RESEARCH

Variations in surgical management from a national bowel cancer screening programme

R J Codd,¹ R Thomas,² H Heard,³ A G Radcliffe,³ G L Williams,^{2,4} M D Evans^{1,2}

¹Department of Colorectal Surgery, Morriston Hospital, Swansea, UK

²Welsh Cancer Intelligence and Surveillance Unit, Public Health Wales, Cardiff, UK

³Bowel Screening Wales, Llantrisant, UK

⁴Department of Colorectal Surgery, Royal Gwent Hospital, Newport, UK

Correspondence to

M D Evans,
Department of Colorectal Surgery, Morriston Hospital, Swansea SA6 6NL, UK;
martyn.evans@wales.nhs.uk

Received 8 April 2013

Revised 3 June 2013

Accepted 7 June 2013

Published Online First

6 July 2013

ABSTRACT

Objective Population screening for colorectal cancer (CRC) was introduced to Wales in October 2008. The aim of this study was to evaluate the early impact of screening on CRC services.

Design Prospectively collected data from the Bowel Screening Wales (BSW) programme and the Welsh Bowel Cancer Audit (WBCA) were used to identify all screen-detected (SD) CRC diagnoses in Wales between April 2009 and March 2011. Data from the WBCA were used to calculate surgical outcomes.

Results 444 SD cancers were registered during the study period representing 11% of all CRC diagnoses. There was a 9.9% increase in CRC incidence following the introduction of the BSW. SD patients presented with earlier stage disease; SD Dukes' A 35.1% vs 13.9% symptomatic patients ($p < 0.001$) and SD Dukes' D 7.4% vs 21.8% symptomatic, ($p < 0.001$). There were more colonic cancers among the SD population ($p < 0.001$). The resection rate for SD cancers was 89%, significantly higher than symptomatic cancers (67.7%; $p < 0.0001$). There was variability in the use of polypectomy as a definitive procedure to treat CRC between units. Overall laparoscopic resection was used in 52% of cases but with considerable interunit variability (0–92%).

Conclusions The introduction of screening has increased the workload of the colorectal multidisciplinary teams in Wales. This has occurred through both an increase in case volume and the identification of more patients with early stage disease. There is considerable interunit variability in the use of techniques of local excision and rates of laparoscopic resection that need to be addressed.

INTRODUCTION

Bowel cancer is the third most common cancer in the UK, and the second leading

cause of cancer death.¹ It is responsible for 16 000 deaths every year in the UK¹ and 1000 deaths per year in Wales.² The human and financial costs of this disease have prompted considerable research to evaluate the efficacy of population screening to detect bowel cancer at an early curable stage. A systematic review and meta-analysis of screening for colorectal cancer (CRC) with faecal occult blood (FOB), showed a 16% relative risk reduction in CRC-related mortality in those who were allocated to screening.³ Following this, pilot programmes in England and Scotland confirmed the feasibility and efficacy of population-based screening using FOB.⁴

In October 2004, the UK Department of Health announced that a NHS Bowel Cancer Screening Programme would commence in England in April 2006. Population screening in Wales, (population 3.06 million), started as 'Bowel Screening Wales' (BSW) over 2 years later, (October 2008). At that time, men and women aged between 60 and 69 years were offered 2 yearly FOB (guaiac primarily and immunochemical if equivocal) testing. Those returning positive FOB tests were offered colonoscopy at approved screening centres.

In 1993, the Welsh Office commissioned Wales' participation in the Royal College of Surgeons based Wales Trent Bowel Cancer Audit (WTBA)⁵ which, with the Lothian and Wessex audits, evolved into the UK National Bowel Cancer Audit Project (NBOCAP). Since 2001, data on Welsh patients has contributed to the UK-wide NBOCAP. In addition to the NBOCAP reports, the Colorectal Cancer Services Co-ordinating

To cite: Codd RJ, Thomas R, Heard H, et al. *Frontline Gastroenterology* 2013;**4**:302–307.

Group (CSCG) for Wales has published separate Welsh Bowel Cancer Audit (WBCA) reports of patients treated solely in Wales. The 4th and 5th WBCA reports^{2,6} include data on patients managed prior to the introduction of the BSW programme. This information along with data from a recent study looking at the management of bowel cancer in Wales between 1993 and 2008⁷ provides a reliable baseline to quantify the impact of bowel cancer screening in Wales.

