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ORIGINAL PAPER

Where and when is blood transfused? An observational study of the timing and location of red cell transfusions in the north of England

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Background and Objectives This study was undertaken to provide denominator data relating to the timing and location of transfusion, to support interpretation of reports of incorrect blood component transfused (IBCT) events to the UK Serious Hazards of Transfusion (SHOT) scheme.

Materials and Methods The study was carried out in 29 hospitals in northern England. Data on the timing, location and speciality responsible for transfusion were collected retrospectively (usually the following day) for all red cell units transfused over a 7-day period in September 2005. The timing and location of transfusion of these units was compared with those IBCT reports to SHOT between 1 January and 31 December 2005 in which there was an error in blood collection from the hospital storage site and/or administration to the patient.

Results Data were received on 3123 red cell units, 3118 of which were analysable. Individual hospitals returned data on between 1 and 279 units. The data showed that 888 out of 3118 (28.5%) of units were transfused between 20:00 and 08:00 hours, while 63 out of 169 (37%) of IBCT reports to SHOT where there was an error in blood collection/administration were recorded as occurring during this time period.

Conclusions Comparison of our data with those from SHOT suggests that transfusions that are given outside core hours are more likely to be associated with clinical errors.

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Introduction

The Serious Hazards of Transfusion (SHOT) scheme is a UK-wide professionally led haemovigilance system focused on learning from adverse events. The scheme receives and analyses reports of adverse reactions and events relating to transfusion of labile blood components and formulates recommendations aimed at improving the safety of transfused patients. Since the inception of SHOT, the most frequently reported hazard of transfusion is incorrect blood component transfused (IBCT), accounting for 2317 out of 3239 (71·5%) of reports between 1996 and 2005, during which time approximately 30 million blood components have been issued by the UK blood services. In-depth analysis of the circumstances surrounding transfusion errors can provide insights into contributory factors, and SHOT asks reporters to provide data on the time and location of transfusions.

In 2003, SHOT reported that 65 out of 176 (37%) of IBCT events in which there was an error involving the collection of blood from the hospital storage site and/or administration to the patient, and the time of transfusion was known, occurred outside 'core working hours' (i.e. between 20:00 and 08:00 hours) [1]. In the absence of denominator data on transfusion practice, it was not possible to ascertain whether or not this figure was higher than expected. This study was therefore undertaken to provide data on the time and location of transfusion, which could be compared with SHOT data in

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order to determine whether blood transfusions during certain time periods or in particular hospital locations are more likely to result in an error.

This article reports the results of a survey of the timing, location and speciality for all units transfused during a 7-day period in 29 hospitals in the Northern and Yorkshire regions in England (combined population of over 6·2 million), with the intention of providing information to help interpretation of SHOT data.

Methods

We contacted all hospitals that administer blood transfusions in the Northern and Yorkshire regions of the northeast of England. The approach was made through the hospital transfusion committee (in 1998, the Chief Medical Officer required all hospitals to set up such committees to oversee all aspects of transfusion [2]). Twenty-nine hospitals out of a possible 34 that carry out blood transfusions (14/18 for the Northern region, 15/16 for Yorkshire region) agreed to participate and to collect data on all red cell units transfused over a 7-day period from 18 September to 24 September inclusive.

Data were collected on a preprinted proforma, using a hospital code and unique hospital number for each unit transfused. A member of the hospital transfusion team, usually a transfusion practitioner, completed the proforma as soon as possible after the unit was transfused. Data could be traced back to individual patients by the participating hospital, but not by the National Blood Service, who only had access to the hospital code and a patient ID number. Information on the timing of transfusion was collected using the same headings as the 2005 SHOT/IBCT questionnaire: 08:01–20:00, 20:01–24:00 and 00:01–08:00 hours [3]. Locations were the same as those used by SHOT in 2003: wards, including medical or surgical admission wards, theatres including recovery areas, outpatients or day units (OP/DU), intensive care units (ITU) and accident and emergency departments (A&E) [1]. Data were collected on transfusions in special care baby units (SCBU) under a separate heading, but numbers were few and results were aggregated with intensive treatment unit (ITU) and high-dependency unit (HDU).

