51	(1.7%)

* Classification of most advanced tumour if more than one. ◆

cer site, cancer stage (Dukes classification), number of primary tumours (one or more), intent of surgery (curative or palliative), hospital location (metropolitan or rural), colorectal or general surgeon, surgeon caseload, hospital type (principal referral, other public, or private), and hospital caseload.

We conducted logistic regression modelling using generalised estimating equations with an exchangeable correlation matrix to identify independent predictors of concordance with individual recommendations, after accounting for patient clustering by surgeon. Variables with $P < 0.25$ in bivariate analyses were entered into the model. Hospital and surgeon caseloads and surgical specialty were entered into all full models regardless of bivariate significance. A manual backwards stepwise approach was used to eliminate variables in order of least significance. Only variables that were significant were retained in the final model. All analyses were undertaken using SAS, version 9.1 (SAS Institute Inc, Cary, NC, USA).

For a summary measure of concordance with the recommendations, each guideline was identified as being relevant or irrelevant for each patient based on clinical criteria. The proportion of relevant guidelines followed was calculated for each patient.

Ethics approval

This study was approved by the Human Research Ethics Committee of the Cancer Council NSW.

RESULTS

Between 1 February 2000 and 31 January 2001, 3443 new cases of colorectal cancer were notified. Of these, 66 patients were ineligible (36 did not have colorectal cancer; 9 were treated outside NSW; 21 had previous colorectal cancer). The treating doctor was unknown for 63 eligible patients (1.9%), precluding mailing of a questionnaire, and no response was received from doctors treating 219 eligible patients (6.5%). Responses were received for 3095 of 3377 eligible patients (91.6%) from 268 surgeons, and included care provided at 129 hospitals. There were no important differences in age, sex or accessibility to health services between patients for whom a questionnaire was or was not completed (data not shown).

Surgery was performed for 2984 patients (96.4% of those with a completed questionnaire) by 251 surgeons. Patient, disease and provider characteristics for these patients are summarised in Box 1. The median colorectal cancer caseloads were 5 for surgeons (range, 1–86; interquartile range [IQR], 2–14) and 12.5 for hospitals (range, 1–156; IQR, 4–35); for rectal cancer only, they were 3 (range, 1–44; IQR, 1–8) and 5 (range, 1–66; IQR, 2–16), respectively.

Seven hospitals that did not admit any patients having surgery were excluded from hospital-level analyses.

Concordance with guidelines

Box 2 presents the results of the logistic regression, including only the significant predictors of concordance.

Colonic pouch reconstruction

Of 581 patients who had a low anterior resection or ultra-low anterior resection, 169 (29.1%; 95% CI, 23.4%–35.5%) had a colonic pouch reconstruction. Patients who had surgery with curative intent or who were treated by colorectal surgeons were more likely to receive colonic pouch reconstruction after low anterior resection. Neither hospital caseload nor surgeon caseload was a significant predictor of concordance with this guideline.

This guideline had the second highest intracluster correlation coefficient (0.29), which is consistent with the practice of colonic pouch reconstruction being more common among colorectal surgeons.

Adjuvant therapy for patients with node-positive colon cancer

Of 483 patients with Dukes C colon cancer who had surgery with curative intent, 367 (76.0%; 95% CI, 69.4%–81.6%) were offered adjuvant chemotherapy or combined modality therapy. Patients offered adjuvant chemotherapy were younger (mean, 66.2 years) than those not offered chemotherapy (mean, 74.8 years) ($t = 8.58$; df = 263; $P < 0.001$), less likely to be treated by a colorectal surgeon, and more likely to be treated in metropolitan areas. These factors were independently predictive after accounting for clustering. Neither hospital caseload nor surgeon caseload was a significant predictor of concordance with this guideline.

