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National Comparative Audit of Blood Transfusion

NHS Blood and Transplant

Comparative audit of Red Cell use in the hospitals in the South West and West Midlands Regions

St. Elsewhere's Hospital

September 2008

NHS South West Regional Transfusion Committee

NHS West Midlands Regional Transfusion Committee

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Dr J Birchall and Dr C Taylor (Joint Clinical Leads)
Antoinette Turner (Transfusion Practitioner, West Midlands)
Maggie Webb (Transfusion Laboratory Manager, South West)
John Grant-Casey (National Comparative Audit Group)
David Dalton (National Comparative Audit Group)
Derek Lowe (National Comparative Audit Group)

Principal Stakeholders
NHS Hospitals in the South West and West Midlands Region
Independent Hospitals in the South West and West Midlands Region
National Blood Service
Royal College of Physicians

For correspondence, please contact:
Dr. Janet Birchall – Janet.birchall@nhsbt.nhs.uk

CONTENTS

Executive summary

Introduction

The appreciation that blood transfusion is associated with risk, in addition to increasing cost and reduced blood donor availability, has resulted in an 18% decrease in red cell demand between 2000/01 and 2007/08. The main aims of this audit were to understand current red cell transfusion practice by looking at the distribution of blood by hospital specialty and patient demographic data, and also to consider whether transfusions were in keeping with current guidance i.e. whether they are being used appropriately.

Methods

Transfusion episode data was collected during a one week period commencing 17th September 2007. To aid data collection and keep the workload to a minimum the information requested was limited and designed to be available from computer records e.g. coding records. As patient symptoms are often subjective, variably recorded and would have necessitated note searching, this information was not requested. Patient demographic data, hospital specialty and the number of units transfused were requested for all transfusion episodes, and more detailed information to determine appropriateness was requested for the first 40 transfusion episodes. National Blood Transfusion Committee (NBTC) "Indication codes for transfusion: an audit tool"(appendix 4) was used as the basis to define appropriateness of transfusion. To obtain information on red cell transfusion guidelines, a questionnaire was sent to Consultant Haematologists with responsibility for transfusion.

Results

Overall participation was 46% (26/56), comprising 59% (16/27) in the South West and 35% (10/29) in the West Midlands. Selecting only hospitals with an annual red cell order of more than 5,000 red cell units shows that, overall, participation was better at 66% (20/30), comprising 87% (13/15) in the South West and 47% (7/15) in the West Midlands.

<u>Transfusion guideline data</u>
21 hospitals returned information on transfusion threshold guidelines and these were usually in keeping with NBTC recommendations. Included were guidelines on patients with gastrointestinal bleeding where the most common haemoglobin threshold values were 7 g/dl and 9 g/dl in those at low and high risk of significant co-morbidity respectively. This conflicts with guidelines from the British Society of Gastroenterology, which advise a threshold of 10 g/dl should be used for this patient group. In each of the transfusion categories 10-35% of replies stated that no haemoglobin threshold value was used.

Transfusion episode

Data on patient demographics, hospital specialty and number of units transfused was available for 1113 red cell transfusion episodes. More detailed information was available for 822 transfusion episodes. The main results were as follows: –

- The frequency of transfusion increased up to age 80 years with less than a third of all transfusion episodes in patients under 65 years of age.

- 2 unit transfusions were given in about 60% of all transfusion episodes.

- 57% of all transfusion episodes occurred in medical rather than surgical specialties and general medicine and haematology, at 21% each, were the specialties associated with the highest number of transfusions.

- Chronic anaemia was stated as a reason for transfusion in 43% of cases and bleeding in 42%. 10% of all transfusion episodes were associated with a mean cell volume of greater than 100 fl and 14% were associated with a mean cell haemoglobin of less than 27pg. Fewer than 40% of each of these groups had haematinic investigations performed. Nearly 60% of all patients transfused whose transfusion was associated with surgery were anaemic on admission.

- Overall, 79.3% of all transfusion episodes were considered appropriate, 19.5% inappropriate and 1.2% indeterminate. There was higher (around 24% but over 30% for oncology and haematology patients) inappropriate use when the indication was not associated with bleeding compared with 14% when the indication included bleeding. Frequently, however, when bleeding was absent haemoglobin was measured several days before transfusion - a deterioration in haemoglobin may have been anticipated and a repeat blood sample considered unnecessary.

Conclusions

- Participation was poor in the West Midlands Region

- Most transfusion episodes occurred in elderly patients and the increasing age of the population is likely to impact upon future red cell demand

- More than 50% of all transfusion episodes occurred in patients managed within medical specialties who have not bled.

- Overall, transfusion practice in this audit was commendable. Despite the use of stringent haemoglobin thresholds, 79% of all transfusion episodes audited were considered appropriate. Inappropriate use was found to be higher in patients without bleeding (especially haematology and oncology patients). However the evidence base for transfusion in this group is poor and confounded by the lack of consideration of symptoms in this audit and the timing of transfusion.

- It is likely that more can be done to prevent the need for transfusion as the investigation of anaemia and of abnormal red cell indices was poor. Around 60% of all surgical patients who required blood were anaemic prior to operation.

- A range of hospital transfusion guidelines was audited. 10-35% of the guidelines did not include a haemoglobin threshold. More than 80% of all hospital transfusion guidelines did not use the haemoglobin threshold recommended by the British Society of Gastroenterology for patients with gastrointestinal bleeding.

Recommendations

- The West Midlands RTC should identify why participation was low and rectify any constraints to audit participation prior to further regional audits

- The investigation of anaemia and abnormal red cell indices should be improved by the provision of protocols on all admission wards. Patients who require routine surgery should have a pre operative assessment to identify, investigate and treat anaemia prior to operation whenever possible.

- A systematic review of the literature and probable future trials are required before optimum transfusion practice can be defined for transfusion dependant patients. Until this information is available judicious use of the NBTC Indication codes for transfusion is recommended

- Hospitals with transfusion guidelines which do not include haemoglobin thresholds should consider their inclusion as soon as possible as a guide to appropriate transfusion (BBT3)

- Hospitals with haemoglobin thresholds outside of national guidelines should review their practice

- The NBTC and hospitals should adopt the British Society of Gastroenterology guidelines which recommend a transfusion threshold of 10g/dl in patients with acute upper gastrointestinal bleeding

Introduction

Since the introduction of the Serious Hazards of Transfusion initiative in 1996 there has been a heightened awareness that blood transfusion can cause harm. This appreciation of risk, in addition to the increasing cost of processing blood and reduced blood donor availability, together with the threat of blood shortage, has resulted in an 18% decrease in red cell demand between 2000/01 and 2007/08.
An audit carried out in 2005 in all hospitals in Northern Ireland suggested that 20% of red cell transfusions were inappropriate [(1)]. Information on the appropriateness of current red cell transfusion practice, and whether further reductions in red cell use may be possible, is limited. This audit was designed as collaboration between the South West and West Midlands Regional Transfusion Committees (RTCs) to help understand current red cell use in England and identify where practice could be improved.

The aims of the audit were to:

1. Discover what red cell transfusion threshold guidelines are being used?
2. Discover which patients are receiving red cell transfusions and in which specialty?
3. Assess if red cell transfusions are being used appropriately in terms of the need for transfusion and the amount of blood transfused.
4. Suggest how red cell transfusion practice could be improved.
5. Assess how hospitals obtained the data required for this audit.

Method

This audit was performed during a one week period commencing 17th September 2007. To maximise participation, aid data collection and keep the workload to a minimum the information requested was limited (usually needing a tick box or numerical answer only) and designed to be available from computer records (e.g. coding records). As patient symptoms are often subjective, variably recorded and would have necessitated note searching, this information was not requested. Data collection was delayed for 3 months after the audit week to allow time for the patient to be discharged, electronic information to have been generated e.g. coding records, the medical records to be available, and to allow a break between this audit and another national transfusion audit.

A Table indicating where the required information could be obtained was provided (Appendix 1), and at the end of the audit participants were asked which sources of data they had used (Appendix 2).

To obtain information on hospital guidelines for the use of red cell transfusions, a questionnaire was sent to Consultant Haematologists with responsibility for transfusion in each participating hospital (Appendix 3). The patient categories selected were largely based on those recommended by the National Blood

Transfusion Committee (NBTC) (Appendix 4) but also included recommendations from the British Society of Gastroenterology, for gastrointestinal bleeding [2].

An audit proforma was developed to obtain data on each transfusion episode (Appendix 5). For all transfusion episodes the following information was requested to determine the distribution of red cells :–

- patient demographic data
- hospital specialty
- number of units transfused

For the first 40 transfusion episodes additional information to determine appropriateness was requested :–

- reason for transfusion
- co-morbidities
- pre and post transfusion haemoglobin values
- surgery, when this occurred

The NBTC “Indication codes for transfusion: an audit tool” (appendix 4) was used as a basis to define appropriateness of transfusion. In addition haemoglobin levels suggested by the British Society of Gastroenterology were used when transfusion was associated with gastrointestinal bleeding and haemoglobin values from the Orthopaedic Society were used when transfusion was associated with orthopaedic surgery (Appendix 6). A higher haemoglobin threshold is allowed for patients receiving chemotherapy compared to those with chronic anaemia (9 compared to 8g/dl) according to NBTC indication codes. To prevent misclassification of appropriateness (in this section of the audit only) when the reason for transfusion was stated as chronic anaemia but highly likely, from the details provided, to be in patients receiving chemotherapy, reclassification was performed. Also, in cases where transfusion was precipitated by haemorrhage and no pre-transfusion haemoglobin was available or clearly inaccurate, an approximate pre-transfusion haemoglobin was calculated (by subtracting the number of units transfused from the post transfusion haemoglobin value) to define appropriateness. A threshold of 9 g/dl was used for all patients at high risk of cardiovascular disease. Significant respiratory disease was added to this category in keeping with British Committee for Standards in Haematology guidelines [3]. Despite a recent reduction of this threshold to 8 g/dl by the NBTC, 9g/dl was used as the change was considered too recent to have been widely introduced.

In March/April 2007, a pilot audit was performed in one hospital in the South West, following which changes were made to the audit proforma. Children under one year were excluded at this point as the indications for transfusion were considered to be different to those in older age groups and hospital stay was often prolonged, reducing the likelihood that electronic data and patient notes would be available.

In August 2007 all hospitals within each of the two regions were provided with information about the audit and in October 2007 an invitation letter was sent. Information on red cell transfusion guidelines was collected by manual completion of an audit proforma, and transfusion episode data was collected electronically using a web based tool.

Results

Participation

Overall participation was 46% (26/56), comprising 59% (16/27) in the South West and 35% (10/29) in the West Midlands. Selecting only hospitals with an annual red cell supply of more than 5,000 red cell units shows that overall participation was better at 66% (20/30), comprising 87% (13/15) in the South West and 47% (7/15) in the West Midlands. (Table 1).

Table 1 – Participation in the audit

	South West NHS	South West Private	West Midlands NHS	West Midlands Private
No. invited to participate	18	9	23	6
No. agreed to participate	15	1	12	2
No. completed Transfusion Threshold Guideline questionnaire	14	0	6	1
No. provided Transfusion Episode data	14	1	7	2

Action: The West Midlands RTC should identify why participation was low and rectify any constraints to audit participation prior to further regional audits

Transfusion Threshold guideline questionnaire

21 hospitals returned proformas with red cell transfusion guidelines. Only one hospital from the South West stated that no red cell transfusion guidelines were in place. 20 proformas were therefore available for analysis (Table 2).

The most common haemoglobin transfusion thresholds stated were in keeping with those used to define appropriateness in this audit (Appendix 6). The noticeable exception to this was in patients with gastrointestinal bleeding where the most common haemoglobin threshold values were 7 g/dl and 9 g/dl in those at low and high risk of cardiovascular/respiratory disease respectively. This is in contrast to guidelines from the British Society of Gastroenterology, which advises a threshold of 10 g/dl should be used. In each of the transfusion categories 10-35% of replies stated that no haemoglobin threshold value was used to help assess the need for transfusion. It is acknowledged that guidelines from the British Orthopaedic Society should have been included in the questionnaire but were not.

