Blood Utilization for Elective Surgeries at Main University Hospital in Alexandria, Egypt

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Abstract: This study aimed to determine the efficiency of blood ordering and transfusion practices for patients undergoing elective surgical procedures and to assess the compliance with the international blood transfusion clinical practice guidelines**.** Auditing of blood bank registers for patients who underwent elective surgical procedures was done at the Main University hospital in Alexandria governorate. The total number of adult patients who had elective surgery for which requests for cross matching were made was 4844**;** of them only 1788 patients were transfused. A total of 13389 units of blood were cross-matched, but only 3373 units were transfused. Only 25.2% of total blood cross matched was utilized**,** leaving 74.8% unutilized**.** The overall Cross-match to Transfusion ratio (C/T ratio) was 3.9, the overall Transfusion Probability (%T) was 36.9% and the overall Transfusion Index (TI) was 0.69. The overall percentage compliance with Scottish Intercollegiate Guidelines was 27.7%. Institution-specific blood ordering schedules and protocols should be formulated to reduce exposure to transfusion and to screen for high- risk patient. In conclusion, ongoing audit and monitoring of blood ordering and transfusion practices in the hospital are essential for improving the ordering, distribution, handling and administration of blood components. [Samaa Z. Ibrahim, Heba M. Mamdouh, Amal M. Ramadan . Blood Utilization for Elective Surgeries at Main University Hospital in Alexandria, Egypt. Journal of American Science 2011;7(6):683-689]. (ISSN: 1545-1003). http://www.americanscience.org.

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1. Introduction:

Increasing demand for blood and blood products together with rising cost and transfusion associated morbidity led to a number of studies in the late 1970s reviewing blood ordering and transfusion practice (Olawumi & Bolaji, 2006). Moreover, in recent years there has been an increased emphasis on the potential hazards of transfusion as well as evidence supporting the use of lower transfusion thresholds (Boralessa, 2009).

Since the introduction of blood transfusion into clinical practice, its appropriate use has been the subject for debate. It has been reported that only 30% of cross-matched blood is used in elective surgery. Therefore, awareness of the hazards of blood transfusion is becoming more obvious due to the expansion of various aspects of blood transfusion services and the increased understanding of transfusion science in recent years (Abdelhadi & Bashawari, 2001).

Blood transfusion plays a major role in the resuscitation and management of surgical patients, but surgeons most of the times over estimate the anticipated blood loss thereby, over-ordering blood. Moreover, a number of studies in many countries of the world have shown over ordering of blood by surgeons with utilization ranging from 5-40 % (Olawumi & Bolaji, 2006).

Many units of blood routinely ordered by surgeons are not utilized but are held in reserve and thus are unavailable for other needy patients. This can impose inventory problems for blood bank, loss of shelf life and wastage of blood (Vibhute, et al.,2000). In South Africa for example, 7-10% of blood is wasted annually because of over-ordering of blood (Olawumi & Bolaji, 2006). Also reports from different parts of the world revealed an unintentional misuse of the blood bank services causing a great burden on its resources, namely wastage of blood, reagents and manpower (Abdelhadi & Bashawari, 2001).

Wide variations in transfusion practice are existed between countries and institutions and even between the individual clinicians within the same institution (Western Ausralia Department of Health, 2010). Blood use audits in Scotland showed that**,** large variations are existed among individual practitioners or operating teams within a hospital (Scottish Intercollegiate Guidelines Network (SIGN), 2001).
Variations in rates of transfusion may be due to many factors, including differing opinions on the threshold

level of hemoglobin below which a patient needs blood transfusion, differences in surgical and anesthetic techniques, differences in case mix, pre-operative anemia, and lack of availability of transfusion protocols. This may reflect uncertainty about the relative benefits and risks of transfusion and the different perceptions of the value of minimizing blood loss and subsequent transfusion (SIGN, 2001).

Moreover, many surgeons prescribing blood are unaware of recommended published guidelines for transfusion practice and still adhere to historical practice and not evidence (National Blood Users Group, 2001).

A study was conducted in Kuwait reported that only 28.3% of cross matched blood for elective surgery was actually transfused. In addition, it documented monthly mean wastage (±SD) of 45 (±13) blood units due to the absence of a blood ordering policy also it was estimated that a technician can cross-match three units per hour. This results in wastage of 54.5% of technician working time, leading to an average blood bank annual loss of US $25,000.00 for one 120-bed department of surgery (Juma et al., 1990). This can be decreased by simple means of changing the blood cross- matching and ordering schedule depending upon the type of surgery performed (Vibhute, et al.,2000). Moreover, implementation of the recommended maximum surgical blood-order schedule and introduction of type and screen for eligible surgical procedures is considered as a safe, effective and economic solution to preoperative over-ordering of blood (Bhutia et al., 1997).