Adjuvant radiotherapy for patients with high-risk rectal cancer

Of 692 patients with cancer in the middle or lower third of the rectum, 314 (45.4%) had stage T3, and 34 (4.9%) had stage T4. Of these 348 patients with "high-risk" rectal cancers, 208 (59.8%; 95% CI, 52.4%–66.7%) were offered radiotherapy, alone or as combined modality therapy. Men, younger patients, and those treated by surgeons with lower caseloads were more likely to be offered adjuvant radiotherapy for high-risk rectal cancer. Neither hospital caseload nor surgeon specialty was predictive.

Preoperative radiotherapy for patients with fixed or tethered rectal cancer

Of 113 patients with rectal cancer and preoperative evidence of tumour invasion into the adjacent structures, 67 (59.3%; 95% CI, 47.4%–70.3%) received preoperative radio-

therapy. Patient age and intent of surgery were independently predictive of concordance with this guideline. Hospital caseload, surgeon caseload and surgeon specialty were not predictive.

No preoperative bowel preparation

This guideline was considered relevant only for people undergoing elective surgery for colon cancer. Of 1490 eligible patients, 95 (6.4%; 95% CI, 3.6%–10.9%) did not receive routine preoperative bowel preparation. Older patients and those treated at hospitals with higher caseloads were more likely not to receive routine bowel preparation. The intracluster correlation coefficient of 0.6 supports a strong effect of institutional policy in relation to this guideline.

Preoperative prophylactic antibiotics

Of 2984 patients who had surgery, 2964 (99.3%; 95% CI, 98.8%–99.6%) received preoperative prophylactic antibiotics. The only predictor of concordance with this recommendation was higher surgeon caseload, but absolute differences between surgeons were small.

DVT prophylaxis

Of 2984 patients who had surgery, 2966 (99.4%; 95% CI, 98.9%–99.7%) received DVT prophylaxis. Patients treated by surgeons with higher caseloads were more likely to receive DVT prophylaxis, but absolute differences between surgeons were small.

Overall concordance for individuals

Concordance with relevant guidelines for individual patients ranged from 0 to 100%. The mean overall concordance was 78% (SD, 17%) with a median of 67% (IQR, 67%–100%).

2 Independent predictors of concordance with guidelines

Guideline	Predictor	Adjusted odds ratio (95% CI)	*P*	ICC*
Colonic pouch reconstruction following resection of low rectal cancer	Surgical intent		0.0003	0.29
	Palliative	1.00		
	Curative	4.55 (2.00–10.32)		
	Surgeon's specialty		< 0.0001	
	General	1.00		
	Colorectal	4.85 (2.30–10.22)		
Adjuvant therapy for patients with node-positive colon cancer	Patient's age	0.93 (0.90–0.95)†	< 0.0001	0.1
	Surgeon's specialty		0.03	
	Colorectal	1.00		
	General	1.88 (1.06–3.36)		
	Hospital location		0.04	
	Metropolitan	1.00		
	Rural	0.56 (0.32–0.99)		
Adjuvant radiotherapy for patients with high-risk rectal cancer	Patient's age	0.97 (0.95–0.99)†	0.005	0.15
	Patient's sex		0.01	
	Female	1.00		
	Male	1.64 (1.12–2.39)		
	Surgeon's caseload	0.99 (0.98–1.00)‡	0.02	
Preoperative radiotherapy for patients with fixed or tethered rectal cancer	Patient's age	0.96 (0.93–0.99)†	0.004	0.09
	Surgical intent		0.0005	
	Palliative	1.00		
	Curative	4.90 (1.99–12.1)		
No routine bowel preparation for elective surgery for colon cancer	Patient's age	1.01 (1.00–1.03)†	0.05	0.6
	Hospital caseload	1.006 (1.003–1.009)‡	< 0.0001	
Antibiotic prophylaxis	Surgeon's caseload	1.06 (1.01–1.12)‡	0.03	0.04
DVT prophylaxis	Surgeon's caseload	1.08 (1.01–1.15)‡	0.02	0.008

* Intracluster correlation coefficient. † Change in odds of concordance per increase in patient's age of 1 year. ‡ Change in odds of concordance per increase in caseload of one patient. ◆

DISCUSSION

We found varied uptake of specific management guidelines for colorectal cancer. Almost all patients received antibiotic and DVT prophylaxis, as recommended. For adjuvant therapy and preoperative radiotherapy, about 60% of eligible patients were offered the recommended therapy. Almost 95% of eligible patients received mechanical bowel preparation, despite the lack of support in the guidelines.

