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# ORIGINAL ARTICLE

# An Audit on Overnight Transfusion Practice in A Teaching Hospital in Malaysia

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*Abstract*

*Introduction:* Overnight transfusion (OT) is the blood transfusion taking place from 9pm to 8am. During this period, patients are exposed to increased risk of errors. This cross-sectional study aims to determine the incidence and practice of OT in Universiti Kebangsaan Malaysia Medical Centre. *Materials & Methods:* Data from all OT in June and mid-July 2017 were collected from recipients' cards, transfusion request forms and patient's case files, regarding discipline involved, indications, time intervals from request of blood transfusion to the completion of OT on patients, monitoring of patients and adverse reactions. *Results:* A total of 1285 transfusion cases were identified during the study period. 216 (16.8%) cases were OT while the 1069 (83.2%) cases were non-OT. Surgery discipline has the highest (30.1%) OT. The indications of OT were acute clinical need: 82.9%, less acute clinical need: 13.9% and no clinical need: 3.2%. A huge delay (average: 5 hours 40 minutes) in starting transfusion after grouping and crossmatching (GXM) completion was noted. Besides, 25.9% cases took >4 hours to complete OT; 83.4% cases did not have proper transfusion monitoring and three transfusion reactions were reported. *Discussion:* Although most of the OT cases had appropriate clinical indications, the transfusion can be commenced earlier at day time rather than overnight. Cases without absolute indication should avoid OT. The poor monitoring of patient during OT had posed risks to patients' life if an adverse transfusion reaction happened. The major reason for OTs was a huge delay in starting transfusion after the GXM completion. The contravention of 4-hour infusion rule increased the patients' risk of developing bacterial sepsis. The practice of OT should be discouraged wherever possible except for clinically indicated cases.

*Keywords:* Transfusion safety, overnight transfusion, GXM, 4-hour rule, patient monitoring

## INTRODUCTION

Blood transfusion safety starts from prescription by the treating physician to completion of the whole transfusion process.[1] It has been mentioned that transfusion safety has yet to gain much attention compared to blood safety.[2] Various measures have been taken to improve the blood safety worldwide such as nucleic acid amplification testing for transfusion transmitted infections, pathogen inactivation techniques for cellular products; some measures like adoption of correct patient identification, bedside sample labelling are implemented but not widely practiced for prevention of mistransfusion.[2] The transfusion safety can be hampered at any stage of the transfusion chain starting with the clinical decision to transfuse, prescription and request, patients' blood sampling, pretransfusion testing and eventually the collection of the blood product from the blood bank and administration to the patient.[3] All administered blood products need to be monitored closely regardless of the timing of transfusion to avoid transfusion hazards.

Overnight transfusion (OT) has been defined in various ways. Two previous studies defined OT as transfusion occurred between 8 pm to 8 am[4,5] while another study defined OT as transfusion occurred between 8 pm to 6 am.[6] Overnight transfusion has some drawbacks that put the patients at risk because of inadequate observation and monitoring related to lower staff numbers and the reduced lighting at night.[5,6] The reduced lighting in the ward could mask

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the early detection of clinical problems or an adverse reaction.[6] Additionally, the sleep of the patients receiving OT and neighbouring patients in the same cubicle are interrupted throughout the night.[4,6] Sleep deficiency has been recognised as a physiological stressor with detrimental effects on health that can result in pimples, lethargy, mouth ulcers and impaired cognitive function.[7]

Universiti Kebangsaan Malaysia Medical Centre (UKMMC) is a tertiary care teaching hospital with many patients' referral for different disciplines such as oncology, cardiac surgery, orthopaedic surgery, general surgery and obstetrics & gynaecology cases that requiring a huge amount of blood transfusion support. The current hospital policy does not encourage blood transfusion at night unless for lifesaving. However, OT is still in practice and in some cases, the clinical indication for transfusion is not justified to be urgent. In view of these problems, we have decided to perform an audit of the OT. The objective of this audit was to evaluate the practice of OT in UKMMC that covering five important aspects. They were clinical indication of OT, delaying timing factors that led to OT, duration of OT, monitoring of patients during OT as well as adverse reactions occurring in OT.

