ABSTRACT

Introduction: Blood transfusion practices affect both patient’s outcomes and utilization of institutional resources. Evidence shows that liberal blood transfusion has a detrimental effect on patient’s outcome. A restrictive approach of blood transfusion is recommended by current clinical guidelines. Aim: The aim of this study was to evaluate the attitudes, knowledge, and practices of general surgery (GS) staff and residents regarding peri-operative blood transfusion and anemia management. Material and Methods: A self-administered, web-based questionnaire was developed, and its link was sent to the emails of all general surgeons at King Abdul-Aziz University Hospital (KAUH), Jeddah city, Saudi Arabia. The questionnaire included four parts: 1) background of surgeons; 2) preoperative assessment and management of anemia; 3) post-operative blood transfusion and alternatives; and 4) enablers and barriers. Results: 56 surgeons responded to the questionnaire. We found variations in blood transfusion practices, notably the hemoglobin threshold. For stable non-cardiac cases, 7 g/dL was considered the threshold by 50% of respondents. For stable patients with past cardiac disease, a higher threshold was chosen by most (9 g/dL by 43% and 10 gm/dL by 21%). Most respondents believed that transfusion had no effect on the risk of survival (73%) and on the risk of cancer recurrence (55%) after oncologic surgical resection. Recognized facilitators were the availability of scientific evidence (84%), medicolegal concerns (57%), preference (52%), and institutional protocols (50%). Conclusion: Although current clinical guidelines recommend a restrictive transfusion practice, most respondents tended to over-order blood for elective procedures and were not aware of the potential complications of liberal blood transfusion. To implement the restrictive transfusion policies, health institutions should improve the awareness of surgeons and incorporate a strong supporting evidence in formulating local institutional guidelines. Keywords: blood transfusion, survey, surgeon, Saudi Arabia.
Transfusion Practices Among General Surgeons at a Tertiary Care Center: A Survey Based Study

2. AIM

Therefore, the aim of this study was to evaluate the attitude, knowledge, and practice of general surgery staff and residents regarding perioperative blood transfusion and management of anemia.

3. MATERIAL AND METHODS

This study was approved by the Institutional Review Board of King Abdul-Aziz University Hospital (KAUH). We conducted a web-based self-administered cross-sectional survey of general surgery consultants, specialists, and residents who are involved in the care of elective surgery patients. Our sample included all consultants, specialists, and residents in General Surgery Department at KAUH, Jeddah, Saudi Arabia.

The questionnaire was developed by authors after adopting and modifying a validated and standardized questionnaire (6). The questionnaire included 4 parts. The first part focused on the level of education and the level of experience, whereas the second part evaluated the pre-operative assessment and management of anemia. The third part assessed the post-operative RBC transfusion and alternative methods of RBC transfusion based on a scenario of a 55-year-old male who underwent a total gastrectomy, was not bleeding, and was hemodynamically stable. We modified the scenario by changing different key elements potentially associated with the need for the RBC transfusion (no symptoms of anemia, symptoms of anemia, intraoperative blood loss, and cardiac comorbidity), for a total of five modifications of the baseline scenario. The fourth part was to know the enablers and barriers for the use of a restrictive transfusion strategy.

The questionnaire was filled online by the participants themselves via secure web link that was sent by emails. A reminding email was sent two days later to increase the response rate. In compliance with the American Association of Public Opinion Research, surveys were considered completed when more than 80% of questions were answered (13). The data was kept confidential and was available for the authors only. We used Statistical Package for the Social Sciences (SPSS), version 22 for data entry and analysis.

