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A cohort investigation of anaemia, treatment and the use of allogeneic blood transfusion in colorectal cancer surgery

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HIGHLIGHTS

- Exclusion of anaemia is underperformed during initial management of colorectal cancer.
- Anaemia is more frequently associated with larger diameter and right sided tumours.
- When identified, preoperative anaemia is undertreated.
- Reduction in severity of anaemia at surgery is associated with reduced transfusion requirements.

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ABSTRACT

Introduction: Preoperative identification and treatment of anaemia is advocated as part of Patient Blood Management due to the association of adverse outcome with the perioperative use of blood transfusion. This study aimed to establish the rate of anaemia identification, treatment and implications of this preoperative anaemia on ARBT use.

Methods: All patients who underwent elective surgery for colorectal cancer over 18 months at a single Tertiary Centre were reviewed. Electronic databases and patient casenotes were reviewed to yield required data.

Results: Complete data was available on 201 patients. 67% (n = 135) had haemoglobin tested at presentation. There was an inverse correlation between tumour size and initial haemoglobin ($P < 0.01$, $Rs = -0.3$). Initial haemoglobin levels were significantly lower in patients with right colonic tumours ($P < 0.01$). Patients who were anaemic preoperatively received a mean 0.91 units (95%CI 0–0.7) per patient which was significantly higher than non-anaemic patients (0.3 units [95%CI 0–1.3], $P < 0.01$). For every 1 g/dl preoperative haemoglobin increase, the likelihood of transfusion was reduced by approximately 40% (OR 0.57 [95%CI 0.458–0.708], $P < 0.01$). Laparoscopic surgery was associated with fewer anaemic patients transfused ($P < 0.01$).

Conclusion: Haemoglobin levels should be routinely checked at diagnosis of colorectal cancer, particularly those with large or right sided lesions. Early identification of anaemia allows initiation of treatment which may reduce transfusion risk even with modest haemoglobin rises. The correct treatment of this anaemia needs to be established.

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1. Introduction

The administration of allogeneic red blood cell transfusions has been demonstrated to adversely impact upon host immune function [1]. Consequently, the perioperative use of allogeneic red blood cell transfusions in colorectal cancer surgery has been associated with adverse outcomes in the both the short term, with increased postoperative morbidity and mortality, and also longer term with

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impaired oncological outcomes [2].

The model of Patient Blood Management advocates instigation of measures to mitigate this need for ARBT [3]. These interventions can be considered in either the preoperative, intraoperative of postoperative phases of surgery and the preoperative management of anaemia has been highlighted as one particular area of focus [3]. This is particularly relevant in the context of CRC surgery due to the frequent association of anaemia with this disease [4].

Advances in CRC management such as the Bowel Cancer Screening Programme (BCSP) could reduce the prevalence of anaemia at diagnosis by identifying malignancy at an earlier stage [5]. Similarly, laparoscopic surgery (LS) may reduce the overall need for ARBT by minimising blood loss [6].

In light of these changes in current practice, this study aimed to identify the prevalence of anaemia and changes in haemoglobin levels across the course of surgical treatment of CRC in a National laparoscopic surgery training centre with an established BCSP. Furthermore, the study aimed to establish the rate of treatment and implications of this preoperative anaemia on ARBT use.

2. Methods

Patients who underwent elective surgery for resection of a primary colonic or rectal tumour between 1st January 2011 and 31st May 2012 were identified from the local National Bowel Cancer Audit Programme (NBOCAP) registry.

Two-hundred and twenty seven patients were considered for analysis. Sixteen were excluded for incomplete records, 6 for having undergone emergency surgery, and a further 4 for having had benign disease. Two-hundred and one patients were thus included in analysis.

Data was retrieved from patient casenotes and hospital electronic records and was reviewed at several time points. The first out-patients appointment (OPA) which prompted investigation resulting in the registered operation was defined as the presentation OPA. Blood test values taken at that appointment or on referral were used as the *"diagnosis"* value. The WHO definition of anaemia (Males, <13 g/dL; Females, <12 g/dL) was applied to all haemoglobin (HB) levels [7].

The second time point evaluated was the preadmission clinic (PAC) appointment when the patient was assessed for surgery. This occurred within the 7–14 days preceding surgery. Blood test values acquired at this visit were used clinically to reflect day of surgery values, and were regarded similarly in this review.

"Initial" HB levels were defined as the earliest available HB level, i.e. the "diagnosis" value when tested, and the PAC result when this was not available.

Tumour details were recorded as documented in the final histopathology report. The site of the tumour was classified as either "Right" (from caecum to distal transverse colon) or "Left" (from splenic flexure to anorectum). Tumour stage was noted per modified Dukes' [8] and TNM classifications [9]. Tumour size was recorded as the maximum tumour diameter in millimetres.

Details were obtained from the operation note, including the American Society of Anesthesiology grade (ASA), operative approach and description including documented blood loss. Blood transfusions including date and volume of administration were delineated from electronic transfusion logs and in patient charts and recorded from OPA until postoperative discharge. The transfusion policy employed by the clinical teams included a "trigger" of 7 g/dL in healthy individuals, or a target closer to 9 g/dL in those with significant cardiovascular or respiratory disease, in line with local policy.

Ethical approval was not sought for this review, but data collection was registered with the Clinical Audit and Evaluation office at Nottingham University Hospitals NHS Trust, audit reference 13-027C.

Statistical significance was defined as $P < 0.05$. Non-parametric

Table 1
Demographic details within groups.

	Group		*P* Value
	Entire cohort		
Gender (M:F)	201 (109:92)		–
Age years (IQR)	68.3 (61–77.3)		–
ASA (95%CI)	2.1 (1.99–2.21)		–
	Anaemic at diagnosis – untreated†	**Anaemic at diagnosis – treated oral iron†**	
Gender (M:F)	43 (23:20)	27(12:15)	0.624
Age years (IQR)	73 (63–79.8)	75 (68–82.8)	0.244
ASA (95%CI)	2.13(1.87–2.38)	2.35 (2.07–2.63)	0.202
Laparoscopic: Open	25:18	17:10	0.238
MCV fl (IQR)	83 (76.8–90)	80 (74.5–87)	0.24
	Anaemic at surgery	**Non-anaemic at surgery**	
Gender (M:F)	87 (41:46)	114 (68:46)	0.09
Age years (IQR)*	76 (67.5–81)	67 (59–73)	<0.01
ASA (95%CI)*	2.26 (2.09–2.43)	2.01 (1.87–2.15)	<0.05
Laparoscopic: Open	39:48	46:68	0.566
MCV fl (IQR)*	83.5 (76.5–90)	91 (86–93)	<0.01
	Laparoscopic surgery	**Open surgery**	
Gender (M:F)	84 (49:35)	117 (60:57)	0.39
Age years (IQR)	69 (62–78)	70.5 (61–76.3)	0.88
ASA (95%CI)	2.1 (1.93–2.27)	2.1 (1.96–2.25)	0.996
Anaemic at surgery(A:NA)	38:46	49:68	0.667
Converted procedures (converted:completed)	12:72	–	–
Tumour Size mm (IQR)	40 (30–50)	37.5 (25–51.25)	0.447
Tumour site (Right:Left)*	36:48	33:84	<0.05
T stage (95%CI)	2.82 (2.63–3)	2.89 (2.72–3.06)	0.687

NB† denotes exclusion of patients who did not have blood results at both diagnosis and surgery; IQR = Interquartile range; MCV = Mean Corpuscular Volume; NA = Not anaemic at surgery; A = Anaemic at surgery; – = Not applicable; *statistically significant.

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