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British Journal of Oral and Maxillofacial Surgery 57 (2019) 543–549

BRITISH Journal of Oral and Maxillofacial Surgery

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Management of anaemia and blood in patients having neck dissections or free flaps for head and neck cancer[☆]

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Accepted 2 May 2019
Available online 23 May 2019

Abstract

Our main aims were to assess haemoglobin (Hb) concentrations from preoperative assessment to discharge from hospital, and to review which patients had blood transfusions and compliance with national transfusion guidelines. We studied a consecutive series of 131 patients between October 2016 and September 2017 who had either neck dissection or resection and free microvascular tissue transfer. Half the patients had soft tissue free flaps (n = 65), 26% had composite free flaps (n = 34), and 24% neck dissection only (n = 32). Using the WHO definition of anaemia, 4% (1/28) of patients who had neck dissections and 19% (16/85) of those who had free flaps were anaemic preoperatively. The median (IQR) Hb at discharge was 131 (119–144) g/L for patients who had neck dissections, 103 (95–114) g/L for those who had soft free flaps, and 95 (90–104) g/L for those who had composite free flaps. No patients who had neck dissection were given a red blood cell (RBC) transfusion, whereas they were given to 26/99 (26%) of those who had free flaps. Hb concentrations were checked after each unit in 31/39 transfusions (79%). Concentrations for those who had free flaps fell by about 30 g/L from admission to operation, and only four patients were given tranexamic acid peroperatively. Postoperatively Hb remained at similar concentrations until discharge, with 23/98 (24%) given iron orally on discharge. In terms of compliance with blood transfusion guidelines there was a notable absence of the use of tranexamic acid and of iron intravenously. An increase in their use could potentially reduce the number of blood transfusions required and the postoperative incidence of anaemia, and have a favourable effect on outcomes such as complications, fatigue, and overall quality of life.

Keywords: Anaemia; Blood Transfusion; Head and Neck Cancer; Free flap reconstruction; Neck dissection; Audit

Introduction

The World Health Organization (WHO) defines iron deficiency anaemia as Hb < 130 g/L in men older than 15 years and <120 g/L in non-pregnant women over 15 years.[1] At presentation the most common haematological abnormality in patients with cancer of the head and neck is anaemia, usually from iron deficiency.[2] Reasons could include difficulties with nutrition because of dysphagia, poor diet, and life style (particularly high alcohol intake). With microvas-

☆ The paper has not be presented at any meeting except at our regional audit day. The study was approved by the Clinical Audit Department at Aintree University Hospital.

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https://doi.org/10.1016/j.bjoms.2019.05.001
0266-4356/

cular reconstruction after tumour ablation it is considered acceptable for haemoglobin concentrations to fall through blood loss and haemodilution, as reduced blood coagulability can help anastomotic success. Consequently, anaemia does occur intraoperatively and because perioperative blood transfusions are avoided where possible, postoperative anaemia is common. This anaemia could contribute to poorer wound healing, fatigue, delayed recovery, and worse health-related quality of life. During follow up, around one fifth of patients report fatigue or tiredness.[3]

A meta-analysis of 4984 patients from 28 papers indicated preoperative anaemia as a potential risk factor for failure of a free flap, with postoperative transfusion being associated with more medical complications.[4] Anaemia (less than 120 g/L) at different treatment times (before and after operation, or before and during radiotherapy) was reported as an independent negative prognostic factor for local recurrence-free and overall survival in patients with cancer of the head and neck.[5] Similar findings were reported by van de Pol et al.[6] Anaemia and body mass index (BMI) independently predicted overall survival for laryngeal squamous cell carcinoma (SCC),[7] while in oropharyngeal cancer that was treated mainly by operation, coexisting conditions and anaemia significantly influenced disease-specific survival and had more impact on overall survival than p16 concentration.[8]

Perioperative blood transfusions in patients with cancer of the head and neck who have free flaps vary across units, for example, from a quarter[9] to nearly half.[10] One reason for this is differences in the criteria for when to transfuse. Rossmiller et al[11] suggested a postoperative transfusion trigger of packed cell volume of less than 0.25, which decreases blood transfusion rates without increasing flap-related complications. Clinical characteristics such as BMI, tumour stage, preoperative haemoglobin, and type of free-flap reconstruction have been identified as being associated with perioperative blood transfusion and can be used to inform risk stratification.[9,12,13] Occasionally a transfusion is required for patients who have only a neck dissection.[14]

Every effort should be made to limit the amount of blood transfused as it carries risk. Patients given three or more units of blood after free tissue transfer were reported to have a considerably worse prognosis in terms of survival and wound infection,[15,16] even after controlling for age, preoperative haemoglobin and albumin, cancer stage, and adverse pathological features. The precise mechanism is not clear but might be related to an altered immunological response.[17] Fenner et al[18] reported that transfusion of more than four units of blood did not seem to influence overall survival, as the strongest predictors were age and American Society of Anesthesiologists'(ASA) class. Other salient reasons to limit perioperative transfusions relate to shortage of blood donations and expense.