Table 1. Characteristics of participants and their institutions with regard to blood transfusion.

| Your current position is: | n   | %   |
|--------------------------|-----|-----|
| Resident (R1 - R3)       | 16  | 28.6% |
| Resident (R4 or above)   | 9   | 16.1% |
| Specialist               | 12  | 21.4% |
| Consultant               | 19  | 33.9% |

| Do you have a sub-specialty? | n   | %   |
|------------------------------|-----|-----|
| No                           | 33  | 58.9% |
| Yes                          | 23  | 41.1% |

| How many years have you been practicing following your board certification? | n   | %   |
|----------------------------------------------------------------------------|-----|-----|
| Not applicable                                                             | 21  | 37.5% |
| 1 - 5                                                                      | 19  | 33.9% |
| 6 - 10                                                                     | 9   | 16.1% |
| > 10                                                                       | 7   | 12.5% |

| On an average active month, how many patients undergoing an elective surgery did you take care of? | n   | %   |
|-----------------------------------------------------------------------------------------------|-----|-----|
| 1 - 5                                                                                       | 8   | 14.3% |
| 6 - 10                                                                                     | 23  | 41.1% |
| > 10                                                                                       | 25  | 44.6% |

| Does your institution have a preoperative blood conservation program? | n   | %   |
|---------------------------------------------------------------------|-----|-----|
| I don't know                                                       | 24  | 42.9% |
| No                                                                  | 16  | 28.6% |
| Yes                                                                 | 16  | 28.6% |

| At your institution, who is responsible of assessing and managing pre-operative anemia? | n   | %   |
|--------------------------------------------------------------------------------------|-----|-----|
| Anesthesia + surgeons                                                              | 1   | 1.8% |
| Anesthetics/Pre-admission clinics                                                    | 33  | 58.9% |
| Hematology                                                                            | 3   | 5.4% |
| Surgeons                                                                            | 19  | 33.9% |

Table 2. Likelihood (as indicated by the participants) of conducting/ordering some investigations in pre-operative assessment.

| Clinical situation                                                                 | Likelihood | n   | %   |
|----------------------------------------------------------------------------------|------------|-----|-----|
| Conducting an anemia work-up in different clinical situations                     |            |     |     |
| Anemia (Hb<13g/dL):                                                               |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 43         | 76.8% |
| Likely/Very likely to conduct                                                    | 13         | 23.2% |
| Documented or suspected bleeding disorder:                                       |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 5          | 8.9%  |
| Likely/Very likely to conduct                                                    | 51         | 91.1% |
| Colo-rectal resection                                                            |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 23         | 41.1% |
| Likely/Very likely to conduct                                                    | 33         | 58.9% |
| Gastric resection                                                                |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 19         | 33.9% |
| Likely/Very likely to conduct                                                    | 37         | 66.1% |
| Hepato-bilio-pancreatic resection                                                |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 20         | 35.7% |
| Likely/Very likely to conduct                                                    | 36         | 64.3% |
| Abdominal wall reconstruction                                                    |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 38         | 67.9% |
| Likely/Very likely to conduct                                                    | 18         | 32.1% |
| Endocrine Surgery                                                                |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 28         | 50.0% |
| Likely/Very likely to conduct                                                    | 28         | 50.0% |
| Breast Surgery                                                                   |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 36         | 64.3% |
| Likely/Very likely to conduct                                                    | 20         | 35.7% |
| Extent of surgery - Major Vs. Minor                                              |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 23         | 41.1% |
| Likely/Very likely to conduct                                                    | 33         | 58.9% |
| Laparoscopic approaches                                                          |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 40         | 71.4% |
| Likely/Very likely to conduct                                                    | 16         | 28.6% |
| Patient had surgery before not less than 3 weeks ago                             |            |     |     |
| Unlikely/Very Unlikely to conduct                                                | 33         | 58.9% |
| Likely/Very likely to conduct                                                    | 23         | 41.1% |
| Ordering some investigations in a pre-operative period of 4 weeks for a 55-year-old man, with no significant co-morbidity who will undergo total gastrectomy with Hb level of 10.5 g/dL |            |     |     |
| Referral to hematology clinics                                                   |            |     |     |
| Unlikely/Very Unlikely to order                                                  | 47         | 83.9% |
| Likely/Very likely to order                                                      | 9          | 16.1% |
| Group and screen                                                                  |            |     |     |
| Unlikely/Very Unlikely to order                                                  | 0          | 0.0%  |
| Likely/Very likely to order                                                      | 56         | 100.0% |
| Cross-match RBCs units                                                            |            |     |     |
| Unlikely/Very Unlikely to order                                                  | 8          | 14.3% |
| Likely/Very likely to order                                                      | 48         | 85.7% |
| RBCs transfusion before surgery                                                   |            |     |     |
| Unlikely/Very Unlikely to order                                                  | 52         | 92.9% |
| Likely/Very likely to order                                                      | 4          | 7.1%  |
| Oral iron supplementation                                                        |            |     |     |
| Unlikely/Very Unlikely to order                                                  | 30         | 53.6% |
| Likely/Very likely to order                                                      | 26         | 46.4% |

