# Enhanced BMS cut-up role in colonic cancer reporting

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**Abstract**

Aims

To extend the BMS cut up role to include gastrointestinal category D colorectal cancer resection specimens and to address issues of quality and safety by presenting performance data from the first 50 BMS cut up specimens in comparison to national guidelines and pathologist performance over the same timeframe.

Methods

Close mentoring and consultant supervision was carried out for every case with adherence to standard operating procedures and following colorectal cancer dataset guidelines as published by the RCPath. Performance targets were audited including anticipated spread of Duke's stage, targets for mean lymph node harvest, percentage extramural vascular invasion and serosal involvement, and mean tumour blocks sampled. Histological pre-reporting of 20 cases was encouraged and time spent by BMS and consultant at all stages of specimen reporting was noted.

Results

Performance targets were all exceeded by the BMS and compared favourably with pathologist performance. A measure of consultant cut up and histology reporting time saved was identified.

Conclusions

Benefits of extending the BMS role to category D specimens may include BMS professional advancement, efficient use of consultant time, and development of a team approach to cancer reporting. Achievement of colorectal cancer performance targets and favourable comparison with

pathologist performance implies there was no perceived detrimental effect on quality or safety and hence patient management.

Competing Interest: None to declare.

Introduction

Biomedical scientist (BMS) participation in examination and dissection (cut-up) of surgical pathology specimens has a long history in the UK, Europe and particularly in the USA where the role of the advanced, non-medical, “pathologist assistant” is well developed [1,2]. Medical pathologist support for BMS cut up in the UK has had a chequered history stimulating fierce debate in the literature in the mid-nineteen nineties [3,4,5], and still with a tendency to polarise pathologist opinion, especially around BMS input into the more complex specimens.

In 2001 the Royal college of Pathologists (RCPath) issued draft guidelines for the involvement of BMS in cut-up [6] that included an appendix outlining the different categories of specimen complexity from A to D. The 2001 draft guidance was superseded by a final report published by a joint working party of the RCPath and Institute of Biomedical Science (IBMS) in January 2004 [7] that outlined an initial review of the experience of UK sites piloting the extended role of the BMS, and discussing benefits, problems, constraints and funding. Benefits cited included;

- Release of consultant time for other professional activities
- Increased job satisfaction and career opportunities for BMS
- Development of team-work within the laboratory
- More flexible and efficient use of cut up facilities

Importantly there was no perceived detrimental effect on the overall standard of histopathological reporting, timeliness, or professional practice providing principles of good practice are adhered to standard operating procedures (SOPs), training and audit measures are in place.

Following the report many departments have renewed efforts to develop BMS cut-up to some degree with benefits reported including release of consultant time and stricter adherence to trimming SOPs, outweighing the slight increase of blocks and slide levels generated, and with no reduction in quality of dissection. [8,9]. In 2004 we successfully secured funding to promote the BMS cut up role and have been actively involved in the training of two of our Senior BMS. We have extended BMS cut-up to include the majority of category A, B and C specimens and now include a proportion of category D specimens, traditionally cut-up only by medical staff. This development has taken place in conjunction with training and examination by the IBMS, and both BMS have gained the 'Diploma of Extended Practice in Histological Dissection'. One of the two BMS (AS) has been developing specialised cut-up of gastrointestinal (GI) category D specimens, which includes non-malignant colorectal excisions (including inflammatory bowel disease), small bowel resections, and colonic cancer. Training has also included a small number of high anterior resections for recto-sigmoid cancers but has not yet extended to include anterior resection or abdomino-perineal resection specimens for mid and low rectal cancers. The publication of guidelines of pathologist performance in the second edition of the colorectal cancer dataset [10] aids objective assessment of cut-up performance for this type of gastrointestinal category D specimen. We previously reported preliminary

performance data for BMS cut-up of colonic cancer against national performance guidelines and departmental performance figures [11], and now, as a pilot study, present more comprehensive performance data on the first 50 cases, and outline perceived and potential service benefits. We also discuss the potential to develop the BMS role further towards a consultant assistant/advanced practitioner role to include pre-reporting of colon cancer cases into a dataset proforma, prior to consultant re-reporting, editing, and authorisation.

## Methods

### 1) BMS cut up and performance

All of our departmental colorectal cancer reports are issued or supervised by one gastrointestinal consultant pathologist (DSAS). All cases are entered onto a locally designed 'Access' type colorectal cancer database which contains all data items in the 2nd edition of the RCPath cancer dataset for colorectal cancer [10]. A final pathology report in Microsoft Word is generated from the database. In the 2 year timescale of the study cut-up of colonic cancers was carried out by the consultant (SAS), one of 4 rotating pathology trainees or by the BMS. Cases were allocated to the BMS selectively with a bias initially towards less complex cases. Cases to be cut-up by the BMS followed a defined protocol;

- Resection specimens are examined on receipt by BMS under consultant supervision. Decision taken to clean-out and pin-out

specimen for a minimum 24 hours additional fixation, or to proceed to cut-up.