The aims of this study were to evaluate the impact of a newly introduced screening programme on the colorectal surgical services within this well-defined region. We were particularly interested in the changes to the surgical workload generated by screening, and wished to explore any variance in the multidisciplinary team (MDT) management of screen detected (SD) cancers.

PATIENTS AND METHODS

Hospitals managing CRC in Wales are mandated to submit data on all patients diagnosed with bowel cancer to the Welsh national cancer information system (Cancer Network Information Systems Cymru (CaNISC)). Each year, data based on the National Bowel Cancer Audit Essential Dataset⁸ is extracted from CaNISC and analysed as part of the WBCA. Data extracted for the 2009/2010 and the 2010/2011 WBCA (April 2009–March 2010 and April 2010–March 2011) and data from the prospectively kept BSW programme were used for this study. These audit periods equate to the first 2 years following the introduction of the BSW programme. This data was compared with data from WBCA from prior to the introduction of the BSW programme in October 2008. The age limit for screening was increased in December 2010 to 71 years.

Databases from the screening programme and the WBCA were cross-linked to identify all patients diagnosed with a SD CRC in Wales between April 2009 and March 2011. Data from the WBCA was used to identify tumour site, patient age, sex, American Society of Anaesthesiology Score (ASA), use of surgery to treat disease, surgical approach, tumour, nodes, and metastases (TNM) and Dukes' stage of those undergoing surgery, length of stay and postoperative mortality. Postoperative mortality recorded in CaNISC was checked for accuracy by cross-linkage of all audit patients' NHS numbers to the Welsh Cancer Intelligence and Surveillance unit file, which receives notification of deaths from the Office of National Statistics data file. Cross-linkage in this way ensured that any unreported audit deaths were identified.

In this study, the term 'operation' was used to include all procedures with or without curative intent carried out under general anaesthesia, but excludes patients who had an endoscopic polypectomy as a definitive procedure to treat their cancer, and also excludes patients undergoing insertion of colonic stents. The term 'resection' was used to describe any procedure in which the primary cancer was excised,

and includes endoscopic polypectomy, TART (Transanal Resection of Tumour) and TEMS (Transanal Endoscopic MicroSurgery) as well as segmental colonic or rectal resection. Definitive polypectomy was used to describe patients who were managed by endoscopic or surgical polypectomy and did not receive any further surgical procedure. The term 'not operated' is used for those patients who underwent no surgical or endoscopic intervention.

Data management and statistical analysis was carried out using SPSS for Mac V.18 (SPSS, Chicago, Illinois, USA) and Stata (StataCorp 2011. Stata Statistical Software; Release V.12. College Station Texas: StataCorp LP). χ^2 Tests were used to compare categorical data, significance was assumed at the 5% level.

RESULTS

The first round of BSW took place between 27 October 2008 and 24 November 2010.⁹ During this period, 412 025 men and women who were resident in Wales were invited to complete the home (FOBT) kit; 55.2% of participants invited in Round 1 of screening returned a used test kit. The average positive test result was 2.8% during the first round of screening. Positive results demonstrated a pathological yield at screening colonoscopy of over 70%, with a cancer detection rate of 7.9%.

The positive test result rate of 2.8% is higher than was originally anticipated by the programme coordinators.⁹ The pathology yield rate at colonoscopy of over 70% is also higher than predicted. The screening process adopted by the Welsh programme may explain the positive test result rate. The screening strategy in Wales is similar to the Scottish system. A guaiac test kit is used initially and contains six wells for testing the three stool samples, which are collected on separate days. If five or six wells show a positive reaction on the initial screening test kit, a positive result is issued and a colonoscopy is recommended. If between one and four wells are positive, the result is equivocal and an immunochemical test kit is sent to the participant. In England, only the guaiac test kit is used. The two-stage process offered in Wales was intended to reduce the number of colonoscopies performed, as the FIT kit should filter out false positive results because it is specific to human globins.⁹

Although only 7.4% of participants used the FIT kit, it had a positive test result rate of over 30%. The use of a two-stage testing process in Wales may explain why the positive test result rate is higher than the 2% rate seen in the English screening programme. The higher than expected pathology yield at colonoscopy, and the positive test result rate may also be partially explained by an apparently high adenoma count among the Welsh population.⁹

