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EVALUATION OF CLINICAL AUDIT ON CTR RATIO AND MICU TRIGGER POINT FOR BLOOD TRANSFUSION FOR IMPLEMENTATION OF BLOOD UTILIZATION GUIDELINES IN DUBAI HOSPITALS

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ABSTRACT

INTRODUCTION: 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. Subsequently a number of authors used the C/T ratio for evaluating blood transfusion practices and C/T ratio of >2.5 was suggested to be indicative of significant blood usage.

OBJECTIVE: Objectives The present study was undertaken to estimate CTR ratio in MICU and find out what is MICU blood transfusion trigger in tertiary care hospitals?

MATERIALS AND METHOD: Materials And Methods: A present cross sectional study was conducted in those patients who were admitted in MICU, Rashid Hospital, a tertiary care health facility in Dubai. Study participants, period and sample size: A consecutive and convenience sample of all MICU patients who received packed cell blood transfusion for any reason during the period from 1.12.2016 to 1.4.2017 was selected from the study hospital. Blood utilization indices were computed with the following equation.(i) Cross-match to transfusion ratio (C/T ratio) = number of units cross-matched/number of units transfused. A ratio of 2.5 and below is considered indicative of significant blood usage. Results: Overall quantitative comparison of mean CTR across the Hb trigger categories revealed a significant difference by ANOVA (P= 0.0071). Mean difference in CTR was not found significant for cases reporting with Hb trigger < 7. difference in mean CTR increased with increase in Hb trigger from 7 to 9 and > 9 categories and found significant with Bonferroni multiple comparison test

CONCLUSION: In this study CT ratio was found to be 1.06±0.32 it indicates adequate utilization at this institution. Although this study was based on a single institution observation, the findings provided an insight into the characteristics of blood transfusion recipients and as well aid in future planning of better blood and blood product utilization.

KEYWORDS

Cross matched, transfusions, utilization, blood,

INTRODUCTION

Blood and its component play a major role in the management of both surgical and medical emergencies. Despite this advantage, currently there is a limited supply with increasing demand and underutilization of the requested blood worldwide [1]. Multicentre observational studies of transfusion in general intensive care unit (ICU) patient's reveals that percentage of transfusion in ICU ranges from 53.0% to 25 % in UK and Canada respectively. Whereas the mean Hb level in Canada was 8.6±1.3 gm/dl. However median Hb level was 8.5 (IQR 7.9.0) gm/dl [2]. Increasing demand for blood and blood products together with rising cost and transfusion associated morbidity led to a number of studies that review blood ordering and transfusion practice [3,4].

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 [5]. The use of the C/T ratio was first suggested by Boral Henry in 1975[6]. Subsequently a number of authors used the C/T ratio for evaluating blood transfusion practices and C/T ratio of >2.5 was suggested to be indicative of significant blood usage. A C/T ratio of > 2.5 means that less than 40% of cross-matches are transfused [5,7]. Regular auditing and periodic feedbacks are vital to improve the blood utilization practices. By a team approach involving the surgeon, anesthesiologist and blood bank doctors and technical staff, we can reduce the number and pattern of ordering blood for various medical and surgical conditions [8]. The best evidence currently available suggests that transfusion can safely be withheld as long as the hemoglobin remains above 70 g/l and the patient is not actively bleeding. Such a policy appears not only to be safe but also perhaps even preferable to a more liberal strategy, even in patients with underlying cardiac disease. Whether a lower transfusion trigger is superior is unknown. Ultimately, however, the decision to transfuse should be based on expectation of individual physiologic benefit rather than on adherence to an arbitrary numeric transfusion trigger [9]. MICU departments treat patients with a wide range of diagnoses, both acute and chronic, many of whom require RBC transfusion during hospitalization. Interestingly, only a few studies include data on transfusion in MICU departments, and most prospective clinical trials were conducted in the intensive care units (ICU) or on patients undergoing surgery.

With this background the present study was undertaken to estimate CTR ratio in MICU and find out what is MICU blood transfusion trigger in tertiary care hospitals?