## MATERIALS AND METHODS

This was a cross-sectional, retrospective, observational study on OT of red blood cells (RBCs) carried out in UKMMC for a period of 6 weeks from June 2017 to mid-July 2017. All patients receiving OT of RBCs during the study period were included in the study. The exclusion criterion was those patients receiving blood components other than RBCs such as platelet, fresh frozen plasma (FFP) and cryoprecipitate. The OT of RBCs is defined as the transfusion of whole blood, packed cell (PC) and leukocyte poor RBC (LPRBC) that occurs from 9 pm to 8 am on the following day. This study was approved by the Ethics and Research Committee, UKMMC with the research number of FF-2017-241.

Each OT was identified by reviewing the cases where the blood was issued on the previous night from the blood bank. A total of 216 patients were identified to have received OT. Data were collected from the recipients' cards, grouping and crossmatching (GXM) forms, patients' case files, clinical information management system and vital signs (body temperature, pulse rate, respiratory rate and blood pressure) monitoring charts. Patients' data such as age, gender, discipline, pre-transfusion haemoglobin (Hb) level and indications of OT were collected from the patients' case files and clinical information management system. A modified classification of the clinical indications of OT was used to suit the local situation. The classification was modified with adaptation based on the Malaysian National Blood Centre guideline[8] and other similar studies.[4,5] The modified classification was shown in Table 1.

Several time points including the GXM order time by the respective doctor, time of blood sampling, time of blood sample arrival at blood bank and time of completion of GXM were recorded from the respective patients' case files and the GXM order forms. Time of administration and completion time of OT and any adverse events occurred during OT were also retrieved from the case files. The monitoring of patients during the transfusion was assessed from the patients' vital signs monitoring charts. Vital signs monitoring of patients should include a

**TABLE 1: Classification of clinical indication of overnight transfusion**

| | |
|---|---|
| Group 1- | Acute Clinical Need:<br>• Patients with active bleeding or haemolysis at the time of transfusion.<br>• Patients with haemoglobin (Hb) >7-10g/dL and symptoms of anaemia or cardio respiratory distress or ≥65 years old.<br>• Patients with Hb ≤7g/dL. |
| Group 2 - | Less Acute Clinical Need:<br>• Patient transfused to raise Hb prior to surgery/procedure.<br>• Patient transfused during haemodialysis.<br>• Patients' transfused while in operating theatre. |
| Group 3- | - No Clinical Need<br>• No clinical indication for transfusion. |