Table 2 – Transfusion thresholds contained in the guidelines

Haemoglobin threshold g/dl/Indication	Risk of cardio-vascular or respiratory disease	≤ 7	≤ 8	≤ 9	≤ 10	≤ 11	≤ 12	Not stated
Acute or perioperative blood loss	low risk	17 (85%)	1 (5%)					2 (10%)
Acute or perioperative blood loss	high risk		7 (35%)	9 (45%)	1 (5%)			3 (15%)
Acute GI haemorrhage	low risk	9 (45%)	2 (10%)		3 (15%)			6 (30%)
Acute GI haemorrhage	high risk	1 (5%)	4 (20%)	5 (25%)	3 (15%)			7 (35%)
Critical Care	low risk	13 (65%)	2 (10%)					5 (25%)
Critical Care	high risk	5 (25%)	1 (5%)	7 (35%)	1 (5%)			6 (30%)
Post Chemotherapy	low risk	2 (10%)	10 (50%)	4 (20%)				4 (20%)
Post Chemotherapy	high risk		3 (15%)	13 (65%)				4(20%)
Radical Radiotherapy	low risk	2 (10%)	2 (10%)	1 (5%)	9 (45%)		1 (5%)	5 (25%)
Radical Radiotherapy	high risk		3 (15%)	1 (5%)	9 (45%)	1 (5%)	1 (5%)	5 (25%)
Chronic Anaemia	low risk	2 (10%)	12 (60%)					6 (30%)
Chronic Anaemia	high risk		5 (25%)	7 (35%)	2 (10%)			6 (30%)

Action: Hospitals with transfusion guidelines which do not include haemoglobin thresholds should consider their inclusion as soon as possible as a guide to appropriate transfusion (BBT3)

Action: Hospitals with haemoglobin thresholds outside of national guidelines should review their practice

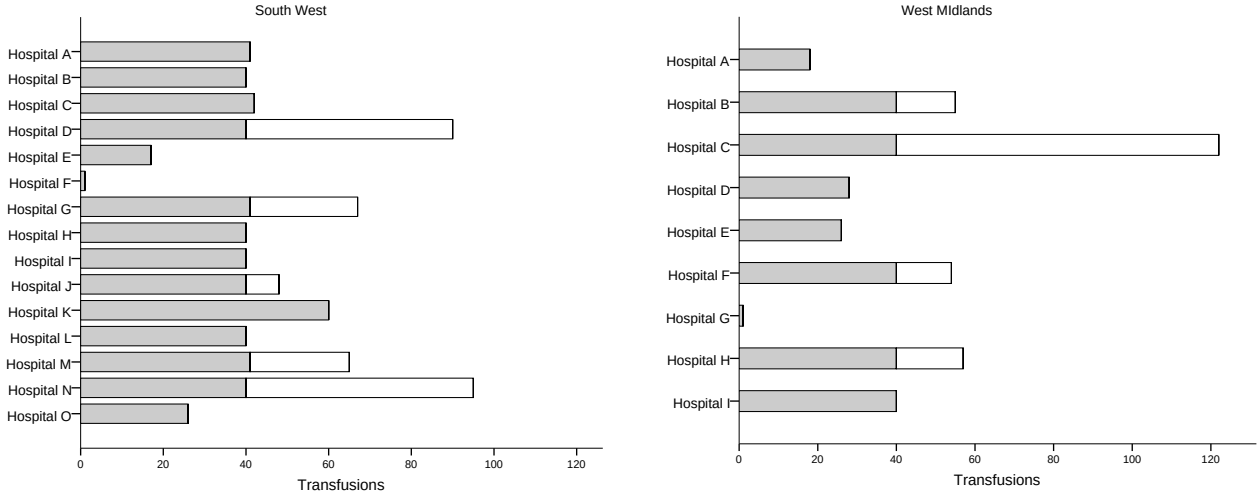
Action: The NBTC and hospitals should adopt the British Society of Gastroenterology guidelines which recommend a transfusion threshold of 10g/dl in patients with acute upper gastrointestinal bleeding.

Transfusion Episodes

Participation

24 hospitals returned data on 1113 red cell transfusion episodes. Fig 1 indicates the data obtained from participating hospitals, anonymised by region. Limited data (sex, age, units transfused, consultant specialty, and final admission diagnosis) was requested for all episodes and full data for a target of 40 episodes where this number of transfusions occurred. Where more than 40 full data sets were supplied from individual hospitals all were included in the analysis.

Figure 1 – Data obtained per region



Key - Shaded box equals full data, open box equals limited data.

Who is being transfused and in what speciality?

The following section contains results on the limited data (patient characteristics, specialty in which they were transfused and reason for admission) returned for all transfusion episodes to identify who is being transfused red cells and in which specialty.

Patient gender

Overall 50% of all patients transfused during the study period were male and 50% female (Table 3). This was consistent across both regions.

Table 3 – Patient gender

	South West (712)		West Midlands (401)		Total (1113)		**Your Hospital (60)**	
	%	N	%	N	%	N	**%**	**N**
Female	50	355	49	198	50	553	**38**	**23**
Male	50	355	51	203	50	558	**62**	**37**
		2		-		2		**0**

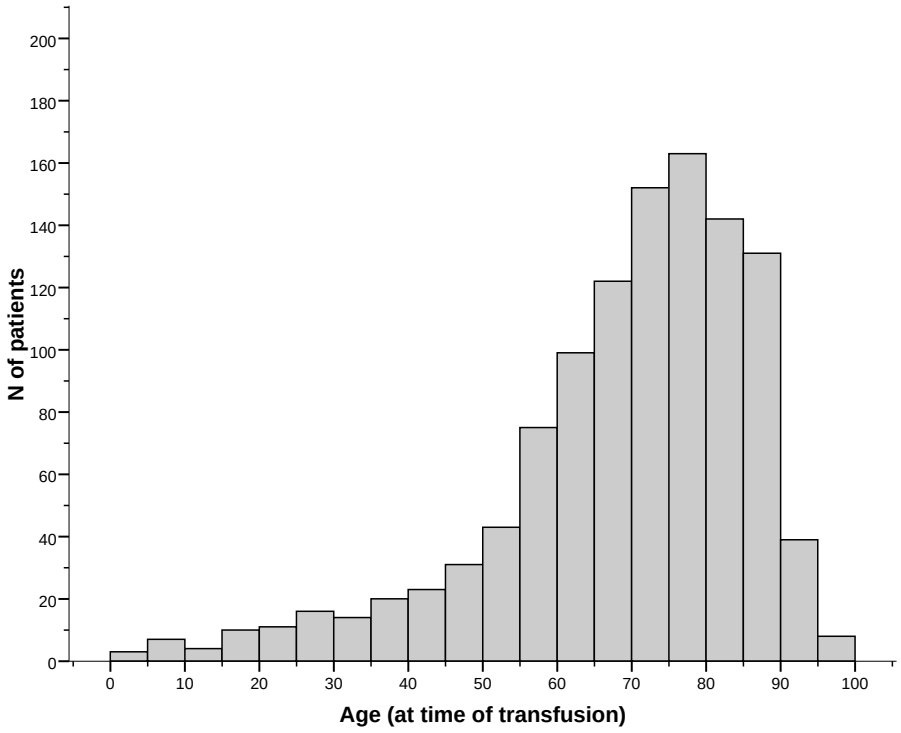
Age at time of transfusion

The frequency of transfusion increased up to age 80 years. Less than a third of all transfusion episodes were in patients under 65 years (Table 4 and Figure 2). The mean age at transfusion in the South West was higher at 70 years compared to 66 years in the West Midlands.

Table 4 – Incidence of transfusion by age group

	South West (712)		West Midlands (401)		Total (1113)		**Your Hospital (60)**	
	%	N	%	N	%	N	**%**	**N**
<65	30	214	35	142	32	356	**42**	**25**
65-74	24	171	26	103	25	274	**30**	**18**
75-84	29	206	25	99	27	305	**15**	**9**
85+	17	121	14	57	16	178	**13**	**8**
	Mean	SD	Mean	SD	Mean	SD	**Mean**	**SD**
Mean (SD) Age	70	(17)	66	(18)	68	(17)	**67**	**15**

Fig 2 – Age at time of transfusion



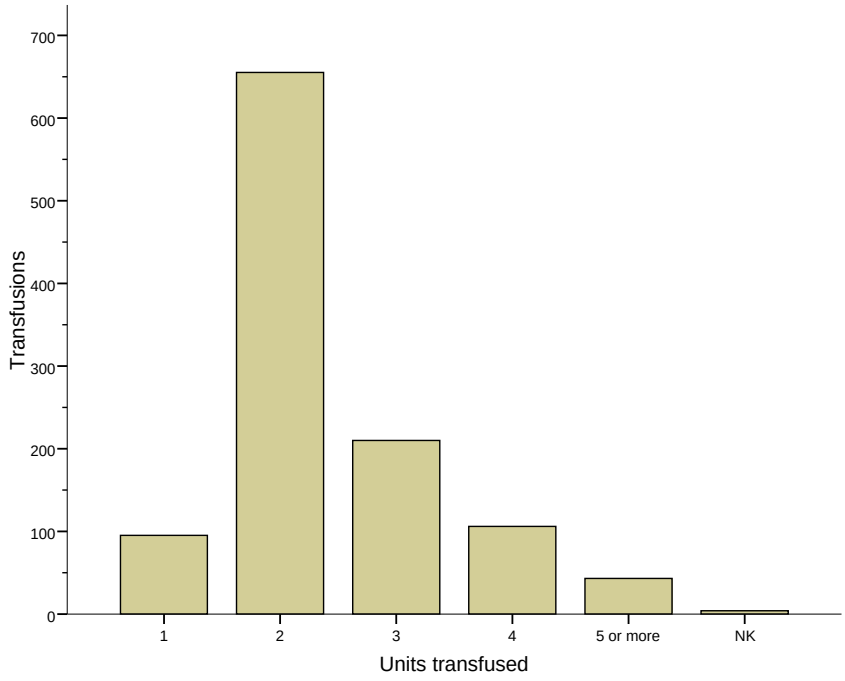
Number of red cell units given at each transfusion episode

2 units were given in 59% of all transfusion episodes and 5 units or more were given in less than 5% of cases (Table 5 and Figure 3). The percentage of units transfused within each region was very similar.

Table 5 – Number of units transfused per episode

	South West (712)		West Midlands (401)		Total (1113)		**Your Hospital (60)**	
	%	N	%	N	%	N	**%**	**N**
One	9	63	8	32	9	95	**10**	**6**
Two	59	422	58	233	59	655	**58**	**35**
Three	18	130	20	80	19	210	**20**	**12**
Four	10	68	9	38	10	106	**3**	**2**
Five or more	4	26	2	17	4	43	**7**	**4**
Not known	0.4	3	0.2	1	0.4	4	**2**	**1**

Fig 3 – Units transfused



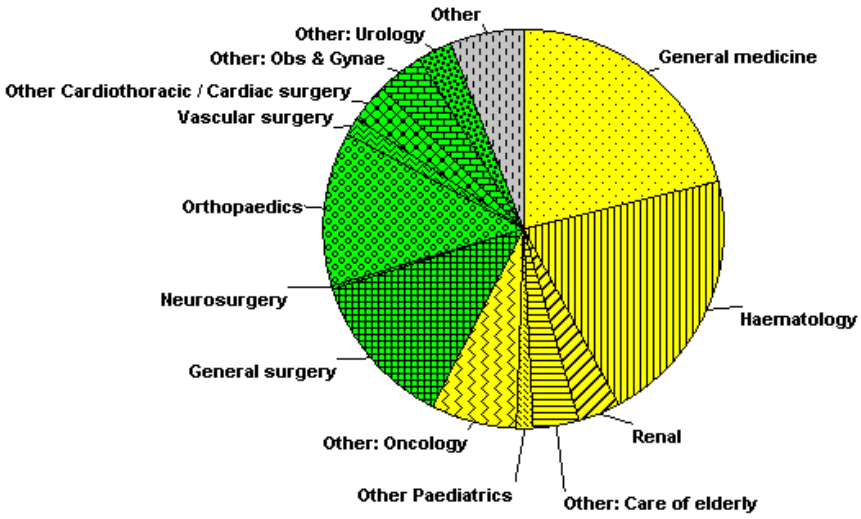
Hospital Specialty at the time of transfusion

Overall, more transfusion episodes (57% (639/1113)) occurred in medical, rather than surgical specialties (Table 6 and figure 4). This difference was more marked in the South West than in the West Midlands - 59% (426/712) compared to 53% (213/401). General medicine and haematology were the specialties associated with the highest number of transfusion episodes at 21% each.