MATERIALS AND METHOD:

Study design and setting: A present cross sectional study was conducted in those patients who were admitted in MICU, Rashid Hospital, a tertiary care health facility in Dubai. Study participants, period and sample size: A consecutive and convenience sample of all MICU patients who received packed cell blood transfusion for any reason during the period from 1.12.2016 to 1.4.2017 was selected from the study hospital. The study sample excluded all those patients for whom cross match was ordered but the patient expired before blood transfusion.

Data was collected in a standard format as prescribed under CPG (Clinical Practice Guidelines) including baseline characteristics and

clinical audit parameters. Ethical clearance was taken from Ethical Board of Rashid Hospital, Dubai. Participants were communicated individually about the purpose of the study and verbal informed consent was taken before the interview. Confidentiality of the information was assured by using code numbers then personal identification names and keeping questionnaires locked.

Blood utilization indices were computed with the following equation.(I) Cross-match to transfusion ratio (C/T ratio) = number of units cross-matched/number of units transfused. A ratio of 2.5 and below is considered indicative of significant blood usage.

Main outcome measure was CTR (Cross match to transfusion) ratio. Correlation between CTR and other clinical parameters was assessed and it's comparison with Hb trigger was done using appropriate statistical procedures.

A total sample of 199 eligible patients was analyzed. Data was coded and analysed in a statistical software STATA, version 10.1, 2011. Descriptive statistics included summary measures like Frequency and percentages for categorical variables and Mean and SD for continuous variables. P-value < 0.05 was considered statistically significant for all comparisons.

RESULTS:

Table 1 describes the baseline characteristics of sampled study subjects. A slight preponderance of males (55.28%) was observed in the study sample. Though acute (48.2%) and chronic (51.8%) patients got admitted in almost equal proportions, but nearly two-third of MICU admissions was of urgent nature. Highest number of morbidities diagnosed among the admitted cases belonged to infectious diseases and conditions (45.2%). Further, more than 60% of these MICU admissions had been reported with high risk status at the time of admission.

Table 1: Baseline characteristics (n=199)		
Characteristics	No.	%
Gender		
Male	110	55.28
Female	89	44.72
Admission Status		
Urgent	129	64.82
Routine	70	35.18
Condition at admission		
Acute	96	48.24
Chronic	103	51.76
Nature of Morbidity		
Burns	11	5.53
Cancer	18	9.05
Chronic diseases	43	21.61
Infectious diseases	90	45.23
Others	37	18.59
Risk status		
High	122	61.31
Low	77	38.69

Clinical audit parameters are presented in Table 2. Majority (76.4%) of the admissions were managed medically. Most of the PRBC units that were ordered were transfused, except in 2 (1.01%) admissions where 4 units were ordered but not transfused. Among 60% of admissions, Hb trigger was found between 7 to 9, while 34% and 6% admissions reported with trigger either <7 or >7 respectively.High (> 2) CT ratio was observed in 9 (4.52%) admissions with mean CTR being 1.06± 0.32.

Table 2: Clinical Audit parameters		
Parameters	No.	%
Management		
Surgical	53	26.63
Medical	146	76.37
Hb trigger (gm%)		
<7	69	34.67
7 to 9	118	59.3
>9	12	6.03
Table 2: PRBC ordered(units)		
1	129	64.82
2	63	31.66
3	5	2.51
4	2	1.01
PRBC transfused(units)		
1	138	69.35
2	56	28.14
3	5	2.51
CT Ratio		
<2	190	95.48
>=2	9	4.52
Mean±SD	1.06±0.32	Range 1-4

Though association between CTR and Hb trigger was not found statistically significant (P= 0.13), but patients with high CTR (> 2) were found to report with higher (>9) Hb trigger also.(Table 3)

Table 3: Correlation between CT Ratio and Hb trigger				
Variables	Hb Trigger			
CT ratio	<7	7 to 9	>9	Total
<2	67 (97.1)	113 (95.8)	10 (83.3)	190 (95.5)
>=2	2 (2.9)	5 (4.2)	2 (16.7)	9 (4.5)
Total	69 (100)	118 (100)	12 (100)	199 (100)
	Fisher's exact P= 0.128, Not Significant			

Further (Table 4), overall quantitative comparison of mean CTR across the Hb trigger categories revealed a significant difference by ANOVA (P= 0.0071). Mean difference in CTR was not found significant for cases reporting with Hb trigger < 7. However,thisdifference in mean CTR increased with increase in Hb trigger from 7 to 9 and > 9 categories and found significant with Bonferroni multiple comparison test.