United Kingdom multidisciplinary guidelines recommend that iron intravenously should be considered for anaemia in urgent cases, and that preoperative blood transfusion should be avoided where possible, but when essential should be completed 24–48 hours preoperatively.[2] National Institute for Health and Care Excellence (NICE) guidelines for blood transfusion are also relevant.[19,20] Though not specific to head and neck cancer and reconstructive microsurgery, they recommend that people with iron-deficiency anaemia who are having operations should be offered iron supplements before and after operation; adults having operations who are expected to have moderate blood loss should be offered tranexamic acid; and haemoglobin concentrations should be checked after each unit of RBC given unless the patient is bleeding or is on a chronic transfusion programme.

Our study therefore had two main aims. The first was to audit haemoglobin perioperatively (from preoperative assessment to discharge from the ward) in patients having neck dissection or microvascular free tissue reconstruction for cancer of the head and neck. The second was to audit which patients had blood transfusions and compliance with national transfusion guidelines.

Patients and methods

We studied patients who had neck dissection or microvascular free tissue reconstruction for cancer of the head and neck from October 2016 to September 2017 at Aintree Hospital regional maxillofacial unit. There were no exclusion criteria. Cases were identified from theatre lists.

We used electronic patients' records to access operating notes, prescriptions for blood, results, discharge medication, and first clinical outpatient review.

The study was approved by the Clinical Audit Department at Aintree University Hospital.

Fisher's exact test was used to compare categorical data between groups and the Mann–Whitney (two groups) or Kruskal–Wallis test (more than two groups) was used to compare numerical data among groups. Statistical significance was at the 5% level. Analyses were done with the help of IBM SPSS Statistics for Windows version 25 (IBM Corp).

Results

There were 131 surgical patients. Of them, 65 (50%) had soft free flaps, 34 (26%) hard free flaps, and 32 (24%) neck dissection only. At a median (IQR) of 18 (12–28) days before operation, the median (IQR) Hb for those who had neck dissections was 147 (136–157) g/L, (n = 28, range 118–185 g/L). Most (25/32) were admitted on the day of operation, and at a median of 1 (0–2) day before discharge, had a median (IQR) Hb of 131 (119–144) g/L (n = 26, range 104–163 g/L). Based on the WHO definition of anaemia, 1/28 (4%) was anaemic preoperatively and 11/26 (42%) on discharge. No patient who had a neck dissection was given a blood transfusion, and none was discharged on iron. Group and save was first done at a median (IQR) of 11 (1–15) days, and the second at 0 (0–1)

Table 1
Haemoglobin concentrations before, during and after operation.

	Hard free flaps (n = 34)			Soft free flaps (n = 65)		
	Median (IQR) days from operation	Median (IQR) Hb g/L	No. WHO definition of anaemia*	Median (IQR) days from operation	Median (IQR) Hb g/L	No. with WHO definition of anaemia*
Preoperatively	−22 (−31, −8), n = 33	135 (128–145), n = 28	6/28	−27 (−39, −12), n = 61	137 (129–147), n = 57	10/57
1st group & save**	−6 (−14, −2), n = 32	–	–	−6 (−23, −1), n = 54	–	–
2nd group & save	−1 (−1, −1), n = 32	–	–	−1 (−1, −1), n = 60	–	–
Admission	1 (−1, −1), n = 34	127 (120–134), n = 30	14/30	1 (−1, −1), n = 64	130 (124–141), n = 62	17/62
Intraoperatively	–	93 (86–103), n = 28	27/28	–	103 (86–113), n = 56	55/56
ITU lowest	–	89 (82–96), n = 34	34/34	–	98 (86–108), n = 65	65/65
Ward lowest	6 (4–7), n = 33	91 (86–96), n = 33	33/33	3 (3–7), n = 63	96 (85–103), n = 65	65/65
Last Hb	7 (7–13), n = 33	95 (90–104), n = 33	32/33	7 (4–13), n = 65	103 (95–114), n = 65	64/65
Discharge	10 (8–14), n = 33	–	–	9 (6–14), n = 65	–	–

* Men Hb < 130 g/L, women Hb<120 g/L.
** a further 12 (2 hard, 10 soft) “had history” while 1 (soft) had “none” taken.

days before operation (n = 25). The remainder of the results relate to free flaps.