in certain surgical patients, including orthopedic and trauma patients, compared to a liberal blood transfusion strategy (10-12).

Up to the best of the authors’ knowledge, blood transfusion practices in Saudi hospitals have not been thoroughly investigated before.
Transfusion Practices Among General Surgeons at a Tertiary Care Center: A Survey Based Study

4. RESULTS

In the present study, 56 out of 75 surgeons responded to the questionnaire. Table 1 summarizes the characteristics of the respondents. The highest frequency of respondents were residents (28.6% in years 1 to 3 and 16.1% in year 4 or above); while specialists accounted for about one fifth and consultants for about one third. More than half the respondents (58.9%) were general surgeons with no sub-specialty training. About one third practiced surgery for one to five years after their board certification. Most respondents were used to take care of more than six patients undergoing elective surgery every month. Only 28.6% of respondents were aware that their institution has a blood conservation program; while the majority were either not aware (42.9%) or denied this (28.6%). More than half the respondents (58.9%) stated that anesthetics and pre-admission clinics hold the responsibility of assessing and managing pre-operative anemia; while surgeons were held responsible by about one third.

Table 2 and Figures 1 and 2 demonstrate the respondents’ pre-operative assessment of anemic cases. Situations for which respondents stated that they are likely/very likely to conduct anemia workup included: patients with documented or suspected bleeding (91%), gastric resection (66%), hepato-bilio-pancreatic resection (64%), colorectal resection (59%), and extended surgery (59%). Most respondents were unlikely/very unlikely to conduct anemia work up in patients with hemoglobin below 13 g/dL (76.8%), laparoscopic approach (71.4%), abdominal wall reconstruction (67.9%), and breast surgery (64.3%). As regards the likelihood of ordering investigations in a patient who will undergo total gastrectomy with hemoglobin level of 10.5 g/dL, all respondents stated that blood group and screening will be ordered, 86% would order cross match of RBCs units, and 46% would order oral iron supplementation.
Transfusion Practices Among General Surgeons at a Tertiary Care Center: a Survey Based Study

Table 3 and Figures 3 and 4 show the respondents’ practices in post-operative period. In a response to a case scenario of a patient who underwent elective surgery, and had active intraoperative bleeding that was stopped, with postoperatively Hb level = 6.4 g/dL and was hemodynamically stable, 89% of surgeons stated that they would often/always order two units of RBCs, while 70% would write the infusion rate. The rate of using RBC alternatives was generally low. The most frequently used alternatives to RBCs transfusion were pre-operative oral iron (30%), pre-operative autologous blood transfusion (16%), cell saver device for benign or malignant cases (9% each), and tranexamic acid (4% only).

Figure 5 (A and B) illustrate the hemoglobin thresholds (as reported by the participants) for red blood cell transfusion for five clinical scenarios. A higher threshold was chosen by most doctors (9 g/dL by 43% and 10 gm/dL by 21%). Transfusion regardless of the hemoglobin level was indicated in symptomatic anemia by 45%; in suspected postoperative bleeding by 57%; and in high intraoperative bleeding by 59%.

Table 4 and Figure 6 summarize the participants’ opinions about how RBCs transfusions increase or decrease the risk of patients’ outcomes. The respondents stated that it will increase post-operative morbidity. As regards post-operative mortality, the respondents’ views were more split as 39% stated that it will decrease the risk while the remainder were divided equally to increased risk or no effect. Most respondents believed that transfusion had no effect on the risk of survival (73%) and on the risk of cancer recurrence (55%) after oncologic surgical resection.