- Specimens are examined by BMS with consultant at cut-up bench. Landmarks, measurements and photography requirements are discussed with reference to core macroscopic data items in the RCPath colorectal cancer dataset. Cut-up technique and block taking is discussed in line with the departmental standard operating procedure (SOP) within which tissue sampling follows guidance in the RCPath colorectal cancer dataset; in particular at least 4 tumour blocks taken with attention to deepest penetration through the bowel wall, serosal involvement, invasion of vessels and involvement of adjacent tissues or organs. The high vascular tie is identified as an aid to locating and sampling the apical lymph node. Blocks are taken to demonstrate closest approximation to the non-peritonealised, distal or proximal surgical excision margin.
- BMS photographs the specimen and commences cut up according to the SOP.
- Consultant available to review specimen again at any time during cut up.
- Discussion of block selection and further feedback undertaken on all cases at the double-headed microscope.

Performance indicators were highlighted and included;

a) Mean lymph node harvest.
b) Percentage serosal involvement.
c) Percentage extramural vascular invasion.

d) Dukes' stage.

e) Number of tumour blocks taken.

When a relatively low lymph node harvest was achieved on first dissection (<10 nodes), the BMS was encouraged to undertake a second search on a case-by-case basis following further discussion with the consultant pathologist.

2) BMS microscopic pre-reporting of cases

On every study case core macroscopic data items were discussed between the supervising consultant and the BMS. The microscopic features were also discussed in all cases using a double-headed microscope. Following the period of initial training the BMS prospectively input microscopic data items into the departmental colorectal database for the last 20 cases, in effect "pre-reporting" these cases prior to consultant review at the double-headed microscope. The supervising consultant re-assessed and re-reported all 20 cases with review of the microscopic features and core microscopic data items. Accuracy of BMS data interpretation and recording was checked against the dataset. Discrepancies around accuracy of reporting were fully discussed with the BMS.

3) Time and motion exercise

For the last 20 cases the consultant and BMS noted the time for direct supervision, cut-up, microscopic interpretation and report generation. Report

generation time included microscopic interpretation, completion of dataset, conversion of dataset file to a microsoft word file, and pasting into the laboratory information management system (LIMS) as the final report.

1) BMS cut-up and performance (n=50)(Pathologist cut up over the same 2 year timeframe n=142)

Spread of operative specimen type is presented in Table 1. The main performance criteria data for the BMS cut-up cases are summarised below and presented in Figures 1 & 2 in comparison with departmental performance data for pathologist cut-up over the same timeframe.

- Dukes' stage; Dukes A 8/50 (16%), Dukes B 18/50 (36%), Dukes C1 20/50 (40%), Dukes C2 4/50 (8%)
- Mean lymph node harvest; 13.78
- Serosal involvement; 12/50 (24%)
- Vascular invasion; 21/50 (42%)
- Mean number of tumour blocks taken; 5.6

| | **BMS** | **Pathologists** |
|---|---|---|
| **TOTAL CASES** | **50** | **142 (consultant n=85, trainees n=57)** |
| **RIGHT HEMICOLECTOMY (INCLUDING EXTENDED)** | **23/50 (46%)** | **70/142 (49%)** |
| **LEFT HEMICOLECTOMY** | **03/50 (6%)** | **03/142 (2%)** |
| **SIGMOID COLECTOMY** | **12/50 (24%)** | **34/142 (24%)** |

| | | |
|---|---|---|
| **HIGH ANTERIOR RESECTION** | **04/50 (8%)** | **28/142 (20%)** |
| **TRANVERSE COLECTOMY** | **02/50 (4%)** | **02/142 (1%)** |
| **SUBTOTAL COLECTOMY** | **02/50 (4%)** | **01/142 (0.7%)** |
| **LIMITED RESECTIONS** | **4/50 (8%)** | **04/142 (3%)** |

**Table 1 Comparison of spread of specimen type between BMS and Pathologists**

2) BMS microscopic pre-reporting of cases (n=20)

Eight of 20 cases (40%) were correctly pre-reported by the BMS into histology section of the cancer dataset with no errors. The remaining 12 cases contained a total of 19 interpretive errors including incorrect pT stage, total nodes recovered, M stage or presence of vascular invasion and 11 typographical errors including incomplete recording of data items on the proforma (mean 1.5 errors per case)

3) Time and motion (n=20)

- Mean time taken for cases cut-up by consultant - 24 minutes (range 20 –35 minutes)
- Mean time taken for BMS to cut-up cases - 35 minutes (range of 20 – 60 minutes)
- Mean time taken for Consultant to supervise BMS at the cut-up bench - 6.5 minutes (range of 5 – 15 minutes).