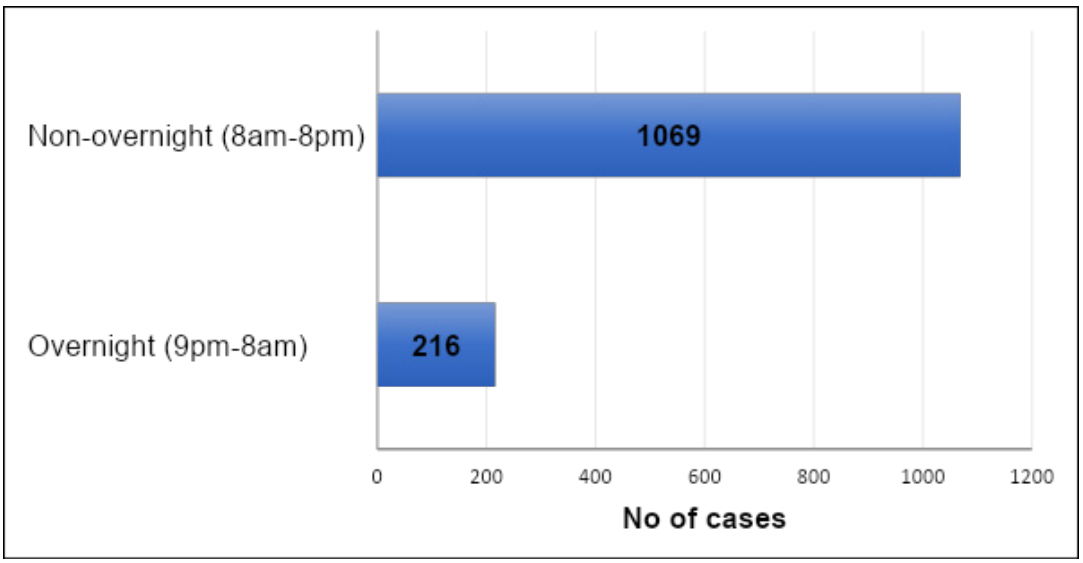


FIG. 1: Overnight transfusion vs non-overnight transfusion from June to mid-July 2017

baseline, soon after the start of the transfusion, and after transfusion.[9] The frequencies of vital signs monitoring according to our local nursing guideline are once before the transfusion, 15 minutes after the transfusion is started followed by 30 minutes interval for one hour, then hourly until the completion of transfusion and finally 15 minutes after the completion of transfusion. The full monitoring of vital signs covers all the frequencies while the partial monitoring of vital signs is defined as one or more frequencies is/ are missing. No monitoring of vital signs is defined as monitoring is not performed. The total number of RBCs transfusion during these 6 weeks period was recorded from the clinical information management system. All these data were tabulated in Microsoft Excel and were analysed. Data were presented as number and percentage.

## RESULTS

A total of 1285 transfusion cases were identified during the six weeks study period. 216 (16.8%) cases are OT while the other 1069 (83.2%) were non-OTs. (Fig. 1). The distribution of gender, age, discipline and pre-transfusion Hb of patients involved in OT are shown in Table 2.

On the analysis of the clinical indication for OT, most of the OT cases have appropriate clinical indications whereby 179 cases (82.9%) were categorised with acute clinical need followed by 30 cases (13.9%) with sub-acute clinical need and only 7 cases (3.2%) with no clinical need (Further subdivisions for each group are shown in Table 3).

Regarding the study of the time intervals, four-time intervals were assessed to evaluate any delay at any one stage that could contributes to the commencement of OT. They are: i) time interval from the order of GXM by the doctor to the taking of blood sample from the patient, ii) time interval from the GXM sample taken to its arrival at blood bank iii) time interval from GXM sample arrived at blood bank to the completion of GXM when blood is ready to be collected, iv) time interval from GXM completed in blood bank to time of commencement of overnight transfusion in the ward. The results were shown in Table 4. It was noted that 32.9% (71 cases) of GXM samples were taken by the medical staffs in advance before the orders were documented officially by the doctors in patients' case files while the rest of 67.1% (145 cases) GXM samples were taken after the orders were made by the doctors. The time interval from the order of GXM by the doctor to the taking of blood cannot be calculated for these 71 cases since the samples were taken before the documentation of ordering at patients' case files. The rest of the time intervals for these 71 cases are not affected.

The duration of OT completion time was recorded. Unfortunately, there were 56 cases (25.9%) of OT that exceeded more than 4 hours with the average time of 3 hours 15 minutes (Table 4). During the OT, the full compliance of vital signs monitoring was present only in 36 cases (16.7%) and majority 174 cases (80.6%) were done partially. No documentation of vital

**TABLE 2: Distribution of gender, age, discipline and pre-transfusion Hb of patients involved in overnight transfusion**

| | | Number | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 121 | 56 |
| | Female | 95 | 44 |
| **Age (years)** | ≥65 | 81 | 37.5 |
| | 13-64 | 127 | 58.8 |
| | ≤12 | 8 | 3.7 |
| **Discipline** | Surgery | 65 | 30.1 |
| | Medical | 64 | 29.6 |
| | A&E | 48 | 22.2 |
| | Orthopaedic | 17 | 7.9 |
| | Obstetrics and gynaecology | 11 | 5.1 |
| | Paediatric | 9 | 4.2 |
| | Otorhinolaryngology | 1 | 0.5 |
| | Oncology | 1 | 0.5 |
| **Pre-transfusion Hb (g/dL)** | ≤7 | 102 | 47.2 |
| | >7-10 | 97 | 44.9 |
| | >10 | 17 | 7.9 |

signs monitoring was seen in 3 cases (2.8%), (Table 5). There were three cases (1.4%) of transfusion reactions occurred during OT and reported to blood bank (Table 5). The reactions identified were febrile non haemolytic transfusion reaction and allergic reaction.