From April 2009 to March 2011, 4050 patients were diagnosed with bowel cancer in Wales with 11% (n=444) of these detected by the screening

Table 1 The number of CRCs managed by Welsh MDTs over time

Year	2007/8	2008/9	2009/10	2010/11
Symptomatic	1793	1893	1816	1790
Screen-detected	0	0	203	241
Total	1793	1893	2019	2031

CRC, colorectal cancer; MDT, multidisciplinary team.

programme. Previous WBCA audit data (2007/2008 and 2008/2009) have demonstrated fewer registered bowel cancers; in 2007–2008 there were 1793 new cases and in 2008–2009 there were 1893 cases (table 1). Overall, there was a 9.9% increase in the number of CRCs registered on CanISC following the introduction of screening.

Among the 444 SD cancers, there were 348 (78.4%) colonic lesions and 96 (21.6%) rectal lesions. Of the 3606 symptomatic patients managed during the same period 2536 (70.3%) were colonic cancers and 1070 (29.7%) were rectal. There were proportionally more colonic cancers among the screened population ($p<0.001$).

During the study period, all the 13 colorectal MDTs in Wales were involved in the management of SD cancers. Overall, SD cancers represented 11% of the CRC MDT workload. The median number of SD bowel cancers managed by the MDTs was 35 (range of 10–73) cases and the proportion of an MDT CRC workload that derived from screening varied from 6.3% to 14.3% (table 2). The overall resection rate for SD cancers was 89%, which was higher than the resection rate for symptomatic cancers (67.7%; $p<0.0001$). The overall resection rate (symptomatic and SD) during this study period was 70% which is similar to that of previous WBCAs.² The resection

rate for cancers in 2007/2008 was 70.6%, and in 2008/2009 it was 71%.

Techniques for local excision (transanal or endoscopic) as a definitive procedure to manage CRC were not uniform across Wales. Definitive polypectomy rates by MDT varied considerably with a median of three cases per unit (range of 0–14). If polypectomies are considered as a proportion of the total number of resections per MDT, then practice varies widely, with a range of 0–33.3% (table 2). The biggest disparity in this range is attributable to two of the highest case volume units (units 4 and 5).

The rate of laparoscopic resection for all CRC diagnoses (excluding examination under anaesthetic (EUA), TART, TEMS, stents and polyps) during the study period was 40%. Among the SD lesions, 52% (177/342) of resections were completed laparoscopically. There was, however, considerable interunit variability in SD laparoscopic resection rates, which ranged from 0% to 92% (table 3). This variability is reflected in the overall (symptomatic and screen-detected) laparoscopic resection rates of the individual units. In the majority of units, the laparoscopic resection rate is slightly higher for the SD lesions when compared with the symptomatic cases.

The postoperative 30-day mortality among the SD cancers was 0.6% (2/346 cases) which was significantly lower than the symptomatic elective cohort of 3% (71/2382), ($p=0.04$). The histological Dukes' staging for the cancers treated in Wales during this study period is presented in table 4. The SD population of this study demonstrated more Dukes' stage A cancers, with 35.1% in the SD group compared with 13.9% overall ($p<0.001$). There was also a lower proportion of Dukes' stage D cancers of 7.4% compared with 21.9%, overall ($p<0.001$).

Table 2 The management of SD cancer by MDT

Unit	Total number of SD CRC	Resected (%)	Operated (%)	Definitive polypectomy (%)	Not operated (%)
1	33	31 (93.9)	29 (87.9)	3 (9.1)	1 (3)
2	35	23 (65.7)	22 (62.9)	2 (5.7)	11 (31.4)
3	41	37 (90.2)	30 (73.2)	7 (17.1)	4 (9.8)
4	36	34 (94.4)	22 (61.1)	12 (33.3)	2 (5.6)
5	51	49 (96.1)	49 (96.1)	0	2 (3.9)
6	40	36 (90)	31 (77.5)	5 (12.5)	4 (10)
7	23	21 (91.3)	20 (87)	2 (8.7)	1 (4.3)
8	10	10 (100)	10 (100)	0	0
9	23	19 (82.6)	18 (78.3)	1 (4.3)	4 (17.4)
10	73	62 (84.9)	49 (67.1)	14 (19.2)	10 (13.7)
11	34	32 (94.1)	27 (79.4)	5 (14.7)	2 (5.9)
12	14	13 (92.9)	13 (92.9)	0	1 (7.1)
13	31	28 (90.3)	26 (83.9)	3 (9.7)	2 (6.5)
Total	444	395 (89)	346 (77.9)	54 (12.2)	44 (9.9)

Resected: procedure in which the primary cancer was excised, includes endoscopic polypectomy, TART, TEMS and segmental colonic/rectal resection.