- Mean time taken for consultant to generate a histology report - 20 minutes (range 12 – 35 minutes)
- Mean consultant reporting time saved by BMS pre-reporting histology - 6 minutes (range 3 – 7 minutes)

## Discussion

Biomedical scientist cut-up has progressed rapidly in many pathology departments for well over a decade in the UK but there is a paucity of published audit evidence to allay doubts relating to efficacy and safety of this practice. Biomedical cut-up became a major clinical governance issue in the late nineteen nineties when more formal laboratory accreditation was being instigated. Moves by the RCPath and IBMS to pilot and provide guidance on the process, the instigation of a log-book for training documentation and mentoring, and a diploma examination addressed many of these issues and re-energised BMS cut-up in many departments. Published evidence of the efficacy of BMS cut-up remains limited and generally confined to lower category specimens [8]. This report aimed to address issues of BMS performance, and hence quality and safety, in comparison to departmental performance and national guidelines with extension to include category D specimens.

The 2nd edition of the colorectal cancer dataset published by the RCPath includes guidance on anticipated frequency of microscopic features that have proven prognostic significance, such as the presence or absence of serosal involvement. These features serve as a benchmark of pathologist performance [10]. The benchmarks allow us to objectively assess BMS cut-up

performance allowing us to compared BMS cut-up with cases cut by and experienced gastrointestinal histoapathologist. Case mix will not have been identical between the two groups with, almost certainly, an element of case bias initially towards allocation of cases perceived to be 'less complex' to the BMS (including 'limited' surgical resections). This is reflected partly in a slightly uneven spread of Duke's stage (Dukes A: BMS 16%, Pathologist 9%) and a slightly higher percentage of limited resection cases (BMS: 8%; Pathologist: 3%). The anticipated Duke's stage of all operative specimens for the BMS almost exactly matches guideline figures (Duke's A 15%, Duke's B 35%, Duke's C 50%)[12]. The BMS achieved all performance targets with a slightly higher extramural vascular invasion rate for the BMS of 42% (target 25%) against 37% for the pathologists. The BMS generated slightly more tumour blocks than pathologists (BMS mean 5.6, pathologists mean 5.0). A slightly lower mean lymph node harvest of 13.78 (target 12) was achieved by the BMS against 15.73, and a lower serosal involvement figure of 24% (target 20%) against 41% for the pathologists. Case bias towards less complex cases may have had a small negative impact on those parameters. In a recent review on reporting colorectal cancer the suggestion is that all departments should aspire to the published lymph node harvest mean from the best centres of 15-18 nodes, and find extramural vascular invasion in 30% of colon cancers [13]. A second search for nodes in our cases with an initial low yield did increase lymph node numbers, although precise records were not kept to expand on that observation. There is published evidence for a positive effect on nodal yield from second dissection, but little evidence of any influence on staging and hence patient management [14].

The saving in consultant time resulting from BMS cut up once supervision time is taken into account was 17.5 minutes per case (29.2 hours per annum on a 100 case/annum workload). Given that our BMS is only in the initial training period and is also training to cut-up all Category D gastrointestinal resection specimens (including IBD resections, ischaemic bowel, diverticular disease, small bowel tumours and resections) the potential future timesaving is likely to be considerable. In a business sense consultant time saved has to be offset by enhanced BMS salary grades and cost of backfilling conventional BMS laboratory roles, which is beyond the scope of this study, and would require a re-audit of BMS performance at different stages of experience.

The potential to extend the BMS role further into histological pre-reporting of cases prior to consultant checking and re-reporting is certainly achievable with our BMS correctly interpreting all the histology dataset parameters correctly in 40% of cases, and with a low mean number of discrepancies in the remaining cases. The value of this development is nevertheless debatable; consultant time saved appears marginal (6 minutes per case) is largely related to time saved populating the database, and is partly dependant on the practicalities of cancer report generation, which may be very department specific. However, involvement of the BMS in microscopic interpretation optimises the training process and allows for a much clearer understanding of the quality and performance issues involved in histological cancer reporting. Developing BMS training to the full would see the BMS potentially in an advanced practitioner role and, as such, a key member of the

pathology team working in partnership with the consultant and with input into the cut-up, microscopic interpretation, and authorisation stages of reporting.