## DISCUSSION

Overnight transfusion has a higher transfusion risk compared to transfusions during day time and this statement was supported by a study that showed 37% of blood administration errors occurred during OT.[10] International standard

**TABLE 3: Clinical indication of overnight transfusion in June and July 2017**

| Clinical Indications | Subgroup of clinical indications | n | % |
|---|---|---|---|
| Group 1 (Acute clinical need) | Active Bleeding/ Haemolysis | 61 | 28.3 |
| | Hb >7-10g/dL with symptomatic anaemia or cardiorespiratory distress or ≥65 years old | 76 | 35.2 |
| | Hb ≤7 g/dL | 42 | 19.4 |
| | Total | 179 | 82.9 |
| Group 2 (Less acute clinical need) | In operation theatre | 2 | 0.9 |
| | Pre-procedure/Haemodialysis | 28 | 13 |
| | Total | 30 | 13.9 |
| Group 3 (No clinical need) | No clinical Indication | 7 | 3.2 |
| Total | | 216 | 100.0 |

**TABLE 4: The time intervals of transfusion process**

| **Time interval between the order of GXM by the doctor and the blood sample was taken.** | **Number** | **Percent (%)** |
|---|---|---|
| ≤2 hours | 66 | 45.5 |
| >2-4 hours | 32 | 22.1 |
| >4 hours | 47 | 32.4 |
| | 145 | 100.0 |
| Mean | 3h 53min | |
| **Time interval between the GXM samples taken to GXM samples arrival at blood bank.** | | |
| ≤2 hours | 181 | 83.8 |
| >2-4 hours | 32 | 14.8 |
| >4 hours | 3 | 1.4 |
| | 216 | 100.0 |
| Mean | 1h 10min | |
| **Time interval between GXM sample arrival and GXM completion.** | | |
| ≤3 hours | 211 | 97.7 |
| >3 hours | 5 | 2.3 |
| | 216 | 100.0 |
| Mean | 1h 15min | |
| **Time interval between GXM completions in blood bank to time of commencement of OT.** | | |
| ≤4 hours | 102 | 47.2 |
| >4-12 hours | 85 | 39.4 |
| >12 hours | 29 | 13.4 |
| | 216 | 100.0 |
| Mean | 5h 40min | |

guidelines strongly recommend that transfusion at night should not be given but postpone to the next following day unless there is a massive trauma or bleeding or have some other urgent clinical need.[11,12] This study showed that the OT rate in UKMMC was 16.8% despite the local hospital policy discourages the practice of OT. Previous studies showed that the OT in New Zealand was 9%[4] while in United Kingdom were 25%-29%.[5,9,13]

The disciplines that practice most OT in UKMMC were surgery (30.1%) and medical (29.6%). These findings were similar to the previous studies done in UK[5] and New Zealand.[4] The clinical indications of OT in our study showed that most of the cases (82.9%) were appropriate and clinically indicated due to acute clinical need for transfusion. However, the delayed in the commencement of blood transfusion of an average of 5 hours and 40 minutes from the time of GXM completion could be the major root cause for the practice of OT in these patients. We believed that without this delay, most of the transfusions could have been commenced during the day time. From this study, there were 3.2% of patients who have been transfused without appropriate clinical indications and this has led to wastage of blood products and unnecessarily exposing patients to unwanted side effects.