We also collected data on the speciality caring for the patient who was receiving the unit, using the main headings from a study of indications for transfusion in the north of England [4].

Data from the proformas were processed using optical recognition software and entered onto an Excel spreadsheet. Statistical analysis was performed using Excel 97 (Microsoft Corporation, Redmond, WA, USA).

Results

Data were collected on 3123 units, and 3118 reports were analysable. Small private hospitals accounted for the four lowest returns. The highest number of returns from an individual hospital was 279, and one trust with two large hospitals submitted analysable data on 409 transfusions. These data were compared with national SHOT figures for 2005, in which there were 485 IBCT reports. One hundred and sixty-nine of these involved an identifiable error in collection of blood from the hospital storage site and/or administration to the patient, with a known time and location of transfusion.

Table 1 Time units were transfused: comparison of survey data with Serious Hazards of Transfusion (SHOT) reports

	Northern and Yorkshire data (%)	SHOT data (%)	*P* value
08:01–20:00	2066 (66·3)	97 (57·4)	0·03
20:01–24:00	482 (15·5)	29 (17·2)	NS
00:01–08:00	407 (13·0)	34 (20·1)	0·03
Unknown	163 (5·2)	9 (5·3)	
Total	3118 (100)	169 (100)	

NS, not significant.

Day of the week

Of the 3118 units, 582 (18·7%) were transfused on a Saturday or Sunday. Twenty-five out of 169 (14·8%) of IBCT errors were related to weekend transfusions. More units are transfused, and more transfusion errors occur on a Wednesday than on other days!

Time of transfusion

Of the 3118 units, 888 (28·5%) were transfused outside 'core hours' (i.e. between 20:01 and 08:00 hours), compared to 63 out of 169 (37%) of SHOT IBCT errors (Table 1).

Location of transfusion

As would be expected, the majority of units were transfused on wards (1794/3118 units, 57·5%). Our study shows that high-dependency wards (ITU/HDU and SCBU), theatre/recovery and outpatient/day units transfused similar numbers of units. Very few units were transfused (15), and very few IBCT errors were reported (1), in SCBU so these data were aggregated with other high-dependency areas (ITU and HDU). Data are compared with SHOT figures in Table 2.

Speciality responsible for transfusion

Specialities with the highest proportion of out-of-hours transfusion were gastroenterology (GI) and emergency surgery (Em Surgery). Medical blood use, which excludes use in

Table 2 location in which units were transfused: comparison of Northern and Yorkshire data with Serious Hazards of Transfusion (SHOT) reports

	Northern and Yorkshire data (%)	SHOT data (%)	*P* value
Wards	1798 (57·7)	122 (72·2)	<0·001
ITU/HDU/SCBU	419 (13·4)	11 (6·5)	<0·001
Theatre/recovery	397 (12·7)	19 (11·3)	NS
OP/DU	398 (12·8)	7 (4·1)	<0·001
A&E	60 (1·9)	7 (4·1)	NS
Other	46 (1·5)	3 (1·8)	
Total	3118 (100)	169 (100)	

A&E, accident and emergency departments; DU, day units; HDU, high-dependency unit; ITU, intensive treatment unit; NS, not significant; OP, outpatients; SCBU, special care baby units.

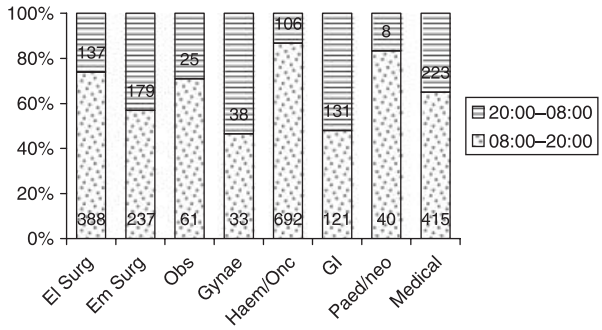

Fig. 1 Timing of transfusion by speciality.

gastroenterology, tends to be high outside core hours. The proportion of night-time transfusions is very high, in our two regions at least, in gynaecology, and our figures have shown that 70 out of 73 (96%) of units were transfused by this speciality on wards (Fig. 1).