## Conclusions

There are considerable benefits to both pathologist and BMS in promoting and extending the BMS cut-up role centred on team building, career progression, and optimal time utilisation. Conversely there is little evidence implied of any detrimental effect to patient care. Using the example of cut-up in colonic cancer our data shows that, robustly trained and supervised, BMS are more than capable of achieving and surpassing published national performance guidelines for this category of specimen and can match performance of pathologists within the department. Many pathologists still have strong entrenched views around whether they are prepared to report cancer cases that they have not personally cut-up. The key to moving the debate forward is comprehensive training, ready availability for preview and review, close teamwork, and provision of evidence through audit.

## Main Collaborators

Dr Peter Hawker, Dr Jeremy Shearman, Dr Bernard Usselmann, Dr Ali Naji, Dr Lisa Gladman, Mr Paul Murphy, Miss Karen Busby, Mr James Francombe, Mr Mike Stellakis, Mr Martin Osborne, Dr Rakesh Sinha.

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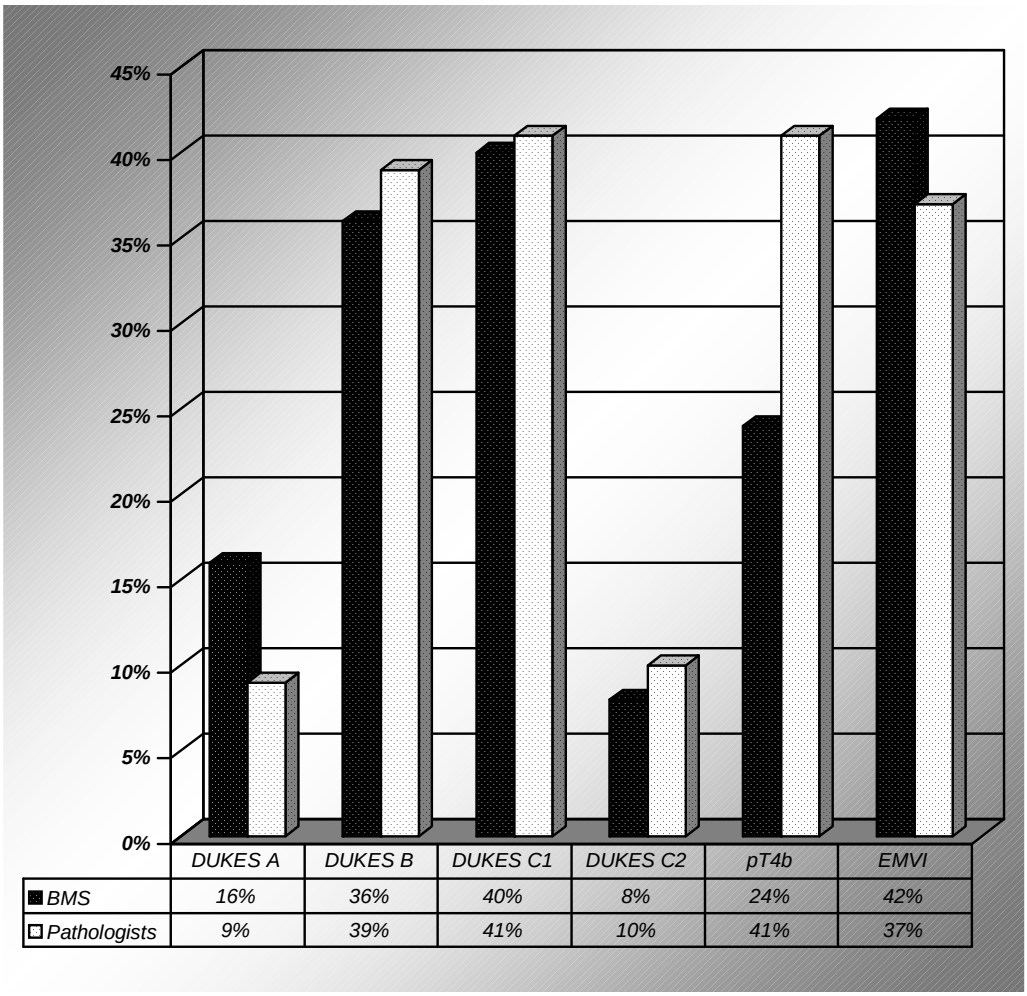
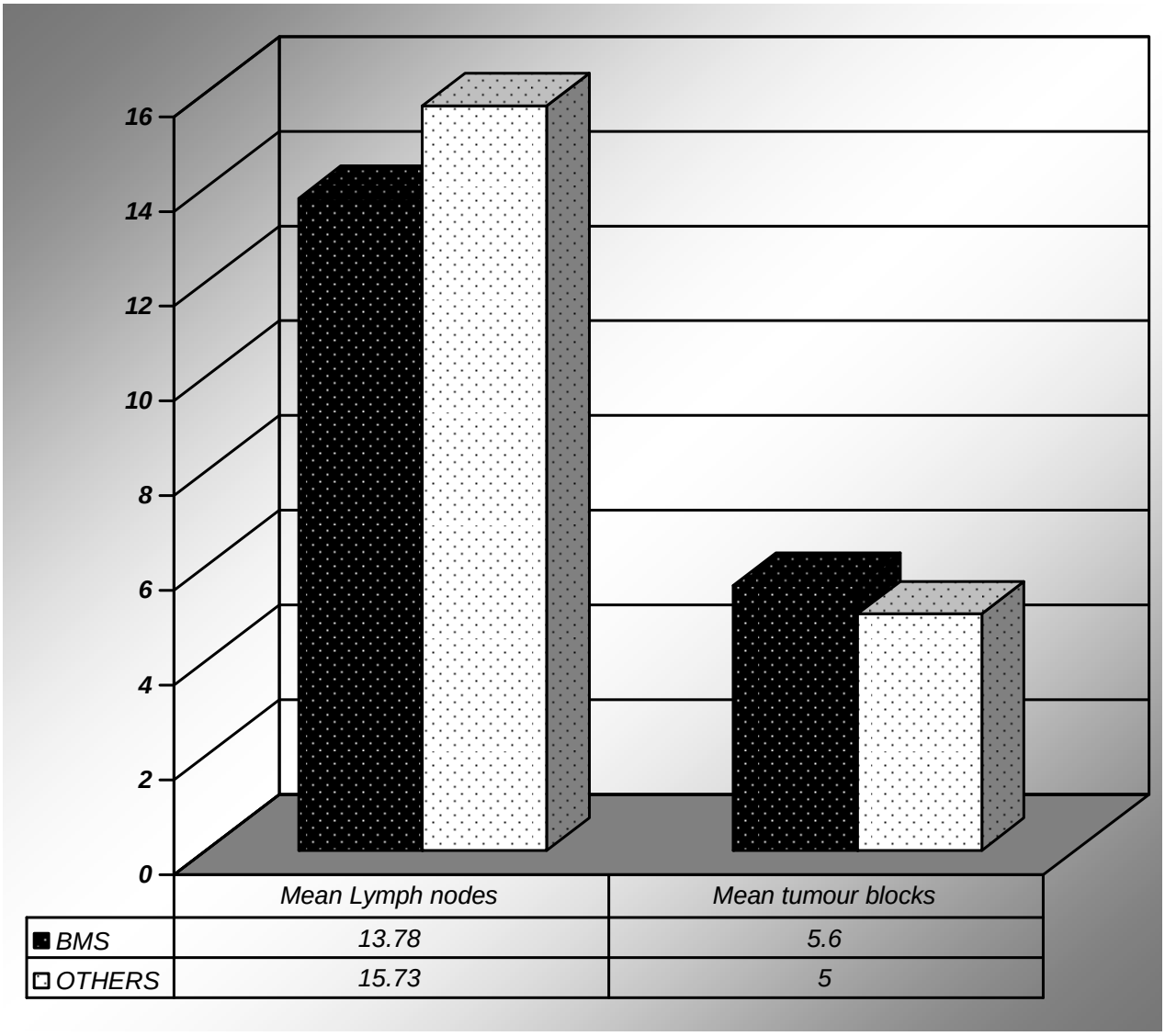
Figure legends

Fig. 1 Graph comparing BMS performance (black bar) with pathologist performance (white bar) expressed as a percentage of total number of cases cut up for Dukes' stage, serosal involvement (pT4b), and presence of extramural vascular invasion (EMVI)

Fig. 2 Graph comparing BMS performance (black bar) with pathologist performance (white bar) expressed as a mean number of lymph nodes found and tumour blocks sampled




| | DUKES A | DUKES B | DUKES C1 | DUKES C2 | pT4b | EMVI |
|---|---|---|---|---|---|---|
| BMS | 16% | 36% | 40% | 8% | 24% | 42% |
| Pathologists | 9% | 39% | 41% | 10% | 41% | 37% |




| | Mean Lymph nodes | Mean tumour blocks |
|---|---|---|
| BMS | 13.78 | 5.6 |
| OTHERS | 15.73 | 5 |