A careful assessment of the risks and benefits of blood transfusion is essential for a good patient outcome. In addition, it is essential that the utilization of blood and blood products be rationalized and they are saved for critical situations. Appropriate placement of blood requests according to a planned schedule most often averts the consequences of indiscriminate ordering of blood. This requires streamlining blood ordering schedule keeping in view the blood bank resources, time, as well as money (Subramanian et al., 2010). Based on available evidence, institution-specific protocols should screen for high-risk patients including advanced age, low preoperative red blood cell volume, preoperative antiplatelet or antithrombotic drugs, complex procedures where blood conservation interventions are likely to be most productive for this high-risk subset (The Society of Thoracic Surgeons, 2007).

Studies assessing blood ordering and transfusion practices couldn't be traced in developing countries especially Egypt. Therefore, the aim of this study is to determine the efficiency of blood ordering and transfusion practices for patients undergoing elective surgical procedures and to assess the compliance with the international blood transfusion clinical practice guidelines.

2. Material and Methods

A. Study Setting:

The study was conducted at the surgical departments pertaining to Main University hospital in Alexandria governorate. It is multi-specialty 1700 bed hospital; of which, 700 surgical beds pertained to thirteen surgical departments performing about 10500 major elective adult surgical procedures per year.

B. Study Population:

Overall, a total of 4844 adult patients (2624 were males and 2220 were females) who underwent elective surgical procedures over a period of 1 year from July 2009 to June 2010 were included in the study.

C. Sampling Design:

Retrospective audit of blood bank registers was performed which covered all adult patients who underwent elective surgical procedures in all surgical departments pertaining to the study hospital and for which cross matching was requested during the study period.

D. Data Collection Methods:

Data were collected using review of registers technique. Blood ordering and transfusion practices for elective surgical procedures in the surgical departments pertaining to the study hospital were assessed according to certain indices including; Cross match to Transfusion ratio, Transfusion Probability, and Transfusion Index (Friedman et al., 1976; Mead, 1980). These indicators were computed using the following equations;

1- Cross match to Transfusion ratio (C/T ratio) = No. of units cross matched / No. of units transfused

2- Transfusion Probability (%T) = No. of patients transfused / No. of patients cross matched

3- Transfusion Index (T I) = No. of units transfused / No. of patients cross-matched

Scottish Intercollegiate Guidelines Network recommended cross match to transfusion ratio (C/T ratio) for evaluating blood transfusion practices [6]. According to this guideline, C/T ratio shouldn't

exceed 2:1. In the present study, compliance with these guidelines was assessed to evaluate blood utilization practices at the selected hospital. The percent of blood cross-matched that was utilized was calculated as = $\frac{\text{No of units transfused}}{\text{No of units cross matched}} \times 100$

E. Statistical Analysis:

Data were statistically analyzed using Statistical Package for Social Science (SPSS) version 11.5 (SPSS Inc., Chicago IL, USA). Frequencies were calculated for all variables and Pearson's Chi-Square test was used to assess the statistical significance of difference in blood utilization between surgical departments pertained to the study

3. Results

The number of adult patients who had elective surgery and for which crosshatching was requested totaled 4844 patients. Male patients constituted the higher percentage (54.2%). The mean age of patients was 42 years with the highest percentage of patients was within age group "from 40 to less than 50" (31.8%), while the lowest percentage was within age group"60 years and more" (7.1%). Neurosurgery was the department of the highest admission rate (29.0%). On the other hand, renal-transplant and otolaryngology were the departments of the lowest admission rates (0.1% and 2.7%, respectively).

Table1 shows that, among a total 4844 patients, only 1788 patients were actually transfused. Neurosurgery was the department of the highest number of both patients cross matched (28.9%) and patients transfused (26.0%). On the other hand, renal-transplant was the department of the lowest number of both patients cross matched (0.06%) and patients transfused (0.16%). Blood utilization was 100% only in renal-transplant department, where the number of patients cross matched and the number of patients transfused were equal (3 patients).

As shown in Table 2, a total of 13389 units of blood were cross-matched, however, only 3373 units were transfused. Neurosurgery was the department of the highest number of both blood units cross matched (30.1%) and blood units transfused (28.2%), while renal-transplant was the department of the lowest number of both blood units cross matched (0.1%) and blood units transfused (0.2%).