Table 4. Comparison of CT Ratio by Hb trigger

Hb trigger (gm%)	Freq.	Mean CTR	Std. Dev.	Comparison	Mean Difference	P (Bonferroni)	Result
<7	69	1.03	0.17	<7 vs 7 to 9	0.02	1	No Significant mean difference between 2 groups
7 to 9	118	1.05	0.26	7 to 9 vs>9	0.28	0.008	Significant mean difference between 2 groups
>9	12	1.33	0.89	> 9 vs< 7	0.3	0.006	Significant mean difference between 2 groups
Total	199	1.06	0.31		P (ANOVA- F test)	0.0071	Significant difference in means across 3 groups

DISCUSSION:

This study provided information on the pattern of PRBC utilization and demographic characteristics of blood transfusion recipients in MICU, Rashid Hospital, a tertiary care health facility in Dubai. This study recorded greater number of male transfusion recipients. Studies from developed countries reported that more men than women receive blood transfusion [10,11]. This may be attributed to advanced health care services which reduced the associated complications of child bearing requiring transfusion [12].

However studies recorded greater number of female transfusion recipients. Blood transfusion recipients in sub-Saharan Africa are mostly children in malaria endemic areas, and women of childbearing age due to complications of labor [13,14]. The normal hemoglobin level in the healthy individual is greater than 130 g/l. In the ambulatory patient levels below this are considered to represent anemia and trigger a search for potentially correctable causes, including sources of occult blood loss. The hemoglobin level of most hospitalized patients and, in particular, patients in an intensive care unit (ICU) fall substantially below this normal range. Multiple factors are responsible, including acute blood loss, dilution secondary to fluid retention and depressed hematopoiesis. At a certain level of anemia, the surgeon becomes concerned that reduced oxygen-carrying capacity may be detrimental to the patient's welfare and considers transfusion. The level that should trigger this decision has until recently been largely unknown [9]. The benefits of transfusion must be weighed against the risks [15].

Transfusion carries a small risk for transmission of viruses such as HIV and hepatitis. Transfusion is also known to be immunosuppressive, and transfusion is an independent risk factor for nosocomial infection or for recurrence of malignancy [16]. Perhaps most importantly, blood is an increasingly scarce resource that must be used responsibly.

The best evidence currently available suggests that transfusion can safely be withheld as long as the hemoglobin remains above 70 g/l and the patient is not actively bleeding. Such a policy appears not only to be safe but also perhaps even preferable to a more liberal strategy, even in patients with underlying cardiac disease. Whether a lower transfusion trigger is superior is unknown. Ultimately, however, the decision to transfuse should be based on expectation of individual physiologic benefit rather than on adherence to an arbitrary numeric transfusion trigger [9,15,16,17,18].