The median (IQR) age of the 99 patients who had free flaps was 66 (57–72) years, 61 were male and 38 female. Three-quarters (n = 74) had oral cancer, eight oropharyngeal cancer, five osteoradionecrosis (ORN), and 12 had other diseases. Staging was early (0–2) in 30, late (3–4) in 61, and unknown in eight. Neck location was unilateral in 62, bilateral in 18, and with vessel access in 19. Seven patients were in the AMG 319 trial.[21]

At three to four weeks before operation, one in five patients was anaemic (Table 1), three below 110 g/L. Twelve of 16 anaemic patients were aged 70 years or more (12/29 aged 70 or more were anaemic, 2/26 aged 60–69, and 2/30 under 60, $p = 0.001$). On admission, 14/30 (47%) patients who had hard free flaps and 17/62 (27%) who had soft free flaps, were anaemic ($p = 0.10$). On admission, Hb concentrations in two patients (one hard, one soft flap) were less than 100 g/L, and in six more were 100–109 g/L. The first group and save was a median of six days before operation, and the second, one day before. Haematinic deficiency checks were recorded in 7/99 patients (7%) (3 hard, 4 soft flaps) before operation; one patient was put on folic acid, no action was taken for one, the rest were not known.

Hb concentrations generally fell by around 30 g/L from admission to during operation (Table 1). Intraoperatively they fell below 80 g/L in 12/84, 80–89 g/L in 16/84, and 90–99 g/L in 16/84. Almost all (98%) were anaemic. Four patients were given tranexamic acid during operation. Thirteen of 99 had complications. Ten of the 13 were given at least one RBC cell transfusion, compared with 16/86 of those without complications ($p < 0.001$). One patient (hard flap) died in ITU. Other issues were evacuation of a haematoma (n = 5), failure of the flap (n = 4), flap salvage (n = 1), bleeding/tracheostomy (n = 1), blowout and evacuation of a haematoma (n = 1).

After operation, Hb changed little until discharge (Table 1). Discharge prescriptions (to take out) for iron were issued to 8/33 who had hard flaps and 15/65 who had soft flaps. The last median (IQR) Hb for patients discharged on iron was 93 (77–103) g/L (n = 23); it was 103 (94–114) g/L (n = 75) for those not on iron ($p = 0.005$). All seven patients with a last Hb concentration below 80 g/L were given iron, as were 2/9 of those with concentrations of 80–89 g/L, 6/33 with concentrations of 90–99 g/L, 5/21 with concentrations of 100–109 g/L, and 3/28 with concentrations of 110 or more g/L. Hb concentrations were reviewed at the next appointment in 16/90. They were unknown for eight who were followed elsewhere, and reviews were mainly opportunistic.

A total of 26/99 patients had 41 RBC transfusions (61 units) (12/34 had hard flaps and 14/65 soft flaps). Most transfusions (26/41) were of a single unit (11 patients had two units, three had three units, and one, four units). Four transfusions were before operation, 12 on the day of operation, 13 the day after, six after 2 days, four after 3-8 days, and two after 19 and 31 days. Hb concentrations were checked after each unit in 31/39 transfusions (24 patients); eight of the 24 patients had a transfusion without such a check and two had surgical complications. Twelve of the 39 transfusions were given during operation with Hb checks in all cases. In addition to RBC transfusions, one patient (hard flap) was given one unit of platelets and four units of fresh frozen plasma (FFP), and another (soft flap), five units of FFP.

Two patients whose concentrations were less than 100 g/L on admission were transfused. One (soft anterolateral thigh free flap) was admitted 13 days before operation (Hb 77 g/L) and was given two RBC units nine days before operation, one unit eight days before, and one unit on the day after operation. The other patient (hard deep circumflex iliac artery (DCIA) free flap) was admitted one day before operation (Hb 81 g/) and given two RBC units on admission and two more on the day of operation. One other patient who had been admitted for bleeding/tracheostomy (Hb 120 g/L) was given two RBC units 10 days before and another unit on the day of operation. The patient who was transfused 31 days after operation was given four RBC units three days after a second operation. The patient who was transfused 19 days after operation had a lowest ward Hb of 71 g/L and was transfused on the day of discharge. All the patients who were given transfusions 3–8

Table 2
Red blood cell transfusion in relation to haemoglobin concentrations at admission, the lowest recorded during operation, and the lowest recorded in the intensive therapy unit (ITU).