Only 25.2% of total blood cross-matched was utilized. The highest percentage of blood cross matched was utilized in Renal-transplant department (56.2%), while Urology-endoscopy was the department of the lowest percentage of blood cross matched that was utilized (9.4%).

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Data from table 3 revealed the blood utilization indices in different surgical departments of the selected hospital. In relation to C/T ratio, urology-endoscopy was the surgical department of highest the C/T ratio and renal-transplant was the department of the lowest C/T ratio (1.7) with overall C/T ratio of 3.9. The overall %T was 36.9%, ranged from 100.0% in renal-transplant department to 15.7% in Urology- endoscopy department. The overall TI was 0.69 that ranged from 3.00 in renal-transplant department to 0.18 in Urology- endoscopy department.

The overall percentage compliance was 27.7% with the highest percentage compliance in renal-transplant department (66.7%) followed by Plastic surgery department (56.6%). On the other hand, Urology- endoscopy was the department of the lowest percentage compliance (11.7%), followed by vascular surgery department (16.0%). There was statistically significant difference between the different surgical departments at the selected hospital regarding the percentage compliance with guidelines (p=0.003), as shown in Table 4.

Table 1: Comparison between the number of adult patients cross-matched and those who were transfused at Main University hospital in Alexandria.

Department	No. of Patients cross-matched		No. of Patients transfused	
	No.	%	No.	%
Neurosurgery	1403	28.9	466	26.0
Urology	855	17.6	242	13.5
Urology- endoscopy.	197	4.0	31	1.7
Hepato- billiary	295	6.0	112	6.2
Colo-rectal	361	7.4	132	7.3
Gastro-intestinal	401	8.2	128	7.1
Cardio-thoracic	511	10.5	277	15.4

Vascular-surgery	162	3.3	33	1.8
Tumor excisions	159	3.2	129	7.2
Plastic surgery	159	3.2	111	6.2
Otolaryngology	131	2.7	55	3.0
Renal-transplant	3	0.06	3	0.1
Maxillofacial	207	4.2	69	3.8
Total	**4844**	**100.0**	**1788**	**100.0**

Table 2: Comparison between the number of blood units cross-matched and that were transfused for elective surgeries at Main University hospital in Alexandria.

Department	No. of blood units cross matched		No. of blood units transfused	
	No.	%	No.	%
Neurosurgery	4033	30.1	954	28.2
Urology	2166	16.1	399	11.8
Urology-endoscopy	382	2.8	36	1.0
Hepato- billiary	802	5.9	192	5.6
Colo-rectal	889	6.6	186	5.5
Gastro-intestinal	1090	8.1	204	6.0
Cardio-thoracic	1539	11.4	561	16.6
Vascular -surgeries	387	2.8	54	1.6
Tumor- excisions	635	4.7	303	8.9
Plastic - surgeries	543	4.0	272	8.0
Otolaryngology	402	3.0	91	2.6
Renal-transplant	16	0.1	9	0.2
Maxillofacial	505	3.7	112	3.3
Total	13389	100	3373	100

Table 3: Blood utilization indices in the surgical departments at the Main University hospital in Alexandria

Department	**Blood utilization indices**								
	C/T ratio			**T%**			**TI**		
	N	**D**	**I**	**N**	**D**	**I**	**N**	**D**	**I**
Neurosurgery	4033	954	4.2	466	1403	33.2	954	1403	0.68
Urology	2166	399	5.4	242	855	28.3	399	855	0.47
Urology-endoscopy	382	36	10.6	31	197	15.7	36	197	0.18
Hepato- billiary	802	192	4.1	112	295	37.9	192	295	0.65
Colo-rectal	889	186	4.7	132	361	36.5	186	361	0.52
Gastro-intestinal	1090	204	5.3	128	401	31.9	204	401	0.51
Cardio-thoracic	1539	561	2.7	277	511	54.2	561	511	1.10
Vascular-surgery	387	54	7.1	33	162	20.3	54	162	0.33
Tumor excisions	635	303	2.1	129	159	81.1	303	159	1.91
Plastic surgery	543	272	2.0	111	159	69.8	272	159	1.71
Otolaryngology	402	91	4.4	55	131	41.9	91	131	0.69
Renal-transplant	16	9	1.7	3	3	100.	9	3	3.00
Maxillofacial	505	112	4.5	69	207	33.3	112	207	0.54
Total	**13389**	**3373**	**3.9**	**1788**	**4844**	**36.9**	**3373**	**4844**	**0.69**

N stands for Numerator; D stands for Dominator; I stands for Index

Table 4: Percentage compliance with blood transfusion guidelines at the different surgical departments at the Main University hospital in Alexandria.