Transfusion guidelines advocate restrictive rather than liberal use of red blood cells (RBC) and are based mostly on randomized trials in intensive care and surgical departments. In the present study common morbid conditions in recipient were (ICD 10) infectious, chronic conditions, cancer, burn etc. However The top six diagnoses for which patients received blood transfusion in other study were pregnancy and childbirth, conditions originating in perinatal period, diseases of the genitourinary system, diseases of blood and blood forming organs, neoplasm, injury, poison [8], digestive system diseases and circulatory system diseases as the main diagnosis associated with transfusion [19,20]. This strongly portrays that blood utilization pattern vary significantly within regions and according to practice as well as patients clinical findings. In our study In our study, Highest number of morbidities diagnosed among the admitted cases belonged to infectious diseases and chronic conditions including cancer. However a study carried by Levenel NR et al reveals that in ICU patients with respiratory and cardiac diseases had a statistically significant higher Hb transfusion trigger compared to patients without those diagnoses [21]. This study describes Hb transfusion trigger of all patients hospitalized in MICU, Rashid Hospital, a tertiary care health facility in Dubai. It shows that restrictive transfusion practice was undertaken in most patients. The most patients Hb trigger was 7.0 to 9.0 g/dl, and most patients received 1–2 RBC units. American Board of Internal Medicine are to use a restrictive threshold of 7–8 g/dl for the vast majority of hospitalised, stable patients [22]. However, most available published data report on patients in critical care or a postoperative setting, while there is less evidence regarding Medical Intensive care Unit (MICU). More specifically, the lowest suggested Hb threshold of 7 g/dl was derived from studies conducted in the ICU context [23]]and may not apply to all patients in MICU. Various studies reveals that patients hospitalised in the ICU were categorized to RBC transfusion at Hb thresholds of either 7 g/dl (restrictive strategy) or 10 g/dl (liberal strategy) [24]. Carson et al randomly assigned hip fracture patients with cardiovascular disease or risk factors to RBC transfusion at Hb threshold of either 8 g/dl or 10 g/dl. [25]. Villanueva et al randomly assigned patients with upper gastrointestinal bleeding to a Hb threshold of 7.0 g/dl versus 9.0 g/dl [26]. Holst et al. randomized ICU patients with septic shock to receive blood transfusion at a Hb cut-off of either 7 or 9 g/dl [27]. Data on Hb transfusion trigger in medical patients was included in several case cohort studies, and summarized in a recent meta-analysis [28]. Restrictive transfusion strategy with a Hb cut-off of 7.0 g/dl significantly reduced clinical endpoints including cardiac events, re-bleeding, bacterial infections, and total mortality compared to higher Hb triggers. In our study Among 60% of admissions, Hb trigger was found between 7 to 9, while 34% and 6% admissions reported with trigger either <7 or >7 respectively. High (> 2) CT ratio was observed in 9 (4.52%) admissions with mean CTR being 1.06± 0.32.Levenel et al [21] reported on Hb trigger of 8.0 g/dl found in their study. Surial et al reported on the Hb trigger in the Internal Medicine departments was 7.3 g/dl and was significantly lower compared to the surgical departments and the ICU [29]. Frank et al compared transfusion strategies in in-hospital services during a 44 months period. The mean Hb trigger in Internal Medicine departments (defined as the lowest Hb level during hospitalization) was found to be 7–8 g/dl [30]. This decrease occurred after the implementation of transfusion initiatives including educational sessions and hospital transfusion guidelines.

In the present study though association between CTR and Hb trigger was not found statistically significant (P= 0.13), but patients with high CTR (> 2) were found to report with higher (>9) Hb trigger also. However, this difference in mean CTR increased with increase in Hb trigger from 7 to 9 and > 9 categories and found significant. This study recorded an average C/T ration of 1.06 which is an indication of effective and efficient utilization of blood and blood products. This finding is similar to 0.9 reported in Ibadan Nigeria [31] but lower than 2.2 reported in , Nigeria [32]. The observed differences may be due to the varying levels of availability of blood and indications for blood transfusion as judged by the requesting physician [31, 32].

In the present study common morbid conditions in recipient were (ICD 10) infectious, chronic conditions, cancer, burn etc. However The top six diagnoses for which patients received blood transfusion in other study were pregnancy and childbirth, conditions originating in perinatal period, diseases of the genitourinary system, diseases of blood and blood forming organs, neoplasm, injury, poison [33], digestive system diseases and circulatory system diseases as the main diagnosis associated with transfusion [34, 35]. This strongly portrays that blood utilization pattern vary significantly within regions and according to practice as well as patients clinical findings.

CONCLUSION: This study recorded greater number of men receiving blood and blood product transfusion for conditions associated with medical and surgical conditions. We found that the most indications for blood transfusion based on ICD-10 were low percentage of Hb gm/dl. One point PRBC was the major blood component recorded in this study. This shows a lag in healthcare improvement and unnecessary waste of blood. Blood transfusion is associated with risk of transmission of infection; think twice before one point PRBC transfusion. However; in this study CT ratio was found to be 1.06±0.32 it indicates adequate utilization at this institution. Although this study was based on a single institution observation, the findings provided an insight into the characteristics of blood transfusion recipients and as well aid in future planning of better blood and blood product utilization. Regular auditing by utilizing guidelines and periodic feedbacks are vital to improve the blood utilization practices. By a team approach involving the surgeon, anesthesiologist and blood bank doctors and technical staff, we can reduce the number and pattern of ordering blood for various surgeries.

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