Table 6 – Incidence of transfusion per clinical speciality

	South West (712)		W Midlands (401)		Total (1113)		**Your Hospital (60)**	
	%	N	%	N	%	N	**%**	**N**
General medicine	24	170	16	65	21	235	**5**	**3**
General surgery	13	93	12	47	13	140	**5**	**3**
Haematology	20	144	22	89	21	233	**22**	**13**
Neurosurgery	0.4	3		-	0.3	3	**0**	**0**
Orthopaedics	12	86	13	53	12	139	**18**	**11**
Renal	2	17	5	21	3	38	**22**	**13**
Vascular surgery	1	5	3	11	1	16	**2**	**1**
Not known	0.3	2		-	0.2	2	**2**	**1**
Other specialties:								
Cardiothoracic/cardiac surgery	1	10	6	25	3	35	**0**	**0**
Care of elderly	5	38	1	3	4	41	**0**	**0**
Obs & Gynae	3	22	5	20	4	42	**3**	**2**
Oncology	6	46	8	31	7	77	**0**	**0**
Paediatrics	2	11	1	4	1	15	**0**	**0**
Urology	3	21	2	10	3	31	**13**	**8**
Others	6	44	5	22	6	66	**8**	**5**

Fig 4 – transfusion per speciality (both regions)



Medical specialties are coloured yellow and surgical specialties green

Final diagnosis(es) for admission

These were too numerous to categorise but are listed in Appendix 7 stratified by the specialty at the time of transfusion.

The following section contains results of transfusion episodes audited in full. These were similar with regard to sex, age, units transfused and specialty to those where more limited details were collected as described above. 822 transfusion episodes occurred in total, 549 from the South West and 273 from the West Midlands Region.

Reasons for Transfusion

Auditors were asked to categorise the reason for transfusion into chronic anaemia, chemotherapy, radiotherapy, renal failure, haemorrhage or other. All reasons, applicable to each transfusion episode, were entered and therefore multiple reasons for each transfusion episode were possible. Chronic anaemia was stated as a reason for transfusion in 43% of all cases and bleeding was stated in 42% (Table 7 and Figure 5). A significant difference in the incidence of chronic anaemia was reported in the South West compared to the West Midlands - 49% compared to 33% respectively. The reason for this is unclear but may reflect differences in the size of specialties in participating hospitals within each region or differences in the categories selected by auditors, e.g. chemotherapy or chronic anaemia.

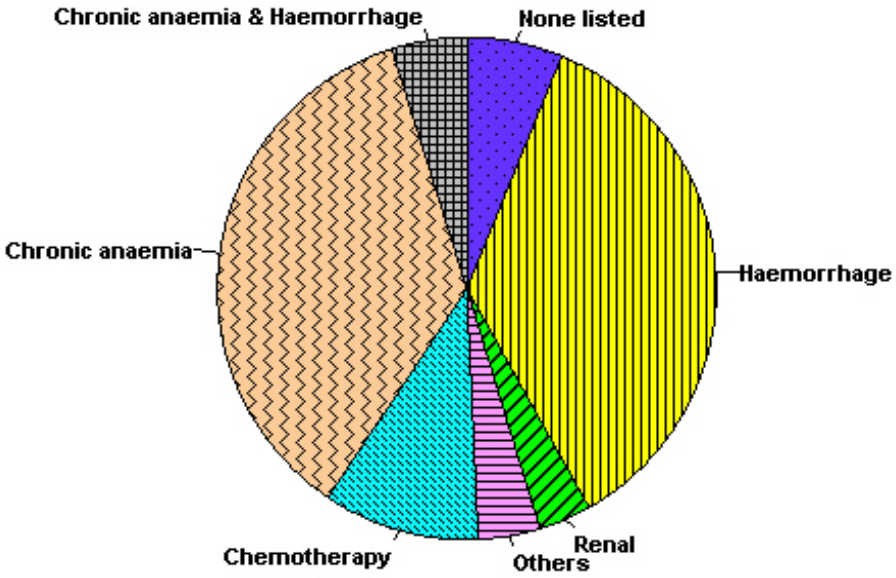
Table 7 – Reason for transfusion

	South West (549)		West Midlands (273)		Total (822)		**Your Hospital (60)**	
	%	N	%	N	%	N	**%**	**N**
Chronic anaemia	49	268	33	89	43	357	**57**	**34**
Chemotherapy	9	51	15	40	11	91	**7**	**4**
Radiotherapy	0.5	3	0.4	1	0.5	4	**0**	**0**
Renal failure	6	35	6	16	6	51	**27**	**16**
Haemorrhage	41	226	44	120	42	346	**48**	**29**
Reasons other than above	3	17	1	2	2	19	**0**	**0**
Reason not known	2	9	8	23	4	32	**2**	**1**

As more than one indication was possible for each transfusion episode, percentages add up to greater than 100.

Figure 5 – Reason for transfusion

TOTAL (822)



This indicates the reason given for each transfusion episode and totals 100%. Category 'other' contained combinations of reasons which are not shown separately as each combination represented 1% or less of total.

Red Cell Indices (Mean Cell Volume and Mean Cell Haemoglobin Values)

10% of all transfusion episodes were associated with a pre-transfusion mean cell volume (MCV) of greater than 100 fl. Within this group, around 30% had B12, folate, TSH or a Coombes test performed within the previous three months. 14% of all transfusion episodes were associated with a pre-transfusion mean cell haemoglobin (MCH) of less than 27 pg. Within this group, 37% had ferritin, serum iron, total iron binding capacity or TSH performed within the previous three months. The percentage of cases with a high MCV and low MCH were similar between regions. Although more than a 10% difference in the rate of investigation was noted for both a raised MCV and low MCH between regions, numbers were small (Table 8).

Table 8 – Haematinics (Abnormal red cell indices = MCV >100 fl & MCH <27 pg)

	South West (549)		W Midlands (273)		Total (822)		Your Hospital (60)	
	%	N	%	N	%	N	**%**	**N**
MCV >100	10	56/538	10	28/272	10	84/810	**5**	**3/57**
If MCV>100 what was the % with ANY of B12, folate, TSH, Coombes recorded?	32	18/56	21	6/28	29	24/84	**33**	**1/3**
MCH <27	15	83/538	11	30/272	14	113/810	**14**	**8/57**
If MCH<27 what was the % with ANY of ferritin, Fe, TIBC and TSH recorded?	34	28/83	47	14/30	37	42/113	**13**	**1/8**

Surgery

36% of all transfusion episodes were associated with surgery. In the vast majority (97%) of these cases, the haemoglobin was known pre-operatively and in nearly 60% the patient was anaemic. In this anaemic pre-surgery group more than 90% (155/167) had additional blood tests performed. However, in most of these cases, 80% (124/155), this was limited to biochemistry assessment alone and in only 8% (14/167) was ferritin recorded within the previous three months (Table 9).

Operation details are provided in Appendix 8 where they are grouped by specialty of consultant looking after the patient at time of transfusion.

Table 9 – Haemoglobin and other tests performed pre-operatively

	South West (549)		W Midlands (273)		Total (822)		Your Hospital (60)	
	%	N	%	N	%	N	**%**	**N**
Surgery	35	188/539	38	104/271	36	292/810	**42**	**25/60**
Pre-operation (admission) Hb known	96	181/188	99	103/104	97	284/292	**100**	**25/25**
Anaemic on admission (males<13.0, females <12.0)	59	107/181	58	60/103	59	167/284	**44**	**11/25**
*If anaemic on admission what was the % with ANY of Ferritin, TIBC, Fe, B12, Folate, TSH, Coombes & Creatinine recorded?	93	100/107	92	55/60	93	155/167	**100**	**11/11**
Ferritin measured	9	10/107	7	4/60	8	14/167	**18**	**2/11**

Action: The investigation of anaemia and abnormal red cell indices should be improved by the provision of protocols on all admission wards. Patients who require routine surgery should have a pre operative assessment to identify, investigate and treat anaemia prior to operation whenever possible.

Comorbidity

75% of all transfusion episodes occurred in patients considered to have, or be at risk of, cardiovascular/respiratory disease. This was 77% in the South West and 75% in the West Midlands. As table 10 shows, the most common category was an age of 65 years or over.

Table 10 - Comorbidity

	South West (549)		West Midlands (273)		Total (822)		**Your Hospital (60)**	
Known comorbidity	%	N	%	N	%	N	**%**	**N**
Aged 65 or over	71	389	63	171	68	560	**58**	**35**
Vascular disease	7	37	6	16	6	53	**8**	**5**
Cardiac	28	156	30	81	29	237	**27**	**16**
Respiratory	7	40	8	21	7	61	**3**	**2**

Multiple comorbid conditions were possible at each transfusion episode therefore totals are greater than the number of transfusion episodes which occurred

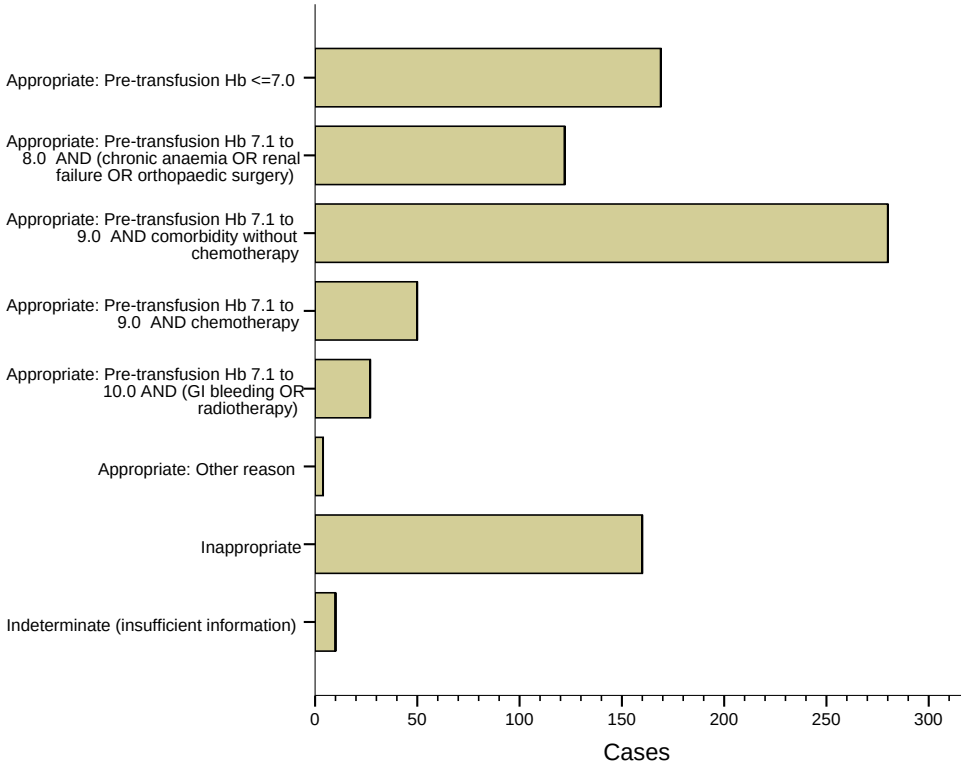
Appropriate Use

Overall, 79.3% (652) of all transfusion episodes were considered appropriate, 19.5% (160) inappropriate and 1.2% (10) indeterminate (Table 11 and figure 6). This was consistent within each region. 21% of all transfusion episodes occurred in patients with a pre-transfusion haemoglobin of $\leq$ 7 g/dl. There was a higher percentage of cases in this category in the West Midlands compared to the South West at 27% and 17% respectively. The most common appropriate pre-transfusion haemoglobin category was 7.1 – 9.0 g/dl and accounted for 40% of all transfusion episodes. The majority of these were associated with a high risk for cardiovascular/respiratory disease rather than chemotherapy.

Table 11 – Appropriateness of transfusion

Appropriateness of Transfusion - grouped according to haemoglobin threshold and category	South West (549)		West Midlands (273)		Total (822)		**Your Hospital (60)**	
	%	N	%	N	%	N	**%**	**N**
1 Appropriate: Pre-transfusion Hb <=7.0	17	95	27	74	21	169	**18**	**11**
2 Appropriate: Pre-transfusion Hb 7.1 to 8.0 AND chronic anaemia OR renal failure OR orthopaedic surgery	17	91	11	31	15	122	**27**	**16**
3 Appropriate: Pre-transfusion Hb 7.1 to 9.0 AND comorbidity without chemotherapy	36	195	31	85	34	280	**33**	**20**
4 Appropriate: Pre-transfusion Hb 7.1 to 9.0 AND chemotherapy	6	31	7	19	6	50	**5**	**3**
5 Appropriate: Pre-transfusion Hb 7.1 to 10.0 AND GI bleeding OR radiotherapy	4	21	2	6	3	27	**0**	**0**
6 Appropriate: Other reason	0.5	3	0.4	1	0.5	4	**0**	**0**
7 Inappropriate	19	104	21	56	19	160	**15**	**9**
8 Indeterminate (insufficient information)	2	9	0.4	1	1	10	**2**	**1**

Figure 6 – Appropriateness of transfusion



Appropriate use by speciality

Obstetrics & gynaecology, oncology and haematology were all found to have an inappropriate use of greater than 20% at 47% (14/30), 46% (25/54) and 33% (58/174) respectively. Haematology was responsible for the largest number of inappropriate transfusions episodes (haematology 58, oncology 25, obstetrics and gynaecology 14).