Department	Percentage compliance with guideline	
	No.	%
Neurosurgery	360 (n=1403)	25.7
Urology	192 (n=855)	22.5
Urology- endoscopy	23 (n=197)	11.7
Hepato- billiary	84 (n=295)	28.5
Colo-rectal	81 (n=361)	22.4
Gastro-intestinal	96 (n=401)	23.9
Cardio-thoracic	218 (n=511)	42.7
Vascular surgery	26 (n=162)	16.0
Tumor excisions	82 (n=159)	51.6
Plastic surgery	90 (n=159)	56.6
Otolaryngology	30 (n=131)	22.9
Renal transplant	2 (n=3)	66.7
Maxillofacial	60 (n=207)	29.0
Total	4844	27.7
Test of significance*	p =0.003	

n= Total number of adult patients who had elective surgery for which requests for cross-matching were made

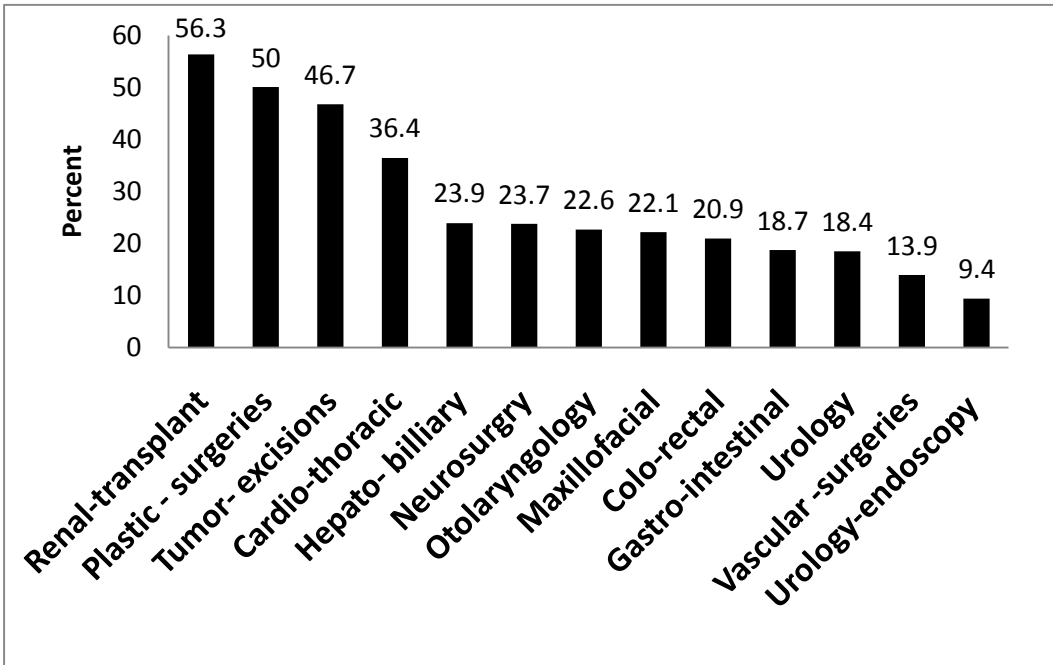

Figure 1: Percentage of blood units utilized per department at the different surgical departments at the Main University hospital in Alexandria

4. Discussion

Blood and blood components are critical in elective surgery patient care, but with limited supply, unnecessary ordering, unnecessary utilization, and significant cost, careful assessment of ordering and benefits of transfusion is essential for a good management of resources (Subramanian et al., 2010). Data from developing countries have shown gross over ordering of blood in 40% to 70% of patients transfused (Chawla et al., 2001). Therefore, it is essential that the usage of blood and blood products be rationalized and saved for crisis situations (Subramanian et al., 2010). The current study

revealed that, 74.8% of the cross- matched blood was unutilized which mean it was unnecessary. This finding is nearly similar to that was reported in an Indian study where 76.9% of blood cross-matched was unutilized.

Other studies as those conducted in Ilorin Teaching Hospital (Olawumi & Bolaji, 2006) and University of Benin Teaching Hospital, in Nigeria reported nearly similar values of unutilized blood (69.7% and 70.0%, respectively) (Ebose et al., 2009). This might indicate that this malpractice is common in developing countries.