Not operated: no surgical or endoscopic intervention.

Operated: all procedures with or without curative intent carried out under General Anaesthetic (GA), excludes endoscopic polypectomy and colonic stenting.

Definitive polypectomy: managed by endoscopic/surgical polypectomy, but no further surgical procedure performed.

CRC, colorectal cancer; MDT, multidisciplinary team; SD, screen detected; TART, transanal resection of tumour; TEMS, transanal endoscopic microsurgery.

Table 3 Screen-detected laparoscopic resection rates (excludes polyps/stents/EUA/TART/TEMS)

Unit	Screen-detected laparoscopic rate (%)	Open (%)	Total number of cases	Overall MDT laparoscopic rate (%)
1	22 (75.9)	7 (24.1)	29	62
2	16 (80)	4 (20)	20	58.9
3	5 (16.7)	25 (83.3)	30	8
4	6 (27.3)	16 (72.7)	22	29.5
5	30 (61.2)	19 (38.8)	49	42.9
6	1 (3.2)	30 (96.8)	31	3.3
7	13 (65)	7 (35)	20	55.7
8	0	10 (100)	10	1.5
9	5 (27.8)	13 (72.2)	18	16.9
10	32 (65.3)	17 (34.7)	49	44.1
11	21 (84)	4 (16)	25	65.1
12	2 (15.4)	11 (84.6)	13	10.7
13	24 (92.3)	2 (7.7)	26	82.9
Total	177 (51.8)	165 (48.2)	342	40

Overall MDT laparoscopic rate: elective symptomatic and screen detected laparoscopic resection rate for the individual unit.

MDT, multidisciplinary team; TART, transanal resection of tumour; TEMS, transanal endoscopic microsurgery.

DISCUSSION

Following the introduction of the Welsh bowel screening programme (BSW), there has been a 10% increase in the number of MDT managed and registered CRCs in Wales. In this study, screening identified more colonic and earlier-stage disease than symptomatic presentation of CRC. Additionally, SD patients were more likely to have their disease resected, which was more frequently performed laparoscopically. We also identified considerable interunit variation in laparoscopic resection rates and variation between MDTs in their approach to the management of early CRC.

Screening in Wales has resulted in an increase in the number of CRCs diagnosed. A similar increase was identified in Ayrshire and Arran as a result of their screening programme.¹⁰ The additional cases diagnosed through BSW have implications on the overall workload of colorectal MDTs in Wales as elsewhere. There are also likely to have been a smaller number of patients who required surgical resection for benign lesions not amenable to endoscopic resection. The CaNIS database used to perform our study does not capture data on non-malignant patients; as such, it has not been possible to capture how many of these patients there were. In future, the additional numbers

of cancers diagnosed will also require clinical, radiological and endoscopic follow-up.

The SD cancers included in this study were more likely to be colonic (78.4%) compared with symptomatic cancers (70.3%) managed during the same period. Data from the larger English Bowel Cancer Screening Programme¹¹ shows a rate of 28.7% for SD rectal cancers among its population. SD cancers in this study were also more likely to be of earlier stage when compared with symptomatic lesions, which is consistent with the findings of other national screening studies.^{11 12} This finding is important as it supports the role of the screening programme in identifying bowel cancer at an earlier, curable stage. Indeed, we have observed that 89% of SD lesions are surgically resected, compared with approximately 70% of symptomatic lesions. A recently published English study has identified a 5-year survival benefit among its screened population when compared with symptomatic patients.¹³ Identification of cancers at an earlier stage is likely to be the reason for this finding.