Discussion

Since 1996, the SHOT reports have documented errors arising from transfusions of blood and blood products in the UK and the cumulative information has highlighted potential hazards and led to improvements in laboratory and clinical practice. The interpretation of errors has been made easier by epidemiological study of blood transfusion, which has provided valuable information about the way clinical specialities use blood [4,5].

SHOT has also provided information about the timing of transfusion errors. Two surveys, from 2003 and 2005, both report that the percentage of clinical errors resulting in incorrect units of blood being transfused (IBCT), which are reported as occurring outside core hours, is fairly constant, at 37% [1,3]. However, until now, there has been no epidemiological study about the timing of red cell transfusions to help interpret these data. Without this information, we do not know whether a similar percentage of red cell units are transfused out of hours.

This study was designed to capture information about the time that red cell transfusions are carried out, by gathering data from 29 hospitals in two regions in the north of England. Information was also gathered about the location of transfusion and speciality caring for the patient, as this could potentially explain the reason for transfusion outside core hours.

In our study, 889 out of 3118 units (28·5%) were transfused outside core hours, 482 (15·5%) of which were transfused between 20:00 hours and midnight and 407 (13%) between midnight and 08:00 hours. The proportion of units transfused out of hours was therefore lower than seen in reports to SHOT. This is an interesting finding – if our study reflects practice throughout the UK, then we could infer that a clinical error resulting in an incorrect component being transfused was more likely to occur if red cells were given between 20:00 and 08:00 hours. There may be reasons for transfusing out of hours, such as clinical urgency, which might go some way towards explaining why more errors are seen out of hours.

We gathered data about the location of transfusion and this assisted our understanding of the type of transfusions that were given outside core hours. Prior to the study, we expected that the majority of red cell units would be transfused to urgent cases in operating theatres, high-dependency areas and accident and emergency departments. While these departments are more likely to use blood out of hours, 584 out of 1728 (33·8%) of night time transfusions were given on wards.

Our data on the clinical speciality caring for the patient at the time of transfusion suggest that medical teams, excluding haematology and oncology, and gastroenterology, frequently transfuse at night [223 out of 641 (34·8%) medical transfusions were given between 20:00 and 08:00 hours]. Given this high percentage of transfusions outside core hours, further study of the indication for night-time transfusions in medical specialities would be helpful.

Thirty-eight of the 71 units (54%) transfused to gynaecological patients in our study where time was recorded were given out of hours. All but three of these transfusions were given on wards, rather than in operating theatres. This suggests that a detailed investigation of transfusion practice in gynaecology should be carried out.

This study has two limitations. First, despite the large number of transfusions that we studied, we cannot be certain that our study population is comparable to that from which SHOT IBCT errors arose. Second, most of hospitals that carried out the study were reliant on paper-based tracking systems and reported that collection of the data required a considerable amount of effort. Nevertheless, we think we have collected valuable denominator data for SHOT, and have indicated areas for further study, particularly transfusion practice outside core hours in medical specialities and gynaecology.

We concur with the advice given by SHOT that transfusions should not be given out of hours unless clinically essential. Despite moves towards hospitals functioning '24/7', there are fewer trained nurses on wards at night [6]. Wards are likely to be dark, and patients are, or would like to be, asleep. Symptoms or signs of adverse reactions to transfusion are therefore more likely to be missed. Our study strongly suggests that transfusions given outside core hours are more likely to give rise to errors, the consequences of which could be even more serious than errors occurring in the daytime.

Conclusion

This study has provided useful data that can aid the interpretation of SHOT reports of incorrect units of blood transfused as a result of errors in the collection and administration of blood. The incidence of errors associated with transfusion outside core hours is greater than that would be expected. Further study of the timing and location of transfusions could identify where hospital-based transfusion education should be focused.

Acknowledgements

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