Hb g/L	Hard free flaps	Soft free flaps	All free flaps
Admission:			
<70	–	–	–
70–9	–	1/1	1/1
80–9	1/1	–	1/1
90–9	–	–	–
100–109	2/2	3/4	5/6
110–119	2/4	2/5	4/9
120–129	4/13	6/19	10/32
130+	2/10	1/33	3/43
Not known	1/4	1/3	2/7
Lowest during operation:			
<70	–	1/1	1/1
70–9	3/4	7/7	10/11
80–9	2/6	4/10	6/16
90–9	1/9	0/7	1/16
100–109	2/6	1/15	3/21
110–119	0/2	1/10	1/12
120–129	–	0/6	0/6
130+	1/1	–	1/1
Not known	3/6	0/9	3/15
Lowest in ITU:			
<70	1/1	–	1/1
70–9	6/6	3/5	9/11
80–9	5/11	7/12	12/23
90–9	0/11	4/19	4/30
100–109	0/3	0/18	0/21
110–119	0/2	0/8	0/10
120–129	–	0/3	0/3
130+	–	–	–
Not known	–	–	–

Table 3
Haemoglobin (Hb) concentrations whether or not patient had transfusion.

	Median (IQR) Hb g/L		p value*
	Transfusion group	No transfusion group	
Preoperatively	125 (117–135), n = 19	138 (132–150), n = 66	<0.001
Admission	122 (109–127), n = 24	133 (126–141), n = 68	<0.001
Intraoperatively	82 (75–90), n = 22	104 (92–114), n = 62	<0.001
ITU lowest	83 (76–87), n = 26	98 (92–108), n = 73	<0.001
Ward lowest	90 (82–96), n = 25	96 (87–103), n = 73	0.01
Last Hb	98 (92–108), n = 25	102 (92–113), n = 73	0.45

* Mann–Whitney test.

days postoperatively had had previous postoperative transfusions.

Transfusion was more strongly associated with lowest Hb during the stay in ITU than with Hb on admission or lowest intraoperative concentration (Table 2), and concentrations were more comparable by discharge (Table 3). The relation between lowest ITU, lowest ward, and discharge Hb, is shown in Table 4. Seven patients had last Hb concentrations of less than 80 g/L, concentrations were similar in four of them during their stay in ITU, and in all seven during their stay on the ward. Two of the seven were given one unit one day after operation and they were all prescribed iron on discharge. Another nine had a last Hb of 80–89 g/L.

Hb on admission was significantly lower for women and for patients with late tumours (Table 5). None of the clinicodemographic variables was significantly associated with change in Hb from admission to the lowest recorded during operation, or between admission and discharge. Discharge concentrations were significantly lower in patients with hard free flaps, but no other associations were observed. There were no significant associations with transfusions, but patients who had hard flaps and those with later stages of disease had transfusions more often (Table 6). Women were more likely to be prescribed iron on discharge as were patients who did not have oral cancer.

Table 4
Lowest Haemoglobin (Hb) concentration recorded in intensive therapy unit (ITU) by last reading taken closest to discharge.

	Last Hb (g/L) closest to discharge							Total
	70–9	80–9	90–9	100–109	110–119	120–129	130+	
Lowest Hb (g/L) in ITU								
<70	–	–	–	1	–	–	–	1
70–9	4	–	4	2	–	–	–	10
80–9	3	4	10	1	3	–	2	23
90–9	–	5	13	8	4	–	–	30
100–109	–	–	5	8	8	–	–	21
110–119	–	–	1	1	3	5	–	10
120–129	–	–	–	–	2	1	–	3
Total	7	9	33	21	20	6	2	98
Lowest Hb (g/L) on ward								
70–9	7	3	1	1	1	–	–	13
80–9	–	6	11	2	2	–	–	21
90–9	–	–	21	9	6	–	2	38
100–109	–	–	–	9	6	1	–	16
110–119	–	–	–	–	5	3	–	8
120–129	–	–	–	–	–	2	–	2
Total	7	9	33	21	20	6	2	98

Table 5
Median (IQR) haemoglobin (Hb) concentrations in relation to patients' and clinical characteristics.