From this study, several factors causing delayed in starting the blood transfusion that has led to OT were identified. Delayed in taking GXM sample is one of the most important reason. We found that 54.5% cases took more than 2 hours for the medical staffs, mostly house

**TABLE 5: Duration to complete the OT, monitoring of patients during OT and transfusion reactions that occurred during OT.**

| Duration of OT | Number | Percent (%) |
|---|---|---|
| ≤4 hours | 160 | 74.1 |
| >4 hours | 56 | 25.9 |
| Total | 216 | 100.0 |
| Mean | 3h 15min | |
| **Vital sign monitoring** | | |
| Full | 36 | 16.7 |
| Partial | 174 | 80.6 |
| No | 6 | 2.8 |
| Total | 216 | 100.0 |
| **Transfusion reaction** | | |
| Yes | 3 | 1.4 |
| No | 213 | 98.6 |
| Total | 216 | 100.0 |

officers in UKMMC to get the blood samples from patients following the official order by the specialist or medical officer. The reasons for this delay could be due to the heavy ward works or long clinical ward round that finished late or the medical staffs were late in prescribing the blood transfusion.[4] Another delay was seen in 16.2% cases where the samples took more than 2 hours to be delivered to the blood bank. The explanation behind this delay was the medical assistants late in sending the blood sample to blood bank due to other jobs such as tracing patients' case files or accompanying patient to clinic and radiological investigations.

In local blood bank, the turnaround time for GXM was three hours. This study revealed that majority of the GXM were completed within the recommended time. Only 2.3% cases did not fulfil the requirement mainly due to the presence of unexpected red cell alloantibody where further investigations were performed to identify the antibody and search for compatible blood.

This study has identified a tremendous delay in collecting the blood from blood bank to start the transfusion on patients. An average of 5 hours and 40 minutes were lapsed before starting the transfusion following completion of GXM. Thirty nine percent cases took more than 4 hours, but less than 12 hours and 13.4% cases took more than 12 hours to start the transfusion. We believed that this was the most significant factor that contributed the high incidence of OT in UKMMC. This huge delay could be due to lack of awareness of the importance of starting blood administration within the core hours among the medical staffs or lack of continuation in patient care because of staffs' poor attitudes. Lack of team work, miscommunication, insufficient knowledge and poor training are also some of the possible contributing factors.

This present study has demonstrated that 25.9% of cases have taken >4 hours to complete the OT and 83.4% were lack of proper patient monitoring during OT. All RBCs transfusion must be completed within 4 hours after removal from the blood fridge.[14] Prolonged transfusion can lead to the risk of bacterial proliferation due to prolong exposure to temperature above 4°C.[15] The percentage of improper patients monitoring during OT in our study was alarming and proper education and training must be given to the nurses to prevent unwanted major disaster. In a study by Stevenson et al in 2007, 40% of patients did not receive proper monitoring during OT.[13] An adverse transfusion reaction may occur at any time, should this happened during OT, it may be less likely to be recognised, treated or reported due to the improper monitoring, poor lightings, lack of medical staffs on duty and reluctance in waking up the patients. Those reasons may explain the under-reporting of transfusion reactions (1.4%) in this study. Previous study done in New Zealand also showed that 69% of

the adverse reactions documented in the patient notes were not reported to blood bank.[4]

## CONCLUSION

The incidence of OT in UKMMC is 16.8%. Although most of the OT cases were clinically indicated, however, the delayed in the commencement of blood transfusion following the completion of GXM was one of the major reasons that led to the OT. The poor monitoring of patients at night has posed risks to patients' life if an adverse transfusion reaction occurred. Multiple delays were detected at different time intervals along the transfusion process especially following the completion of GXM, that has contributed to the development of OT. Therefore, the medical staffs need to be informed about these delays and pay special attention in addressing the root causes in order to minimise OT. In conclusion, the practice of OT should be discouraged wherever possible and should only be applicable for urgent clinically indicated cases to ensure patients safety. Continuous education for doctors and nurses should be conducted to minimise inappropriate OT.

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