In this study, we observed variance in the management strategies employed by colorectal MDTs in Wales with regards to the local excision of SD cancers. There were also differences in practice between some of the larger MDTs that manage SD cancer most frequently. Indeed, some centres seem to avoid local excision of polyp cancers, while others definitively treat up to a third of SD lesions this way. This is similar to experience from the North of England in a symptomatic cohort of malignant polyps.¹⁴ With such interunit diversity, there seems a need for some consensus regarding the appropriate management of malignant polyps.

The variability observed between units in the management of polyp cancers may be related to the expertise of the specialists involved in each individual MDT. Access to advanced endoscopic polypectomies and TEMS procedures is not uniform across Wales. MDTs also differ in their opinion and attitude towards the use of polypectomy as a definitive procedure for the treatment of polyp cancers. A study of individual MDT decision about the management of malignant polyps is warranted to understand the differences in practice observed in the present study.

The overall rate of laparoscopic resection for SD lesions was 52% which compares very favourably with rates throughout the rest of the UK.¹⁵ However, we again observed considerable interunit variability. Some centres performed all resections via an open approach, while the unit with the highest laparoscopic

Table 4 Dukes' stage of CRCs: overall and SD

Dukes	A	B	C1	C2	D	Missing
Overall (%)	562 (13.9)	1026 (25.3)	732 (18.1)	133 (3.3)	886 (21.8)	711 (17.6)
SD (%)	156 (35.1)	106 (23.9)	85 (19.1)	11 (2.5)	33 (7.4)	53 (11.9)
Symp (%)	406 (11.3)	920 (25.5)	647 (17.9)	122 (3.4)	853 (23.7)	658 (18.2)

CRC, colorectal cancer; Missing, missing data entry; SD, screen-detected; Symp, symptomatic.

resection rate operated on 92% of its SD cases via this approach. Current NICE guidance¹⁶ states: 'Laparoscopic resection is recommended as an alternative to open resection for individuals with colorectal cancer in whom both laparoscopic and open surgery are considered suitable.' To adhere to this recommendation, it may be necessary to review the provision of laparoscopic colorectal services in Wales.

Our study has limitations including the possible inaccuracy of using self-reported data to national audits.¹⁷ However, the quality of data submitted to the WBCA has improved with each audit cycle to a position where the data completeness has now reached 93%. The impressive data accuracy for Welsh hospitals was acknowledged in last year's NBOCAP report.¹⁸ Also, it is difficult to interpret differences in local excision rates between individual units, because detailed pathological data on early lesions (such as Haggitt and Kikuchi level) are not routinely recorded as part of the WBCA.

In conclusion, we have identified a significant increase in both the surgical and MDT workload as a result of the introduction of the bowel screening in Wales. Review of current surgical provision may be necessary to manage these additional patients. The screening programme has been successful in identifying CRC at an earlier stage. We have identified variability in the use of local excision (endoscopic polypectomy or transanal surgery) between MDTs, which may require discussion at a national level in order to reach a consensus agreement. There is also considerable difference between units in the proportion of SD patients offered laparoscopic surgery. Broader laparoscopic surgical provision and further training of existing surgeons will hopefully address this variability.

What is already known on this topic

- ▶ This paper reports the impact of a bowel cancer screening programme within a defined national population.

What this study adds

- ▶ We have identified an increase in surgical workload since the introduction of the screening programme and a variation in management strategy between MDT's within this population.

How might it impact on clinical practice in the foreseeable future

- ▶ The findings of the study may help guide future surgical provision in order to deal with the impact of the screening programme.

Contributors RJC contributed by analysis and interpretation of data and in writing the manuscript. RT and HH contributed by the acquisition of data and by analysis and interpretation of data. AGR, GLW and MDE contributed by their involvement in the study conception and design and in writing the manuscript.

Competing interests None.

Ethics approval All the information included in this study is from the Welsh Bowel Cancer Audit data only.

Provenance and peer review Not commissioned; internally peer reviewed.