	Admission Hb (g/L)	p value*	Reduction in Hb (g/L) from admission to lowest during operation	p value*	Reduction in Hb (g/L) from admission to discharge	p value*	Last Hb (g/L)	p value*
All patients	129 (122–140), n = 92		30 (20–40), n = 78		29 (18–38), n = 91		100 (92–111), n = 98	
Surgical group:								
Hard free flap	127 (120–134), n = 30	0.10	32 (25–40), n = 24	0.36	32 (23–37), n = 29	0.41	95 (90–104), n = 33	0.005
Soft free flap	130 (124–141), n = 62		30 (17–42), n = 54		27 (17–38), n = 62		103 (95–114), n = 65	
Sex:								
Male	134 (125–141), n = 55	0.005	32 (24–43), n = 46	0.07	30 (22–39), n = 54	0.23	102 (93–113), n = 60	0.30
Female	126 (120–131), n = 37		24 (17–39), n = 32		27 (12–36), n = 37		98 (91–109), n = 38	
Age (years):								
<60	127 (121–140), n = 34		30 (18–37), n = 30	0.56	27 (14–40), n = 34	0.11	98 (91–113), n = 36	
60–69	134 (126–140), n = 31	0.25	31 (24–43), n = 24		34 (24–39), n = 31		102 (91–110), n = 31	0.87
≥70	128 (120–140), n = 27		28 (17–43), n = 24		28 (18–33), n = 26		102 (92–113), n = 31	
Diagnosis:								
Oral	129 (123–140), n = 68		30 (19–39), n = 58		29 (19–38), n = 67		102 (91–112), n = 73	
Oropharyngeal	130 (na), n = 8	0.55 oral cf rest	34 (na), n = 7	0.37 oral cf rest	30 (na), n = 8	0.90 oral cf rest	105 (na), n = 8	0.81 oral cf rest
ORN	129 (na), n = 5		34 (na), n = 5		31 (na), n = 5		97 (na), n = 5	
Other	124 (120–140), n = 11		30 (na), n = 8		28 (22-37), n = 11		95 (80–113), n = 12	
Stage:								
Early	133 (126–143), n = 29	0.05 excl NK	31 (22–44), n = 23	0.56 excl NK	29 (20–38), n = 29	0.81 excl NK	105 (95–115), n = 30	0.14 excl NK
Late	127 (121–139), n = 55		30 (18–40), n = 47		29 (21–38), n = 54		99 (90–110), n = 60	
NK	122 (na), n = 8		29 (na), n = 8		24 (na), n = 8		98 (na), n = 8	
Neck:								
Unilateral	129 (124–140), n = 58		28 (18–40), n = 48	0.33	32 (22–38), n = 57	0.58	100 (91–113), n = 61	
Bilateral	129 (123–141), n = 17	0.60	36 (21–49), n = 15		26 (12–39), n = 17		103 (98–111), n = 18	0.22
Vessel access	127 (119–137), n = 17		33 (22–41), n = 15		28 (16–39), n = 17		95 (91–106), n = 19	

Also note: (na) refers to IQR not being given as there were <10 cases.
NK: not known; cf: compared with.
* Mann–Whitney (2 group comparison) or Kruskall–Wallis (>2 group comparison) test.

Table 6
Red blood cell (RBC) transfusion and prescription of iron on discharge, in relation to patients' and clinical characteristics. Data are number.

	With RBC transfusion	p value*	Prescribed iron on discharge	p value*
All patients	26/99	–	23/98	–
Surgical group:				
Hard free flap	12/34	0.16	8/33	>0.99
Soft free flap	14/65		15/65	
Sex:				
Male	14/61	0.36	10/60	0.05
Female	12/38		13/38	
Age (years):				
<60	9/36		7/36	
60–69	8/31	0.96	8/31	0.80
≥70	9/32		8/31	
Diagnosis:				
Oral	17/74		13/73	
Oropharyngeal	4/8	0.29 oral cf rest	3/8	0.03 oral cf rest
ORN	3/5		1/5	
Other	2/12		6/12	
Stage:				
Early	5/30	0.30 excl NK	4/30	0.30 excl NK
Late	17/61		17/60	
NK	4/8		2/8	
Neck:				
Unilateral	15/62		14/61	
Bilateral	5/18	0.76	3/18	0.59
Vessel access	6/19		6/19	

NK: not known; cf: compared with.
* Fisher's exact test.

Table 7
Proposed schema for patients who have microvascular reconstruction for cancer of the head and neck.