Appropriate use with haemorrhage

Appropriate and inappropriate use was then classified according to the presence or absence of haemorrhage. The haemorrhagic category included all cases where haemorrhage, orthopaedic surgery or gastrointestinal bleeding was indicated. The non haemorrhagic “medical” category included all other cases which consisted of chronic anaemia, renal failure, chemotherapy or radiotherapy without bleeding. There was a much higher inappropriate use in the medical category of around 24% compared with 14% when the indication included haemorrhage (Table 12).

Table 12 – Appropriateness of transfusion per reason

Reason:	Appropriate %	Appropriate n	Inappropriate %	Inappropriate n	Indeterminate %	Indeterminate n	Total
Haemorrhage	85	300	14	48	1	4	352
Medical	75	324	24	104	1	3	431
Unclear	72	28	21	8	8	3	39

Appropriateness of quantity transfused

In addition, transfusion episodes were considered as to whether an appropriate amount of blood was given or whether over-transfusion occurred. The definition of appropriate amount was the same as used in a previous large audit (reference 1) i.e. the post transfusion haemoglobin was within the haemoglobin threshold plus 2gm. Patients with post transfusion haemoglobin values above this were considered to have been over-transfused. In the haemorrhage category only 4% of transfusions considered appropriate were over-transfused, while 38% of inappropriate transfusions were over-transfused. Similarly, when the indication for transfusion was medical, only 4.2% of all appropriate transfusions were over-transfused, however, in the inappropriate transfusion category, unlike haemorrhage, only 12% of these were considered over-transfused (Table 13).

Table 13 – Appropriateness of transfusion by post-transfusion Hb levels

		Post Hb minus threshold <=2.0		Post Hb minus threshold >2.0		
Reason		%	n	%	n	Total
Haemorrhage	Appropriate	96	281	4	11	292
	Inappropriate	62	28	38	17	45
Medical	Appropriate	96	299	4	13	312
	Inappropriate	88	88	12	12	100
Unclear	Appropriate	92	24	8	2	26
	Inappropriate	50	3	50	3	6

The reason for a significantly lower number of over-transfused cases in those classified as medical and inappropriate was investigated further. Nearly 40% in this category had a pre-transfusion blood sample taken 2 or more days before the transfusion (in 12% this was more than 5 days before transfusion). Transfusion in many medical and inappropriate cases may not therefore have been inappropriate at all. A deterioration in haemoglobin may have been anticipated and a further haemoglobin check considered unnecessary. This inability to accurately classify this group is further compounded by the fact that post transfusion haemoglobin values in more than 50% of these cases were taken greater than 5 days after the transfusion occurred (data not shown). This issue is considered further in the discussion.

Action: A systematic review of the literature and probable future trials are required before optimum transfusion practice can be defined for transfusion dependant patients. Until this information is available judicious use of the NBTC Indication codes for transfusion is recommended.

Obtaining data for the audit

Once data collection had finished auditors were asked to identify which sources of data they had used to obtain information regarding each transfusion episode. 80% (20/24) responses were received from hospitals who had submitted transfusion data. The patients' notes were the most common source for all information requested except date and time of transfusion for which the blood fridge or traceability method was most common. Only 9 hospitals managed to obtain all data without using patient notes (Table 14).

Action: Hospitals who required patients' notes to provide data should identify whether alternative electronic sources exist for future use.

Action: The NBTC should progress information technology solutions to allow all hospitals to easily produce and provide blood transfusion data for audit.

Table 14 – sources of information for the audit

	Patient Notes *	Discharge Letter	Blood Fridge / Traceability	Path / Tx Computer Records *	Coding *
Final Diagnosis for admission	9	2	0	4	4
Reason for Tx	11	1	0	8	3
Comorbidities	10	2	0	3	4
Type of Surgery	10	1	0	5	4
Date of Surgery	10	1	0	8	1
Date of Transfusion	6	0	7	6	0
Time of Transfusion	6	0	8	4	0

** Reason for Tx 3 Trusts / Hospitals used 2 methods*

Discussion

Since 2000 the demand for red cells has steadily declined by 18%. Studies looking at red cell use in 2004 identified that large reductions in surgical blood use were responsible for this decline despite an increase in blood use in medical patients [4] [5]. An audit of appropriate red cell use performed the following year in hospitals in Northern Ireland reported that 20% of all transfusions were considered inappropriate [1]. The main aims of this audit were to understand current red cell transfusion practice by looking at the distribution of blood by hospital specialty and patient demographic data, to consider whether transfusions were in keeping with current guidance i.e. whether they are being used appropriately and to understand whether further reductions in red cell use are possible. By chance, this audit was performed in September 2007, which according to NHS Blood & Transplant statistics, was around the time their red cell issues stabilised. This audit is therefore well placed to provide useful data.

An audit period of one week was considered to be achievable for hospitals and provide sufficient information for analysis. It is acknowledged that for many small hospitals only a tiny number of transfusion episodes may have taken place and for this reason participation in these hospitals was anticipated to be limited. In the South West 87% (13/15) of hospitals with an annual red cell order of greater than 5,000 contributed data. In the West Midlands, however, only 47% of hospitals with an annual red cell supply of greater than 5,000 provided data. As a consequence differences in the results between the two regions such as the mean age at transfusion, the frequency of transfusion classified by specialty and the reason for transfusion may not be genuine. As this audit was agreed by each RTC and coordinated by the NCA group, participation was expected to be high. Low uptake in the West Midlands may have been caused by a lack of awareness of this audit or lack of resource. It is acknowledged that several and perhaps too many other transfusion audits occurred that year. RTCs need to be aware of audit participation and the workload these create and feedback both concerns and suggestions to the NBTC and NCA group.

Limited data was requested for all transfusion episodes which occurred over the audit period to understand which patients and specialty use most blood. Elderly patients were more frequently transfused and nearly 30% of all transfusion episodes occurred in the 75-84 year old age group. 57% (639/1113) of all transfusions were in medical specialties with haematology and general medicine each contributing 21% of all reported episodes. These results are in keeping with previous studies [4] and have implications for future blood supply as the age of the population is steadily increasing and medical conditions are not subject to reduction of blood use by better surgical technique or autologous transfusion.

More detailed transfusion information was available for 822 transfusion episodes. It is accepted that this cannot be used to accurately assess blood use in participating hospitals as it does not include all episodes over the audit week. However when the limited data collected for all transfusion episodes was compared to the same data for

the 822 episodes, the results were similar and would support this data being used to reflect blood use and comment on the appropriateness of red cell use in general.

Perhaps one of the most remarkable results in this audit was the fact that around 60% of all patients who were transfused and underwent surgery were anaemic on admission. This was consistent across both regions. Within this group only 8% had a ferritin recorded up to three months previously. As a significant proportion of these anaemic patients may respond to treatment, other than blood transfusion, pre-operative assessment to identify, investigate and treat pre-operative anaemia must be a priority.

By considering red cell indices it is also likely that further effort is required across all specialties. Only 29% of all cases where the pre-transfusion MCV was 100 fl or greater, had haematinics, TSH or a coombes result recorded and only 37% of all cases where the MCH was less than 27pg had any iron study investigations recorded, in the previous three months. Although it is possible, that these results were expected in some patients (e.g. raised MCV with bleeding or chemotherapy, or investigation may have been performed earlier than the three month audit period), it is probable that investigation to identify the cause of anaemia could be improved and transfusion episodes reduced.

An important aim of this audit was to try and assess the appropriateness of each transfusion episode where full audit data was available. It is accepted that blood transfusion is an inexact science and appropriateness is not defined by randomised control trial evidence apart from for a limited number of patients in intensive care units [(6)]. Blood transfusion however is known to be associated with hazard and resource and therefore unnecessary transfusion should be avoided and current NBTC guidelines suggest safe thresholds above which transfusion is unlikely to be of benefit. These recommendations therefore formed the basis of assessing appropriateness in this audit with the addition of guidelines from the British Society of Gastroenterology and British Orthopaedic Society (Appendix 6). The haemoglobin levels used in this audit were much less tolerant than those used in a prominent red cell transfusion audit performed in Northern Ireland in 2005 [(1)]. In the latter the threshold haemoglobin for all patients with bleeding, marrow failure or receiving chemotherapy or radiotherapy was below 10g/dl. This group also considered symptoms (excluding tiredness) where again a more generous threshold of less than 10g/dl was applied. Despite these differences, the results in this current audit and the audit in Northern Ireland were almost identical with about 80% of all transfusion episodes appropriate and 19% inappropriate. This was consistent across both the South West and West Midlands region.

The most common appropriate pre-transfusion haemoglobin category was 7.1 – 9.0 g/dl and accounted for 40% of all transfusion episodes. The majority (85%) of these were in patients with co-morbidity rather than receiving chemotherapy. A change in transfusion practice as a consequence of implementation of the revised NBTC transfusion guidelines, which now suggest a threshold haemoglobin of 8 g/dl for patients with significant co-morbidity, may therefore impact on blood use.

When appropriate and inappropriate transfusions were considered in association with bleeding or medical indications, only 14% of all transfusion episodes associated with haemorrhage were considered inappropriate and only 4% considered appropriate were over transfused. Given the difficulty in determining a patient's need for transfusion in some of these cases this would appear to be an excellent result, indicating overall careful transfusion practice. This is in contrast to the apparent lack of attention given to the treatment of anaemia prior to surgery. Inappropriate transfusion was found to be higher at 24% in the medical indication category and much higher in oncology and haematology patients at 46% and 33% respectively. This however is very likely to be an overestimation given the timing of samples in relation to transfusion and may have made best use of resources by avoiding a hospital or GP visit to have a repeat blood sample taken.

Haematology as a specialty warrants specific comment. It has been identified as a large blood user responsible for 21% of all transfusion episodes and cares for many elderly patients with chronic transfusion dependant anaemia. Chronic anaemia was the most common indication for transfusion reported in this audit and occurred in 43% of all patients whose transfusion episode was audited in detail. Haematology was also associated with a high number of inappropriate transfusions at 33% and 58 individual episodes respectively. It must therefore be considered as a prime target for improvement. This however is not straightforward. Even if it were practical to monitor haemoglobin levels to define more precisely when to transfuse in this group, symptoms of tiredness may be relevant, affect quality of life, and longer term outcome using more liberal or restricted transfusion regimens is unknown.

The audit of transfusion guidelines identified that the majority of hospitals supported the use of haemoglobin thresholds suggested by the NBTC. Several hospitals however stated that no haemoglobin levels were used to help decide when transfusion should occur and presumably relied mainly on symptoms and signs. Given that symptoms and signs of anaemia are usually non-specific, appropriate transfusion practice is likely to be improved by consideration of haemoglobin threshold levels.

It is disappointing that only 9 out of 20 centres that provided information to determine where they had obtained the data did not require patient notes. However this does indicate that the data requested was available electronically in at least this number of hospitals, was likely to have saved time and resource and should be considered by others for future audits.

Limitations

- Limited participation by large blood using hospitals within the West Midlands may have produced results which are not representative of the region

- Although signs and symptoms of anaemia may have been difficult to obtain their omission is likely to have resulted in misclassification of some transfusion episodes as inappropriate.

- The use of haemoglobin levels closest to but several days before or after the transfusion episode to determine the appropriateness of transfusion or over transfusion will have resulted in misclassification of some transfusion episodes.

Conclusions

- Participation was poor in the West Midlands Region

- Most transfusion episodes occur in elderly patients and the increasing age of the population is likely to impact upon future red cell demand

- More than 50% of all transfusion episodes occur in patients who have not bled and were managed within medical specialties.

- It is likely that more can be done to prevent the need for transfusion as the investigation of anaemia and of abnormal red cell indices was poor. Around 60% of all surgical patients who required blood were anaemic prior to operation.