We found that older patients were less likely to be offered adjuvant therapy. Suboptimal use of adjuvant therapies has been reported elsewhere, with increasing patient age commonly predicting non-referral.[7-10] However, recent data for elderly patients with advanced colorectal cancer treated with chemotherapy indicate no greater toxicity and similar probabilities of benefit as for younger patients.[11] Preoperative radiotherapy was also less likely to be given to older patients, regardless of whether surgery was intended to be curative or palliative. Given these results, the development of resources focusing on appropriate care for older patients appears to be a priority.

The only guideline we investigated that related to technical aspects of colorectal cancer surgery was the use of colonic pouch reconstruction. This was also the only guideline where subspecialist training in colorectal surgery was predictive of concordance. Surgical education is an important component of any strategy to improve surgical care. Although the role of subspecialisation in colorectal surgery remains controversial,[12] systematic training of surgeons in new, effective techniques can have a major effect on cancer outcomes. In Sweden, for example, training surgeons in total mesorectal excision for rectal cancer led to significant reductions in local recurrence rates and 2-year cancer-related mortality.[13,14]

We found that patients with node-positive colon cancer were significantly more likely to be offered adjuvant chemotherapy if they were treated by a general surgeon rather than a colorectal surgeon. The reason for this is unclear and warrants further investigation.

The greatest discordance we found related to bowel preparation, which has no support in the guidelines. Moreover, there is evidence that it may increase anastomotic leak rates.[15] Lack of familiarity with the evidence may be one reason why the guideline is not followed. A survey of colorectal surgeons just before release of the NHMRC guidelines reported very low awareness of the evidence against bowel preparation.[16] Even after dissemination of the national guidelines and publica-

tion of further studies on the topic, a survey in 2001 found that knowledge of this evidence had not changed.[17] Technical and aesthetic considerations may also influence the readiness of surgeons to follow this guideline. However, surgeon-related factors were not predictive of concordance in our study. The only independently predictive factors were patient age and hospital caseload, highlighting the potential importance of institutional factors in determining guideline compliance.

Despite substantial literature supporting an association between higher caseload (particularly for rectal cancer) and improved care for people undergoing surgery for colorectal cancer,[4,18] we found limited evidence of it. Use of antibiotic and DVT prophylaxis did relate to surgeon caseload, but the absolute differences were small. Use of adjuvant radiotherapy for patients with high-risk rectal cancer was lower among surgeons with higher caseloads. It is plausible that this is due to a lower perceived need for adjuvant radiotherapy if surgeons with higher caseloads are using better techniques. We focused only on care processes; patient outcomes such as survival and recurrence rates could vary by caseload. This will be further investigated as follow-up data become available for this cohort.

We calculated the overall proportion of relevant guidelines that were followed for individual patients. Our finding that, on average, 78% of relevant guidelines were followed for individual patients is encouraging. If found to be a robust yet discriminating measure of quality of care, a summary measure such as this could be useful for monitoring the uptake of evidence-based practice over time or between hospitals, while taking into account differences in patient numbers and clinical characteristics.

Strengths of our study include the population-based sample and very high participation rate — data were received for more than 90% of eligible patients. Furthermore, the accuracy of the clinicians' self-reported data was confirmed in a pilot study, which found good agreement between questionnaire responses and independent medical record audit.[6]

Our identification of predictors of concordance with individual recommendations provides an empirical base for future strategies to promote uptake of evidence into patient care. In particular, strategies are needed to ensure that all patients who may benefit from adjuvant therapy, including older patients, are fully informed of their treatment options.

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COMPETING INTERESTS

None identified.

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