REFERENCES

- 1 Bowel Cancer Statistics. Cancer Research UK. <http://www.cancerresearchuk.org/cancer-info/cancerstats/types/bowel/> (accessed 28 Oct 2012).
- 2 Evans M, Harris M, Roberts L, *et al.* Cancer Services Co-ordinating Group 4th Bowel Cancer Audit Report. Bowel cancer: presentation, treatment and outcomes in Wales: April 2007–March 2008. <http://www.wales.nhs.uk/sites3/Documents/322/CSCG%5F4th%5FBowel%5FCancer%5FAudit%5FReport%5FApril%5F2007%5F%2D%5FMarch%5F2008.pdf> (accessed 28 Oct 2012).
- 3 Towler B, Irwig L, Glasziou R, *et al.* A systematic review of the effects of screening for colorectal cancer using the faecal occult blood test, Hemoccult. *BMJ* 1998;317:559.
- 4 UK Colorectal Cancer Screening Pilot Team. *Evaluation of the UK Colorectal Cancer Screening Pilot*. Final report. 2003. <http://www.cancerscreening.nhs.uk/bowel/pilot-evaluation.html> (accessed 28 Oct 2012).
- 5 Mella J, Biffin A, Radcliffe AG, *et al.* Population-based audit of colorectal cancer management in two UK health regions. Colorectal Cancer Working Group, Royal College of Surgeons of England Clinical Epidemiology and Audit Unit. *Br J Surg* 1997;84:1731–6.
- 6 Evans M, Harris M, Roberts L, *et al.* Cancer Services Co-ordinating Group 5th Bowel Cancer Audit Report. Bowel Cancer in Wales: presentation, treatment and outcomes: April 2008–March 2009. <http://www.wales.nhs.uk/sites3/Documents/322/Wales%20Bowel%20Cancer%20Report%20July%202010.pdf> (accessed 29 Oct 2012).
- 7 Evans M, Thomas R, Williams GL, *et al.* A comparative study of colorectal surgical outcomes in a national audit separated by fifteen years. *Colorectal Dis* 2013;15:608–12.
- 8 The NHS Information Centre. National Bowel Cancer Audit Essential Data Items. Version 3.0: July 2009. [http://www.ic.nhs.uk/webfiles/Services/NCASP/Cancer/New%20web%20documents%20\(Bowel\)/NationalBowelCancerAuditEssentialDataItemsv3.pdf](http://www.ic.nhs.uk/webfiles/Services/NCASP/Cancer/New%20web%20documents%20(Bowel)/NationalBowelCancerAuditEssentialDataItemsv3.pdf) (accessed 28 Oct 2012).
- 9 Heard H, Beer H. *Bowel Screening Wales, First Round Report*. Public Health Wales. Sept 2011. <http://www.wales.nhs.uk/sites3/page.cfm?orgid=747&pid=42411> (accessed 29 Oct 2012).
- 10 Roxburgh CSD, McTaggart F, Balsitis M, *et al.* Impact of the bowel-screening programme on the diagnosis of colorectal cancer in Ayrshire and Arran. *Colorectal Dis* 2013;15:34–41.
- 11 Logan RFA, Patnick J, Nickerson C, *et al.* On behalf of the english bowel cancer screening evaluation committee. Outcomes of the bowel cancer screening programme (BCSP) in England after the first 1 million tests. *Gut* 2012;61:1439–46.
- 12 UK Colorectal Cancer Screening Pilot Group. Results of the first round of a demonstration pilot of screening for colorectal cancer in the United Kingdom. *BMJ* 2004;329:133.

- 13 Pande R, Froggatt P, Baragwanath P, *et al.* Survival outcome of patients with screening versus symptomatically detected colorectal cancers. *Colorectal Dis* 2013;15:74–9.
- 14 Gill M, Rutter M, Holtham S. Management and short term outcome of malignant colorectal polyps in the North of England. *Colorectal Dis* 2013;15:169–76.
- 15 Hospital Episode Statistics. 2012. <http://www.hesonline.nhs.uk/> (accessed 20 Oct 2012).
- 16 NICE Guidance. Colorectal cancer: the diagnosis and management of colorectal cancer. Clinical guidelines, CG131—Issued: November 2011. <http://www.nice.org.uk/nicemedia/live/13597/56998/56998.pdf> (accessed 29 Oct 2012).
- 17 Lewis RS, Graham DG, Watson JD, *et al.* Learning the hard way: the importance of accurate data. *Colorectal Dis* 2012;14:1015–18.
- 18 National Bowel Cancer Audit Project. Annual Report 2011. http://www.ic.nhs.uk/webfiles/Services/NCASP/audits%20and%20reports/Bowel_Cancer_Audit_Report_2011_interactive.pdf (accessed 29 Oct 2012).