- Overall transfusion practice in this audit was commendable. Despite the use of stringent haemoglobin thresholds, 79% of all transfusion episodes audited were considered appropriate. Inappropriate use was found to be higher in patients without bleeding (especially haematology and oncology patients). However the evidence base for transfusion in this group is poor and confounded by the lack of consideration of symptoms in this audit and the timing of transfusion.

- 10-35% of all hospital transfusion guidelines did not include a haemoglobin threshold. More than 80% of all hospital transfusion guidelines did not use the haemoglobin threshold recommended by the British Society of Gastroenterology for patients with gastrointestinal bleeding.

- Transfusion audit data can be obtained from electronic sources without the need for patient notes

Recommendations

- The West Midlands RTC should identify why participation was low and rectify any constraints to audit participation prior to further regional audits

- The investigation of anaemia and abnormal red cell indices should be improved by the provision of protocols on all admission wards. Patients who require routine surgery should have a pre operative assessment to identify, investigate and treat anaemia prior to operation whenever possible.

- A systematic review of the literature and probable future trials are required before optimum transfusion practice can be defined for transfusion dependant patients. Until this information is available judicious use of the NBTC Indication codes for transfusion is recommended

- Hospitals with transfusion guidelines which do not include haemoglobin thresholds should consider their inclusion as soon as possible as a guide to appropriate transfusion (BBT3)

- Hospitals with haemoglobin thresholds outside of national guidelines should review their practice

- The NBTC and Hospitals should adopt the British Society of Gastroenterology guidelines which recommend a transfusion threshold of 10g/dl in patients with acute upper gastrointestinal bleeding

- Hospitals who required patients' notes to provide data should identify whether alternative electronic sources exist for future use.

- The NBTC should progress information technology solutions to allow all Hospitals to easily produce and provide blood transfusion data for audit

References

1. Clincal Resource and Efficiency Support Team (CREST), Department of Health NI - Regional Appropriateness of Blood Transfusion Audit, NI Regional Transfusion Committee 2006.

2. British Society of Gastroenterology Endoscopy Committee. Non-variceal upper gastrointestinal haemorrhage: guidelines. Gut 2002. 51 (suppl IV) iv1-iv6

3. British Committee for Standards in Haematology. Guidelines for the clinical use of red cell transfusion. British Journal of Haematology. 2001; 113: 24-31

4. Wallis JP, Wells AW, Chapman CE. Changing indications for red cell transfusion from 2000 to 2004 in the North of England. Transfusion Medicine. 2006; 16: 411-7.

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6. Hebert PC, Wells G, Blajchman MA, Marshall J, Martin C, Pagliarello G, Tweeddale M, Schweitzer I, & Yetisir E. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion Requirements in Critical Care Investigators, Canadian Critical Care Trials Group. New England Journal of Medicine. 1999; 340: 409-417

Appendix 1

Source of data Used in the Audit

	Patient notes or discharge letter relating to relevant admission	Blood fridge / traceability method	Pathology computer	Transfusion laboratory computer	Coding
Audit code number					
Hospital/NHS number	x		x	x	x
Gender	x		x	x	x
Age	x		x	x	x
Number of units transfused	x		x	x	
Hospital specialty at time of transfusion	x		x	x	x
Main diagnosis for admission	x				x
Reason for transfusion	x		x	x	x
Cause of anaemia (haematinics)	x		x	x	
Co-morbidity	x				x
Surgery if yes what was it	x		x	x	x
Date of surgery	x		x	x	
Pre-operation haemoglobin	x		x		
Date & time of pre-operation Hb	x		x		
Date & time of transfusion	x	x	x	x	
Pre-transfusion haemoglobin	x		x		
Date & time of pre-transfusion Hb	x		x		
Post-transfusion haemoglobin	x		x		
Date & time of post-transfusion Hb	x		x		

Appendix 2

Questionnaire to Identify Where Data was Collected From

Please tell us, using the table below, where you obtained the information for the audit questions shown. We would be grateful for only **one** answer for each of the questions

*Please **type an X** in the box for the <u>main</u> method used to obtain most of the data for each of the questions in the table below*

Data source / **Audit Question**	Patient notes	Discharge letter obtained relevant to admission without obtaining notes	Blood fridge or traceability method without obtaining notes	Pathology or transfusion computer records	Coding records
Final diagnosis for admission					
Reason for transfusion					
Co-morbidities i.e. cardiac, respiratory or vascular disease					
Type of surgery					
Date of surgery					
Date of transfusion					
Time of transfusion					

When you have complete this table, please email it to john.grant-casey@nbs.nhs.uk

Appendix 3

National Comparative Audit of Blood Transfusion

Audit of the use of red cell transfusions

Organizational Audit Questionnaire

CLINICAL EFFECTIVENESS & EVALUATION UNIT

Royal College of Physicians

Hospital Name:

This questionnaire is sent to you as part of the South West and West Midlands RTCs audit of red cell transfusion. When it is complete, please return it to the address at the foot of the page

1. Does your trust have **local guidelines or policy** for appropriate transfusion of blood and blood components? Yes ☐ No ☐

If you answered Yes, please continue below. If you answered No, please now return this questionnaire.

2. If Yes, please give the suggested haemoglobin thresholds for transfusion in the following clinical situations:

Acute Blood Loss/peri-operative transfusion

Clinical Situation	**Hb** *(or write n/a if does not apply)*
Acute blood loss / peri-operative transfusion in patients **without/at low risk** of cardiorespiratory disease	
Acute blood loss / peri-operative transfusion in patients **with/at high risk** of cardiorespiratory disease	
Acute gastrointestinal haemorrhage in patients **without/at low risk** of cardiorespiratory disease	
Acute gastrointestinal haemorrhage in patients **with/at high risk** of cardiorespiratory disease	

Non-acute Anaemia

Clinical Situation	**Hb** *(or write n/a if does not apply)*
Critical care patients **without/at low risk** of cardiorespiratory disease	
Critical care patients **with/at high risk** of cardiorespiratory disease	
Post chemotherapy in patients **without/at low risk** of cardiorespiratory disease	
Post chemotherapy in patients **with/at high risk** of cardiorespiratory disease	

Radical radiotherapy in patients **without/at low risk** of cardiorespiratory	
Radical radiotherapy in patients **with/at high risk** of cardiorespiratory disease	
Chronic anaemia e.g. MDS in patients **without/at low risk** of cardiorespiratory disease	
Chronic anaemia e.g. MDS in patients **with/at high risk** of cardiorespiratory disease	

Please return this questionnaire to: David Dalton, National Comparative Audit of Blood Transfusion, FREEPOST (SCE14677), BIRIMINGHAM, B2 4BR

Appendix 4

National Blood Transfusion Committee Indication Codes For Transfusion

The indications for transfusion provided below are taken from UK national guidelines for the use of blood components (see references). Although it is accepted that clinical judgement plays an essential part in the decision to transfuse or not, the purpose of drawing available transfusion guidelines together into one short document is to help clinicians decide when blood transfusion is appropriate, and to minimise unnecessary exposure to transfusion.

Each indication has been assigned a number, which may be used by clinicians when requesting blood or for purposes of audit. Specific details regarding the patient's diagnosis and any relevant procedures to be undertaken should also be provided.

These are current guidelines and may change depending on new evidence.

Red cell concentrates

R1. Acute blood loss (British Committee for Standards in Haematology, 2001):-
Objective: to maintain circulating blood volume and haemoglobin (Hb) concentration > 7 g/dl in otherwise fit patients, and > 8g/dl in elderly patients and those with known cardiovascular disease.

> 15-30% loss of blood volume (800-1500ml in an adult): transfuse crystalloids or synthetic colloids. Red cell transfusion is unlikely to be necessary.
> 30-40% loss of blood volume (1500-2000ml in an adult): rapid volume replacement is required with crystalloids or synthetic colloids. Red cell transfusion will probably be required to maintain recommended Hb levels.
> >40% loss of blood volume (>2000ml in an adult): rapid volume replacement including red cell transfusion is required.

Peri-operative transfusion (Association of Anaesthetists, 2001; British Committee for Standards in Haematology, 2001; Scottish Intercollegiate Guidelines Network, 2001):- Many patients undergoing elective surgical operations should not require transfusion support if their Hb concentration is normal before surgery. Assuming normovolaemia has been maintained, the Hb can be used to guide the use of red cell transfusion.

R2. Hb concentration below 7g/dl.

R3. Hb concentration below 8g/dl in a patient with known cardiovascular disease, or those with significant risk factors for cardiovascular disease (e.g. elderly patients, and those with hypertension, diabetes mellitus, peripheral vascular disease).

Critical Care (British Committee for Standards in Haematology, 2001);
R4. Transfuse to maintain the Hb >7g/dl.

Post-chemotherapy
R5. There is no evidence-base to guide practice. Most hospitals use a transfusion threshold of an Hb of 8 or 9g/dl.

Radiotherapy
R6.Transfuse to maintain Hb above 10g/dl.

Chronic anaemia (British Committee for Standards in Haematology, 2001):-
R7. Transfuse to maintain the haemoglobin just above the lowest concentration which is not associated with symptoms of anaemia. Many patients with chronic anaemia may be asymptomatic with a haemoglobin concentration >8g/dl.

References

Association of Anaesthetists of Great Britain and Ireland (2001). Blood transfusion and the anaesthetist: red cell transfusion (www.aagbi.org).

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British Committee for Standards in Haematology (2004). Guidelines for the use of fresh-frozen plasma, cryoprecipitate and cryosupernatant. British Journal of Haematology, 126, 11-28.

Consensus Conference on Platelet Transfusion (1998). Synopsis of background papers and consensus statement. British Journal of Haematology, 101, 609-617.

Schiffer CA et al for the American Society of Clinical Oncology (2001). Platelet transfusion for patients with cancer: clinical practice guidelines. Journal of Clinical Oncology, 19, 1519-1538.

Scottish Intercollegiate Guidelines Network (2001). Perioperative blood transfusion for elective surgery. (www.sign.ac.uk).

Indicbt13.doc
MFM/JW
8.3.07

Appendix 5

NHS Blood and Transplant
National Comparative Audit of Blood Transfusion

CLINICAL EFFECTIVENESS & EVALUATION UNIT
Royal College of Physicians
Setting higher medical standards

Audit of the Use of Red cell Transfusion

Downloadable Audit Tool

Episode number

Demographic data

1. Is this patient Male ☐ Female ☐

2. What is the patient's age at the time of transfusion? ☐

3. How many units were transfused at this episode? ☐

4. What is the hospital speciality of consultant managing the patient at the time of transfusion?

- General Medicine ☐
- General Surgery ☐
- Renal ☐
- Haematology ☐
- Vascular surgery ☐
- Neurosurgery ☐
- Orthopaedics ☐
- Other ☐

5. If you ticked "Other", please give details here:

6. What was the final diagnosis(es) for admission?

Reason for transfusion

7. What was the reason for transfusion?

- Chronic anaemia ☐
- Chemotherapy ☐
- Radiotherapy ☐
- Renal Failure ☐
- Haemorrhage ☐
- Other ☐

8. If you ticked “Other”, please give details here

*Please provide the following information, if available. (Use results **nearest** to before the date/time of transfusion, but no earlier than 3 months before the date of transfusion)*

9.

MCV	
MCH	
Ferritin	
TIBC	
Fe	
B12	
Folate	
TSH	
Coombes	
Creatinine	

10. Please indicate which diseases the patient had on admission (*Tick as many as apply)*

Cardiac ☐

Respiratory ☐

Vascular disease ☐

Cardiac is defined as Previous MI; Angina; Hypertension; Heart Failure; Pulmonary oedema; Diabetes. **Respiratory** is defined as Respiratory failure / significant chronic respiratory disease. **Vascular** is defined as Previous CVA (stroke); TIA; Peripheral vascular disease.

Surgery

11. Did the patient have any surgery during this hospital admission? Yes ☐ No ☐

If yes, continue below. If no, go to Q17

12. What was the operation?

13. What was the date of surgery? D D M M ☐☐☐☐ Don't know ☐

14. What was the patient's Hb on admission? *(This should be the haemoglobin on admission or if not done the haemoglobin pre-admission)*

15. What was the date of this Hb result? D D M M ☐☐☐☐ Don't know ☐

16. What was the time of this Hb result? H H m m ☐☐☐☐
(If you don't know the date, leave this blank)

Transfusion episode

17. Date of transfusion D D M M ☐☐☐☐ Don't know ☐

18. If possible, please supply the transfusion start time
(If you don't know the date, leave this blank)

H H m m

19. What was the pre-transfusion Hb?
(This should be the haemoglobin immediately (or closest) prior to the patient being transfused. For outpatients use the most recent available pre-transfusion haemoglobin result.)