Preoperatively	Early preoperative bloods to identify patients with iron deficiency anaemia. Ideally immediately after the consultation at which planned treatment is agreed. A haemoglobin tester (HemoCue®) can help rapid identification of anaemia.
	If Hb <120 consider iron intravenously as soon as possible before planned operation.
	Re-check Hb two weeks later, assess need for second treatment, though if close to time of operation, a need for perioperative transfusion or iron intravenously after operation is likely
Intraoperatively	Optimal surgical techniques to avoid blood loss
	Hypotensive anaesthesia
	Hourly assessment of blood loss and Hb checks
	Administration of 1 gram tranexamic acid at start of resection
	Consider cell salvage
	Use of single unit transfusions unless massive unexpected blood loss
Postoperatively	The use of blood transfusion will depend on unit's protocols and individual patients
	If Hb <120 at day 2 or3 consider iron intravenously
	Avoid use of iron orally – low efficacy and side-effects
	Check Hb before discharge and review in first consultation after discharge. If <120 consider repeating iron intravenously if two weeks since the most recent infusion

Discussion

Anaemia and the management of blood in patients with cancer of the head and neck are important because they relate to complications, survival, and quality of life. During operation, anaemia can be managed by perioperative blood transfusion (PBT), although this is not without risk. Our retrospective review of case notes reports Hb concentrations in a consecutive contemporaneous sample of patients who had neck dissections and free flaps, but is limited in terms of being from a single institution. The findings have highlighted potential deficits in management and have allowed opportunities to reflect on how to improve. We included neck dissection for comparison and because our current practice is to “group and save”, which has implications for cost.

About one fifth of patients who had free flaps were anaemic at preoperative assessment, and rates were highest in the elderly. Generally, the time from preoperative assessment to operation was about three weeks, and as haemoglobin continued to fall during this period (by about 7–8 g/L) there was ample opportunity to give iron intravenously. This strategy would comply with statement one of the NICE guideline QS138.[19]

Compared with admission, Hb was generally about 30 g/L lower after operation in patients who had free flaps. To reduce blood loss during resection we now give tranexamic acid at the time of ablation and, so far, it has been safe to use and has not comprised the success of the flap. However, although these early findings are encouraging, it is the subject of an ongoing audit. Das et al reported that tranexamic acid can considerably reduce blood loss and the need for transfusions of colloids, blood, and crystalloids in these operations,[22] but Kulkarni et al found that it did not reduce intraoperative blood loss or the need for transfusions.[23] Its use complies with statement two of the NICE guideline QS138.[19]

Patients who have neck dissection only usually present with higher Hb on admission and in our series no PBT was given. Concentrations of Hb at discharge were satisfactory and there was little indication for iron supplements. Only occasionally will a PBT be necessary for patients who have a neck dissection.[14]

One quarter of patients who had free flaps were transfused (most intraoperatively or in the first few days postoperatively). The local hospital recommends that patients should be given a blood transfusion in theatre or the high dependency unit if Hb falls below 90 g/L. Depending on the patient, this might fall as low as 80 g/L and only then would a transfusion definitely be given. Most patients had only one unit of blood and most had their Hb checked after each unit of RBC. However, there is room for improvement regarding compliance with statement three of the NICE guideline QS138.[19]

The postoperative fall in Hb in patients with free flaps remained until discharge. There is evidence for correcting such anaemia, particularly in those who have radiotherapy or chemotherapy, as anaemia has been shown to be an independent significant prognostic factor for survival[24] and might relate to the oxygenation of tumour cells. Concentrations below 12 g/dl were associated with worse outcomes.[25] After operation there is merit in giving iron intravenously during inpatient stay. In our sample, despite the incidence of postoperative anaemia, only a quarter of the patients were prescribed iron orally because of concerns about its efficacy.

In conclusion, we have highlighted the issue of blood loss and anaemia in patients who have free tissue reconstruction after ablation of tumours in the head and neck. In respect of blood transfusion guidelines, two areas raised particular concern: the use of tranexamic acid and of iron intravenously. As postoperative anaemia is common, iron intravenously should be given where possible instead of blood transfusion, and tranexamic acid should be given during resection. Table 7 summarises a proposed schema for patients who have microvascular reconstruction for cancer of the head and neck. The benefits to patients require further investigation, but could lead to improved outcomes such as fewer complications, lower levels of fatigue, and improved health-related quality of life.

Ethics statement/confirmation of patient's permission

The data, which had been collected as part of a service audit rather than for research, met the criteria of the local Clinical Governance Department for service evaluation.

Conflict of interest

We have no conflicts of interest.

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