The use of cross-match to transfusion ratio (C/T ratio) was first suggested by Boral Henry in 1976 (Friedman et al., 1976). Subsequently, a number of authors used C/T ratio for evaluating blood transfusion practices. Ideally, this ratio should be1.0, but a ratio of 2.5 and below was suggested to be indicative of efficient blood usage (Olawumi & Bolaji, 2006). According to these recommendations, the overall C/T ratio of 3.9 that reported in current study was considered to be indicative of inefficient blood usage except for Renal-transplant (1.7), Plastic surgery (2.0), and Tumor excisions departments (2.1). This inefficient blood usage was reported by other studies conducted in Nigeria (2.2), and Malaysia (5.0) (Ebose et al., 2009; Jarnee et al., 2002).

The results of the present study demonstrated that, C/T ratio varied widely across the surgical departments under the study from 10.7 at urology-endoscopy department to 1.7 at renal-transplant department. This was somewhat similar to that reported in a Nigerian study but to a lesser extent where the C/T ratio values ranged from 1.6 in obstetrics and gynecology department to 3.3 in Orthopedics and accident and emergency departments (Ebose et al., 2009). Variations in rates of transfusion in the current study may be due to the fact that, there is a great tendency in most departments of surgery to request more units of blood for elective procedures than what is actually required. This over ordering of blood is more often guided by habits and hospital routines rather than clinical needs. This attitude is defended by the simple excuse that, it provides a safety measure in the event of excessive unexpected blood loss during surgery.

The probability of transfusion for a given department is denoted by %T and was suggested by Mead (1980). A value of 30% and above has long been suggested by Friedman et al., to be appropriate and signifies the appropriateness of numbers of units cross-matched. The probability of transfusion values reported in the current study for the different surgical departments under the study are considered appropriate except for Urology (28.3%), Urology-endoscopy (15.7%) and Vascular-surgery department (20.3%). The results of the present study revealed an overall %T of 36.9%. This finding was higher than that has been found in study conducted in Indian tertiary care hospital where %T ranged from 11.1% to 25% (Niraj et al., 2003).

Regarding TI, a value of 0.5 or more is indicative of efficient blood usage and signifies the appropriateness of numbers of units transfused (Mead, 1980). The TI reported in the current study as an overall value (0.69) and the values of the different surgical departments under the study are considered appropriate except for Urology, Vascular-surgery, Urology-endoscopy and Cardio-thoracic departments. This finding was different from that has been found in a study conducted in Indian tertiary care hospital where TI ranged from 0.36 to 0.15 (Niraj et al., 2003). This difference might explained by differences between localities.

Practice guidelines are systematically developed recommendations that assist the practitioner in making decisions about health care. The recommendations might by may be adopted, modified, or rejected according to clinical needs and constraints. The purposes of the American Society of Anesthesiologists guidelines (2006) were to improve the perioperative management of blood transfusion and adjuvant therapies and to reduce the risk of adverse outcomes associated with transfusions. These guidelines recommended that the ratio of the number of units of cross-matched red cells for a given operation to the number of units actually transfused – the C:T ratio – should not exceed 2:1.

The results of the present study revealed that, the overall percentage compliance with blood transfusion guidelines was 27.7%. In the current study the percentage compliance with guidelines varied widely among the individual surgical departments under the study with a range from 66.7% in renal-transplant department to 11.7% in urology-endoscopy department. In Egypt, surgeons order cross-matched blood on the basis of habit. The criteria for ordering blood are often vague and the established policies, if there any existed, may be outdated.

In addition, the percentage compliance with guidelines in cardio- thoracic surgery department was 42.7%. Blood transfusions in cardiac surgery patients are performed inappropriately and transfusion rates would improve if more restrictive strategies for

performing them were employed. However, in one large observational study, investigators reported that, despite the availability of practice guidelines for blood transfusion, rates of transfusion among cardiac surgery patients vary dramatically among hospitals in the United States (Worcester, 2010).

We acknowledge that there are limitations to the present study. The pre-operative data including hemoglobin level and co-morbidities and intra-operative data including duration of surgery and amount of blood loss are very important for correlating the results, but, some logistics preventing us from obtaining these data. Also, the magnitude of cost implication of unnecessary cross-match can be calculated. Therefore, further work is needed to examine these issues.

Trust, confidence and cooperation of clinicians are critical for success of blood conservation policies**.** Continuous monitoring by members of the transfusion staff is necessary for the success of these Policies**.** The clinicians need to be confident that the transfusion medicine unit is capable of supplying blood on time when there is an urgent need before being willing to accept the Group Screen and Hold schedule practice. Moreover, it is necessary to continually educate incoming house surgeons and new attending surgeons concerning the value of the Group Screen and Hold schedule procedure and the cross-matching guidelines

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