20. What was the date of this Hb result?

D D M M

Don't know ☐

21. What was the time of this Hb result?
(If you don't know the date, leave this blank)

H H m m

22. What was the patient's Hb after this transfusion episode?
(This should be the first haemoglobin done after transfusion)

23. What was the date of this Hb result?

D D M M

Don't know ☐

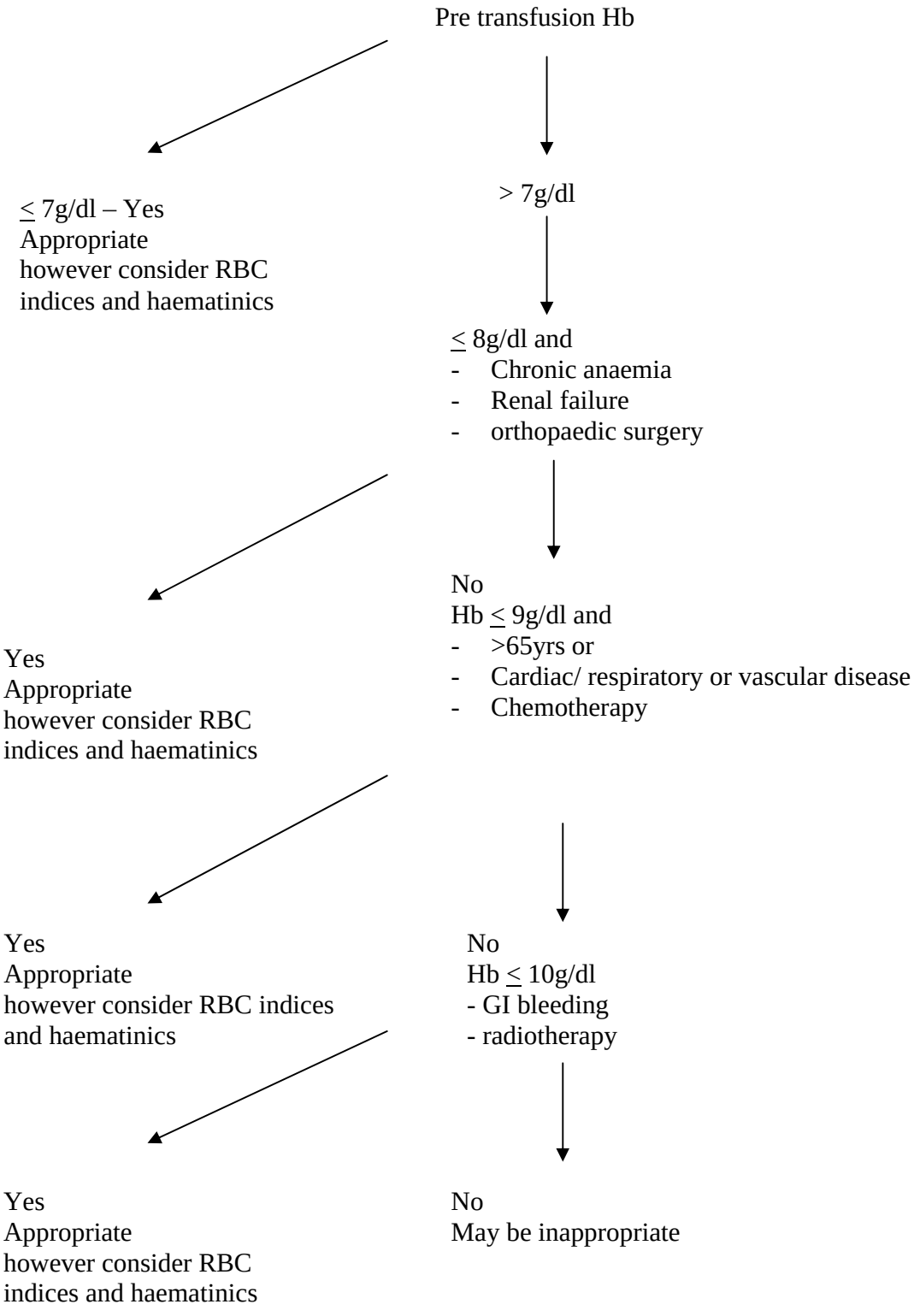
24. What was the time of this Hb result?
(If you don't know the date, leave this blank)

H H m m

Please note here any comments on the transfusion or any discrepancies noted

Appendix 6

Appropriate Use of RBCs flow diagram



Appendix 7

Final diagnosis(es) stratified by specialty of consultant looking after the patient at the time of transfusion

GENERAL MEDICINE

NOT STATED	16
AAA	1
Abdominal pain with black stools	1
ABNORMAL BLOOD CHEMISTRY	1
ACUTE CORONARY SYNDROME, ANAEMIA 2ND TO GASTRIC UL	1
ACUTE DUODENAL ULCER	1
ACUTE LIVER DISEASE	1
Acute MI	2
Acute MI, Renal failure, Gastro conditions	1
acute myeloid leukaemia, anaemic & pyrexial with te	1
acute on chronic GI bleed	1
ACUTE PULMONARY OEDEMA	1
Acute renal failure	1
Alcohol cirrhosis	1
ALCOHOLIC HEPATIC FAILURE	1
ALCOHOLIC LIVER DISEASE	1
Alcoholic liver disease and GI bleed	1
Alcoholic Liver disease PR bleeding	1
Alcoholic Liver Disease, Fracture to Right Ankle [	
ALD - Chronic PR Bleed	1
ALD - Haematemesis	1
ALD	1
AML	1
Anaemia - renal failure	1
Anaemia	19
anaemia / SOB	1
ANAEMIA ?CAUSE	1
anaemia due to chemotherapy	1
anaemia post chemotherapy	1
Anorexia, Low Hb, Diarrhoea, Dyspnoea,	1
Arthritis	1
ascites	1
Ascites/CRF/Cirrhosis	1
Breast cancer	1
Ca bowel	1
ca kidney liver mets	1
ca ovary	1
CA RECTUM	1
CABGs	1
cardiac arrest	1
Chest infection	1
Chest pain	3
CHEST PAIN, SOB, RECENT CHEMO	1
CHEST PAIN/HAEMATOMA	1
Chronic anaemia	1
chronic liver disease	1
CHRONIC RESPIRATORY DISEASE	2
collapse ?cause	1
collapse chain pain	1
Community Acquired Pneumococcal Pneumonia, Pleural	1
confused	1
COPD	1
coronary heart disease	1
CRF CABG	1
Crohn's disease of large intestine	1
Diaphragmatic hernia with obstruction	1
Dizziness, falls, vomiting	1
DUODENAL ULCER - GI BLEED	1
DUODENAL ULCER	2
Duodenal Ulcer with haemorrhage	1
DYSPHAGIA	1
Elective admission	1
Elective CAB	1
Enterocolitis due to Clostridium Difficile	1
Fatigue and SOB ? cause	1
FRACTURE THORACIC VERTEBRAE	1
Fractured neck of femur (NOF)	1
G I Bleed	1
Gastric conditions, Secondary neoplasm liver	1
GASTRIC ANGIODYSPLASIA	2
Gastritis, Malignant Neoplasm of G.I. Tract, Unspe	1
Gastrointestinal bleed	1
Gastrointestinal haemorrhage	3
GI bleed	15
GI BLEED HIGH INR	1
GI Bleed, Diarrhoea, increase size of AAA	1
GI Haemorrhage	1
gram neg bacteraemia ?sepsis, macrocytic anaemia,	1
haematemesis	2
HAEMATEMISIS AND MELEONA	1
Haematological Conditional (HB Keeps dropping at	1
haematemesis	1
Haemoptysis	1
heart failure, renal failure	1
Hepatic encephalopathy	1
Hepatitis	1
Hyperkalemia	1
Hypotensive	1
IDA,OLIGURIA,RENAL FAILURE	1
Increased confusion & lethargy	1
Infectious exacerbation COPD	1
Insertion oesophageal stent	1
investigation of anaemia	1
IRON DEFICIENC ANAEMIA SECONDARY TO BLOOD LOSS	1
iron deficiency anaemia	4
Left ventricular failure	1
Legionella pneumonia and haematemesis	1
Liver Cirrhosis, varices, GI bleed	1
liver disease	3
Liver disease / anaemia	1
Liver failure, alcoholic cirrhosis	1
lower abdo pain	1
Lower G I haemorrhage	1
MALAENA	3
Malignant neoplasm - multi-organ	1
MALIGNANT NEOPLASM - MULTI -ORGAN	1
Malignant neoplasm - multiorgan-ARF	1
Mantle cell lymphoma (new diagnosis)	1
MDS	2
Melaena	1

MELEANA	1
METASTATIC ADENOCARCINOMA	1
microcytic anaemia ? cause	1
Multiple Sclerosis	1
MVR(mitral valve regurgitation), Haemolysis	1
Myelofibrosis	1
MYOCARDIAL INFARCTION	1
Neoplasm	1
NSTEMI	1
Oesophageal cancer	1
OESOPHAGITIS	1
OESOPHAGITIS. DUODENAL ULCER	1
Osteoporosis, fracture	1
PC Anaemia	1
PE,GI bleed, stroke	1
Perforated DU	1
please see comments below	1
Pleural effusion. Known Myelodysplasia	1
Pneumonia	4
Pneumonia post fall & hip injury no #. Melaena for	1
Polyarthrosis, Pain in joints. On warfarin	1
PR bleed	3
PR bleed, SOB, giddiness	1
Psoriatic arthritis	1
PVD - Gastric ulcer	1
pyloric gastric ulcer, GI bleed	1
PYREXIA, UPPER BACK PAIN	1
recurrent Crohns for hemicolectomy	1
renal ca-PE	1
renal disease	1
Renal failure	1
RENAL FAILURE, Fe DEFFICIENCY	1
Requiring oesophagectomy	1
rhabdomyolysis	1
RIGHT VENTRICULAR FAILURE	1
Sepsis, laparotomy for abscess and drainage	1
Sever aortic stenosis	1
Severe LMS stenosis	1
SOB / anaemia	1
Stomach cancer	1
Streptococcal Septicaemia	1
Subdural haematoma , pancytopaenia	1
SUPRAVENTRICULAR TACHYCARDIA	1
SYMPTOMATIC ANAEMIA	1
Syncope & Collapse	1
Ulcer of lower limb	1
Ulcerated leg	1
UMBILICAL HERNIA	1
Unstable angina	3
UNSTABLE ANGINA/CARCINOMA OF THE BREAST	1
Upper GI Bleed	2
Urinary Tract Infection	1
Vomiting over a wk, diarrhoea and fever	1
Total	235

GENERAL SURGERY

NOT STATED	8
?CVA,LRTI, Aneurysm	1
?pancreatitis	1
AAA	1
AAA Repair	3
ABDOMINAL AORTIC ANEURYSYM	1
Abdominal pain	1
ACUTE GALL STONE PANCREATITIS	1
Acute pancreatitis, duodenal ulcer	1
acute urinary retention	1
ALD / Oesophageal varices	1
Anaemia	2
Benign neoplasm of rectosigmoid junction	1
bilateral amputee prev low hb	1
bowel obstruction	2
Breast cancer	1
Ca bowel - post op anaemia	1
Ca breast	1
Ca breast, bed sores	1
Ca colon	3
CA DIGESTIVE TRACT	1
CA KIDNEY	1
CA PROSTATE	1
cancer of bowel	1
cellulitis	1
Central Ca stomach	1
collapse	1
collapse, bowel obstruction	1
Colonic Perforation and abscess	1
Colorectal Ca Liver Mets	1
Crohn's disease or large intestine	1
CYSTITIS GLANDULARIS	1
Diabetic, bleeding	1
DIVERTICULA OF INTESTINE	1
DIVERTICULAR DISEASE	1
DIVERTICULAR OF INTESTINE	1
diverticulitis - anaemia- PR Bleed	1
Duke's A tumour- anterior resection	1
DVT leading to leg abscess	1
elective aortofemoral bypass	1
Elective removal of squamous cell carcinoma	1
Elective repair Left popliteal aneurysm	1
Elective sigmoid colectomy Ca Bowel	1
EMPYEMA OF GALL BLADDER	1
for laparotomy (haemophiliac)	1
for transfusion post haemorrhoid banding	1
Gallstones, cholangitis	1
gastric ulcer	1
Gastrointestinal haemorrhage	1
Gastrointestinal haemorrhage unspecified	1
GI bleed	2
GI Stromal Tumour	1
haematemesis	2
haematuria, anaemia	1
Haematuria, urinary retention	1
Hartmann?s resection	1
hemi-colectomy	4
Hemicolectomy - post op anaemia	1
Ileostomy - post op anaemia	1
intestinal tumour	1
Ischaemic leg ulcer / MDS	1
knee amputation	1
Laparatomy	3
large abscess affecting the left buttock	1
LEAKING AAA	1
Left sided weakness & PR bleeding, TIA	1
Lymphoma	1
MI,Intestinal obstruction	1
Nausea & Vomiting (known ca prostate	1
Nausea & Vomiting (known Ca prostate)	1
Necrotising fasciitis	1
NEOPLASM BLADDER	1
NON INFECTIVE GASTROENTERITIS	1
Obstructive Jaundice	1
OTHER SPECIFIED DISEASES OF DIGESTIVE SYSTEM	1
pancreatic ca, metal heart valve LRTI	1
Pancreatic cancer - jaundice, haematemesis	1
PANCREATITS - HAEMATEMESIS /	1

MALAENA	
PARKINSONS, IRON DEFICIENCY ANAEMIA	1
perforated bowel / septicaemia	1
perforated diverticular disease	1
perforated diverticulum	1
PERFORATION OF BOWEL/OVARIAN CARCINOMA	1
PILONIDAL CYST WITH ABSCESS	1
post-op nephrectomy - arrest- RENAL FAILURE -ITU	1
post op fem pop anaemia	1
PR bleed	2
Pre-op.	6
pre op Aneurysm repair	1
PULMONARY EMBOLISM	1
rectal bleeding	1
Rectal polyp	1
RECTAL POLYP	1
recurrent Crohns disease	1
reoccurrence of Aden carcinoma of colon	1
right hemicolectomy	1
Right total hip replacement	1
RUPTURED AAA	1
RUPTURED AORTIC ANEURYSYM	1
SECONDARY MALIGNANT NEOPLASM OF LIVER	1
sigmoid colectomy & anastomosis for diverticular d	1
skin grafts to pressure sore	1
small bowel obs. post radio & chemo therapy	1
Splenectomy (known lymphoma)	1
Squamous cell carcinoma	1
STEARCOL PERFORATION-FOR OP	1
subphrenic abscess	1
Total hip replacement	1
TURP, Laparotomy & small bowel resection	1
ULCERATIVE COLITIS	1
UMBILICAL HERNIA REPAIR	1
UNSPECIFIED HAEMATURIA	1
Upper GI Bleed	1
VASCULAR DISEASE	1
Total	140

HAEMATOLOGY

NOT STATED	18
A.L.L	1
acute lymphoblastic leukaemia	2
acute lymphoid leukaemia	1
acute myeloid leukaemia	10
ADULT T CELL LYMPHOMA	1
AIHA	1
ALL	2
AML	17
AML elective admission for chemotherapy	1
AML. cycle 4 - MIDAC chemotherapy	1
anaemia - MDS	1
Anaemia	12
anaemia and thrombocytosis	1
ANAEMIA POST CHEMO	1
Angiodysplasia of GI tract - chronic haemorrhage	1
aplastic anaemia	2
AUTOIMMUNE HAEMOLYTIC ANAEMIA	1
B Thalassaemia Major	1
CHRONIC ANAEMIA MDS	1
Chronic Lymphocytic Leukaemia	2
chronic lymphoid leukaemia	1
CLL	4
CLL Septicaemia	1
CMML	2
Cold haemagglutinin disease (CHAD)	1
confusion, alcohol quickly withdrawn then AML diag	1
CRF	1
diffuse non hodgkins small cell lymphoma	1
Epistaxis, Non Hodgkins lymphoma	1
Follicular lymphoma	1
Follicular lymphoma + chemotherapy	1
haematology	1
Haematology Day Case	1
haemophilia	1
hairy cell leukaemia	1
Hairy cell leukaemia	1
HODGKIN'S DISEASE	1
iron deficiency anaemia	1
Leukaemia	2
Lymphoblastic leukaemia	1
lymphoma -post BMT	2
Lymphoma	5
lymphoma of stomach	1
Lymphoma, aplastic	1
MDS - anaemia	1
MDS	36
MDS anaemia	2
MDS/AML	2
MGUS	1
Multiple myeloma	12
Multiple myeloma in overspill	1
Myelodyoplastic Syndrome	1
Myelodysplasia	10
Myelodysplastic anaemia	1
Myelodysplastic syndrome	4
MYELODYSPLASTIC SYNDROME	1
Myelodysplastic syndrome (RAEB 1; IPSS INT 1)	1
Myelofibrosis	5
Myeloma	10
myeloma / renal failure	1
Myeloproliferative Disorder	1
myodysplasia syndrome	4
neutropenic sepsis	1
NHL	3
NHL.,MDS	1
NLH anaemia secondary to chemo at other hospital	1
Non-Hodgkin's Lymphoma	3
non hodgkins lymphoma for BEAM chemo	1
non hodgkins lymphoma, terminal care	1
Please see below comments.....	1
PNH	1
post BMT -myeloma	1
post chemotherapy anaemia	1
Regular transfusions	1
see comments below	1
See comments below (can't be completed here)	1
Sidoblastic Anaemia	2
symptom control-lymphoma	1
T-ALL	1
unspecified anaemia	2
Waldenstroms	2
WALDENSTROMS MACROGLOBULINAEMIA	1
Total	233

ORTHOPAEDICS

NOT STATED	9
# L FEMUR	1

# right NOF	1
# FEMUR	1
# Lt neck of femur	1
# neck of femur	7
# NOF & # humerous due to fall	1
# NOF due to fall known neoplasm in rectum and si	1
#nof/femoral nailing - post op anaemia	1
? # NOF advanced dementia	1
BILATERAL TOTAL KNEE REPLACEMENTS	1
BMT,Splenectomy	1
cellulitis at wound site of previous plated right	1
coxarthrosis	1
Elective Right Hip Replacement	1
For elective surgery - Total Knee replacement	1
For revision of THR	1
fracture femur	1
Fracture femur as result of RTC	1
fracture neck of femur	2
Fracture of femur + GI bleed	1
Fracture of shaft of femur	1
fractured ankle	1
fractured femur	2
fractured neck of femur	10
Fractured neck of femur (NOF)	1
Fractured NOF	3
fractured right hip	1
gonarthrosis	1
hemi arthroplasty	1
Hip refusion	1
hip replacement	3
Hip Revision	1
hip surgery	1
Infantile idiopathic scoliosis, thoracolumbar region	1
Infected THR	1
INFECTION & INFLAMMATORY REACTION DUE TO JOINT REP	1
Knee replacement	1
Malignancy with boney metastasis	1
MRSA Lt hip following THR	1
Multiple fractures	1
multiple fractures / RTC	1
Oseteoarthrosis right hip	1
Osteo arthritis	1
osteoarthrisits - THR	1
Osteoarthritis. Left Hip Replacement	1
Osteoarthrosis left hip	1
pathological fracture of hip	1
Post op Fracture NOF	1
pre-op above knee amputation	1
pre-op orthopaedic surgery	2
Pre-op.	3
Primary Total Prosthetic Replacement of Right Shou	1
prosthetic knee infection	1
reconstruction comminuted # distal femur	2
Revision hip resurfacing	1
Revision Hip Surgery	1
Revision of THR	2
Revision R DHS to THR	1
REVISION TOTAL HIP REPLACEMENT	1
Right closed extra capsular neck of femur fracture	1
Right hybrid total hip replacement	1
RTA - Fracture of upper end of tibia	1
shoulder hemi-arthroplasty	1
spinal surgery	1
surgery	2
THR	11
THR Revision	1
TKR	2
Total hip replacement - post op anaemia	1
Total hip replacement	12
total knee replacement - post op anaemia	1
Total knee replacement	8
Undisplaced fracture neck of femur	1
wound to left lower leg	1
Total	139

OTHER - CARDIOTHORACIC/CARDIAC SURGERY(a)

NOT STATED	1
? NSTEMI	1
3 vessel disease	1
angina for cab	1
Aortic Stenosis. 2x vessel disease	1
AV Replacement	1
AVR	1
AVR & CABG x3	1
bypass surgery	1
CABG	1
CABG x3	1
Cardiac surgery (CAB and MV replacement)	1
Combined disorders of Aortic, mitral & tricuspid v	1
Elective AVR	2
elective surgery	2
heart bypass surgery	2
heart bypass surgery (CABG)	5
HEART BYPASS SURGERY (CABG)	1
heart bypass surgery	1
mitral valve replacement	1
post op	1
post op AVR,MVR	1
post op CAB	2
post op re-admit	1
Squamous Cell Carcinoma Of Right Lung, Upper Lobe.	1
surgery	1
valve replacement surgery	1
Total	35

OTHER- CARE OF ELDERLY

? bowel obstruction	2
Abdomin Pain	1
Acute leukaemia	1
Admitted with a fall	1
Anaemia	1
anaemia, liver mass	2
Anaemic + septic	1
Bleeding leg wound and anaemia	1
Blood tx - Iron Deficiency	1
BROKEN NECK OF FEMUR	1
ca oesophagus ? malaena	1
Chest pain	1
chronic diarrhoea	2
collapse	2
collapse and gangrene of foot	1
collapse, cancer of prostate	1
Endocarditis, renal failure	1
Gastrointestinal bleed	2
Haematemesis and melaena	1
iron deficiency anaemia	2

lower respiratory tract infection	2
macrocytic anaemia	1
MDS	1
No coding data	1
PNEUMONITIS CA KIDNEY	1
Postural hypotension	1
PR Bleed and Pneumonia	1
Pre-op.	1
respiratory tract infection	2
sepsis	1
stroke	1
Unwell	1
UTI, renal failure, anaemia, MTS - IY10 on admiss	1
Total	41

OTHER - OBS & GYNAE

NOT STATED	7
caesarean section	3
cancer of ovary	1
cancer of peritoneum	2
ectopic pregnancy	1
endometrial cancer	1
Hysterectomy	1
HYSTERECTOMY	1
In labour	1
Induction of labour	1
Labour	2
labour / delivery	1
Laparatomy	2
leiomyoma of uterus, heavy menstruation, iron defi	1
Miscarriage	2
Ovary cancer	1
Placenta Praevia with Haemorrhage	1
Post abdominal hysterectomy	1
post delivery anaemia	1
PPH	1
PPH following ventouse delivery	1
Pre-op.	1
pregnancy	1
preop hysterectomy	1
Retained placenta	1
surgery	1
tah	1
Total abdominal hysterectomy & bilateral salpingo-	1
Tubal Pregnancy	2
Total	42

OTHER - ONCOLOGY

NOT STATED	9
acute myeloid leukaemia	1
AML	1
Anaemia	11
ANAEMIA POST CHEMO	1
Bowel cancer	1
Breast cancer	1
breast malignancy	1
Ca bladder	1
Ca breast	2
CA breast admitted with neutropenic sepsis & anaem	1
ca breast mets	1
ca bronchus warf	1
Ca colon	1
CA gastro-oesophageal junction with hepatic mets	1
ca lung	5
CA OESOPHAGUS	1
ca ovary	3
Ca ovary - anaemic	1
ca pancreas	1
CA PROSTATE	2
CA RECTUM	1
CA STOMACH	1
Cancer	1
cancer of bladder, diarrhoea & vomiting	1
cancer of cervix	1
cancer of the breast	1
CANCER PANCREAS	1
Cancer, on chemotherapy	1
Carcinoma of Splenic Flexure Previously resected n	1
Carcinoma of the bladder with metastases	1
CARCINOMA PANCREAS	1
Chronic anaemia	1
for chemotherapy	1
Gastric cancer	2
Gastrointestinal bleed	2
HAEMOTHORAX	1
malignant neoplasm of ovary	1
malignant neoplasm of oesophagus	1
metastatic breast cancer	1
Metastatic colorectal carcinoma	1
metastatic breast cancer	1
oesophageal malignancy	1
Ovarian cancer	2
POST CHEMO, HB 5.7	1
renal carcinoma	1
SARCOMA	1
T2a adenocarcinoma of the prostate regions	1
Total	77

OTHER -PAEDIATRICS

NOT STATED	1
acute lymphoblastic leukaemia	1
AML	1
Anaemia	1
B Thalassaemia Major	1
Blackfan diamond anaemia - routine bld tx	1
CDE	1
Choroid plexus ca.	1
CONSTITUTIONAL APLASTIC ANAEMIA	1
Elective Cardiac surgery	1
osteosarcoma	1
pelvic mass, epistaxis	1
Polycystic kidney disease	1
thalassaemia	1
Thalassaemia	1
Total	15

OTHER - UROLOGY

NOT STATED	4
Bladder tumour	1
Ca bladder	4
CA PROSTATE	1
Cancer of colon	1
Carcinoma Bladder	1
Carcinoma Colon	1

CRF	1
haematuria	3
haematuria / cystoscopy	1
Malignant Neoplasm of Prostate	1
Malignant neoplasm of Ureter	1
post op cystectomy	1
prostate surgery	1
Prostatectomy	1
pt for minor op but developed chest pains	1
RECONSTRUCTION OF UROLOGY TRACT	1
RENAL CA	1
Renal failure	1
Renal malignancy	2
staghorn calculus Right kidney, obstructive uropat	1
surgery	1
Total	31

OTHER - OTHERS

NOT STATED	2
? no electronic records available	1
acute myeloid leukaemia	1
Acute on Chronic Renal Failure	1
Acute pancreatitis	1
ACUTE RENAL FAILURE ? RENAL OBSTRUCTION HYDRONEPHR	1
AML	1
aml sepsis	1
anaemia due to Ca caecum	1
anaemia due to cancer of uterus	1
Bladder Ca	1
Blood tx - Carcinoma of the ovary	1
Bowel cancer	1
Breathlessness, low Hb 6.1 pmh Gastric CA previous	1
BULBAR DUODENITIS	1
CA Bile Duct in Thornbury Hospital	1
Ca bladder	1
ca lung	2
cancer of head face and neck	1
Cancer of the rectum	1
Cancer of Stomach - inpatient at Hospice	1
CARCINOMA OF HYPOPHARYNX/LARYNX	1
Carcinoma of left lung, Cancer at ileocaecal valve	1
FALL	1
Fracture of lower end of tibia	1
Fracture of shaft of tibia	1
Gangrene Lower limb	1
GI bleed	4
haematemesis	1
haemorrhagic gastritis	1
Head injury	1
Head/chest injuries from RTA	1
HIV / Kaposi's sarcoma	1
Ischaemic heart disease	1
ischaemic leg	1
large bowel perforation +long bone fracture	1
Left hip Injury (fall)	1
Malignancy	1
Malignant Neoplasm of Tonsil	1
Menieres disease, malignant neoplasm of prostrate	1
Metastic carcinoma of the breast	1
Multiple fracture and soft tissue injury + skin graft	1
Myelodysplastic syndrome	1
Myelofibrosis	1
obstetrics	1
Open wound of lower leg	1
Orthopaedic surgery following trauma	1
PANCREATITIS	1
please comment box	1
pre surgery	1
Prostate cancer	1
pulmonary TB and pneumonia	1
radical maxillary surgery (tracheostomy, neck dis	1
Recurrent anaemia	1
RENAL FAILURE WITH ACUTE RESPIRATORY FAILURE	1
Right hip injection (unable to move leg)	1
RIGHT SHOULDER FIXATION	1
RTA with multiple foot fractures & burns	1
symptomatic chronic anaemia	1
T4 N2C MO Laryngeal SCC	1
unconscious-coffee grd vomit	1
Total	66

RENAL

NOT STATED	2
Acute renal failure	3
Acute renal failure /anaemia	1
Anaemia	1
clotted access	1
ESRF	1
Gangrene	1
GANGRENE	1
GI bleed	2
Haematemesis and melaena	1
Infective inflammatory reaction to arteriovenous	1
Liver disease, upper GI bleed	1
Not given	1
Pre-op nephrectomy for renal tumor	1
prostrate cancer	1
RENAL DIALYSIS	1
Renal failure	12
Renal Failure and myeloma	1
Renal failure, sepsis	1
renal tumour	1
Septicaemia	1
Septicaemia due to Gram negative organism	1
worsening renal failure	1
Total	38

VASCULAR SURGERY

AAA repair	1
AAA Repair	1
Aorto-bifemoral bypass	1
below knee amputation / diabetes related	1
endarterectomy	1
for surgery	1
ischaemic foot leading to fem pop bypass	1
Ischaemic leg leading to below knee amputation	1
ISCHAEMIC LIMB, ULCER R FOOT	1
Peripheral vascular disease R leg	1
pre-op aneurysm repair	1
Pre-op.	1
Pseudo Aneurysm R groin	1
repair AAA	1
repair of femoral aneurysm	1
surgery	1
Total	16

Appendix 8

Operation details stratified by specialty of consultant looking after the patient at the time of transfusion

GENERAL MEDICINE

3 x CAB	1
Angiocardiography	1
AVR	2
CAB	2
CAB + MVR	1
CAB x 3	2
CABGs	1
ENDOSCOPY	3
insertion oesophageal stent	1
lap chole	1
Laparotomy	2
Laparotomy And Defunctioning Stoma due to Ischemic	1
LAPAROTOMY AND OVERRUNNING OF DUODENAL ULCER	1
Oesophagectomy	1
OGD	1
Right hemicolectomy & Ileostomy to treat bleeding	1

GENERAL SURGERY

AAA Repair	3
Above knee amputation	1
Angioplasty and stent insertion	1
Anterior resection	3
anterior resection for bowel obstruction & loop il	1
ANTERIOR RESECTION OF RECTUM AND ANASTOMOSIS	1
Aortic aneurysm repair	1
bilateral bka	1
BYPASS BIFURCATION AORTA BY ANASTOM AORTA	1
Bypass of stomach to transposed jejenum	1
cystoscopy - known bladder tumour	1
CYSTOSCOPY	1
DRAINAGE OF PILONIDAL SINUS	1
elective aortofemoral bypass	1
ENDOSCOPIC INCISION OF SPHINCTER	1
Endoscopy- peranal dist	1
ERCP	1
Fem-pop bypass graft	1
Freeing of adhesions of peritoneum; open formation	1
Gastrectomy	1
gastric bypass	1
Hartmann rectosigmoidectomy and colostomy	1
HARTMANS PROCEDURE	1
hemi-colectomy	3
ileectomy and formation of ileostomy	1
incision & drainage subphrenic abscess	1
irrigation of breast wound	1
LAP - Gastrojejunostomy	1
LAP & defunctioning LIF colostomy	1
LAP _ oversew of ulcer	1
LAP Bowel resection	1
laparoscopic cholecystectomy	1
Laparotomy	6
Laparotomy & small bowel resection	1
left hemicolectomy	1
Loop colostomy	1
Mandible & bi lat neck resection	1
Mastectomy	1
OPEN CHOLECYSTECTOMY	1
percutaneous insertion of nephrostomy tube	1
revision fem-pop bypass graft	1
RIGHT HEMICOLECTOMY	2
RIGHT HEMICOLECTOMY & ILEOSTOMY HFQ	1
Right hemicolectomy & ileostomy to treat bleeding	2
Right total hip replacement	1
RIGID CYSTOSCOPY	1
Sigmoid colectomy	1
Sigmoid Colectomy	1
Sigmoid colectomy & anastomosis	1
Sigmoid colectomy, total splenectomy	1
skin grafts to pressure sore	1
Splenectomy	1
Surgery for perforation	1
total hip replacement then laparotomy &	1
TURP & small bowel resection	1
Whipples Resection	1
wound debridement	1

HAEMATOLOGY

Diagnostic gastroscopy	1

NEUROSURGERY

Brain surgery	1
craniotomy - clot evacuation	1
Decompression of lumbar spinal canal	1

ORTHOPAEDICS

# nof	1
Above knee amputation	1
Austin Moore hemiarthroplasty	1
BILATERAL KNEE REPLACEMENTS	1
DHS	1
Dynamic Hip screw	7
Exploration / Thoracotomy / Splenectomy	1
fracture femur	1
HEMI-ARTHROPLASTY	2
hemi arthroplasty	1
Hip refusion	1
Hip replacement	2

Hip Revision	1
Insertion of Dynamic Hip Screw	1
insertion of femoral nail	1
Left DHS	2
Left dynamic hip screw	1
LEFT FEMORAL NAIL	1
Metal on metal hip resurfacing arthroplasty	1
ORIF # L FEMUR	1
ORIF greater trochanter	1
Orthopaedic reduction of fracture	1
Orthopaedic surgery	1
Osteoarthrosis right hip	1
PFNA	1
primary posterior fusion with instrument	1
PRIMARY PROSTHETIC REPLACEMENT OF HEAD OF FEMUR	1
Primary THR	1
Primary TKR	1
PRIMARY TOTAL HIP REPLACEMENT	1
Primary total Hip replacement with or without cement	2
Primary Total Prosthetic Replacement of Left Hip J	1
reconstruction # femur	2
Reduction of fracture	1
removal of metal work right femur, removal of inte	1
repair of fractured NOF	1
revision hip resurfacing	1
REVISION OF HIP	1
REVISION OF KNEE REPLACEMENT	1
Revision of right DHS to total hip replacement	1
revision THR	3
Revision of hip	1
Right closed extra capsular neck of femur fracture	1
Right hybrid total hip replacement	1
Right Shoulder Replacement	1
Rt hemiarthroplasty	1
Scoliosis surgery	1
spinal fusion	1
Splenectomy and BMT	1
Thompsons/hemiarthroplasty	1
THR	13
THR Revision	1
TKR	2
Total hip replacement	13
Total Knee Replacement	6
Total Primary Prosthetic Hip Replacement of Right	1

OTHER - CARDIOTHORACIC / CARDIAC SURGERY

Aortic valve replacement & CABGs	1
Atrial valve replacement	1
AVR	3
AVR & CABG x3	1
AVR,MVR,TVR	1
AVR. mitral valve repair, annuloplasty of tricuspi	1
Bypass or coronary arteries including harvesting o	1
CAB	1
cab x 4	1
CAB/MV replacement	1
CABG	2
CABG x3	1
CABGs	1
heart transplant	1
mitral valve replacement	1
Replacement/Repair of aortic valve	1
Right Upper and Middle Lobectomy of Right Lung	1

OTHER - CARE OF ELDERLY

colectomy, ileostomy, splenectomy	2
endoscopic injection & cauterisation of bleeding p	1

OTHER - OBS & GYNAE

bilateral salpingoopherectomy and omentectomy	1
Caesarean Section	3
Debulking (ovary cancer)	1
exploration uterus under GA	1
hysterectomy	3
Hysterectomy&bilateral salpingo-oophrectomy	1
Laparotomy	1
laparotomy /oversewing right ovary	1
LCSC	1
Lower Uterine Segment Caesarean Delivery	1
salpingoopherectomy and omentectomy	1
tah	1
Total abdominal hysterectomy	2
unilateral salpingectomy	2

OTHER - ONCOLOGY

endoscopic injection and cauterisation of bleeding	2

OTHER - PAEDIATRICS

Resection subpulmonary stenosis	1

OTHER - UROLOGY

Cystoprostatectomy	1
Cystoscopy, bladder washout, TURP	1
Endoscopic resection of prostate	1
Nephrectomy	2
Open Nephrectomy	1
RADICAL NEPHRECTOMY	1
right percutaneous nephrolithotomy, percutaneous n	1
TRANSURETEROURETEROSTOMY	1
TURBT	1

OTHER - OTHERS

Amputation	1
Bilateral selective neck disection	1
craniotomy - clot evacuation	1
cystoprostatectomy, urethrectomy and formation of	1
Debridement & repair of open wound	1
Debridement of Abdo wound	1
Mastectomy & immediate reconstruction	1

Microvascular tissue transfer	1
NEPHROSTOMY	1
Orthopaedic	1
Orthopaedic surgery	1
PRIMARY OPEN REDUCTION OF FRACTURE	1
Radical head and neck surgery - excision of tonsil	1
Radical maxilliary surgery	1
Skin Graft	2
TOTAL LARYNGECTOMY, RADICAL NECK DISSECTION	1

RENAL

Insertion of left Brachial arteriovenous shunt	1
left radical laproscopic nephrectomy	1
Nephrectomy	1
Open relief of obstruction of Ileum	1
radical prostatectomy	1

VASCULAR SURGERY

AAA Repair	2
Aneurysm repair	1
angioplasty and revascularisation R leg	1
Aorto-bifemoral bypass & thrombectomy	1
BELOW KNEE AMPUTATION	2
endarterectomy	1
fem/pop bypass grafting	1
femoral endartectomy	1