Table 5 and Figure 7 reveal the respondents’ opinion about barriers and facilitators of the use of restrictive RBCs policy. The most indicated facilitators were the availability of scientific evidence that supports the restrictive policy (84%), medicolegal concerns (57%), and...
5. DISCUSSION

Blood transfusion practices affect both patients’ outcomes and utilization of institutional resources. Evidence shows that liberal blood transfusion has a detrimental effect on patients’ outcome. A restrictive approach of blood transfusion is recommended by current clinical guidelines (8, 9).

We observed variations in the management of anemia and the use of blood transfusion between the respondents. Also, the practices of respondents (as indicated by their responses in case scenarios) contradicted with the recommended restrictive policy of blood transfusion.

Anemia is commonly encountered in surgical patients pre-operatively which is associated with increased risk of post-operative complications (14-16). It has been found that pre-operative anemia management and blood transfusion have beneficial effects during and after the surgery, particularly on wound healing, but blood transfusions also carry increased risks of post-operative morbidity and mortality (17-23). In our study most, respondents (73%) were not aware that transfusion affects survival after oncological surgical resection. 55% of them believed that blood transfusion neither increases nor decreases the risk of recurrences of cancer after oncological resection. With regards of post-operative mortality, even lower percentage believed that transfusion increased the risk, while the majority believed that transfusion decreases the risk of mortality or not affecting it all. Majority of surgeons identified detrimental effect of transfusion was the increased risk of post-operative morbidity- which may have been best recognized due to the fear of transmitted infections. The detrimental effects of blood transfusion could be attributed also to transfusion-related acute lung injury (24). Moreover, the TRIM effect can cause the host immune system to gain tolerance, resulting in increased chance for postoperative and nosocomial infections, cancer recurrence, and improved allograft survival (25). A meta-analysis study on patients with colorectal cancer found that perioperative blood transfusion is associated with an increased risk of tumor recurrence (level III) (14).

Most of the physicians use the level of hemoglobin alone to determine the need for blood transfusion. In fact, they must consider anemic symptoms additionally. Evading unnecessary usage of blood units can be beneficial in preserving resources and protecting patients against the probability of developing post transfusion unfavorable consequences (26). Clinical practice guidelines recommend restrictive transfusion policies in stable patients, so that blood transfusion should be indicated only in the case of hemoglobin below 7 g/dL in the absence of active bleeding. These strategies have been reported to be safe and effective in randomized controlled trials (27-29); resulting in reduction of peri-operative blood transfusion (12). In the presence of manifestations of impaired oxygen delivery (e.g., dizziness while standing, shortness of breath, and chest pain) or a history of coronary artery disease, a higher threshold of hemoglobin level (8 g/dL) is recommended (30). In our study, half of respondents (50%) reported using the recommended
lower hemoglobin thresholds in scenarios involving patients without cardiac disease. However, most respondents did not consider the hemoglobin level at all in the presence of in symptomatic anemia (45%); in suspected postoperative bleeding (57%); and in high intraoperative bleeding (59%), stating that they would order blood transfusion at any hemoglobin level in such cases. For stable patients with past cardiac disease, a higher threshold was chosen by most doctors (9 g/dL by 43% and 10 g/dL by 21%), which was in partial agreement to the result reported by Yohanathan et al. (6) who stated that a hemoglobin level of 9 g/dL or higher was reported by a fourth of respondents for asymptomatic patients with cardiac comorbidities, by (70%) for patients with acute cardiac disease, and by half for non-cardiac symptoms of anemia (e.g., dizziness). These results also are in line with those reported by Sim and his colleagues (31).

Guidelines recommend the transfusion of one unit at a time to reduce the associated risks. However, (89%) of respondents reported ordering two units at a time. Over ordering with minimal utilization wastes technical reagents and imposes extra expenses on patients. Vibhute et al. (7) studied practices of blood ordering and transfusion in elective surgical patients and reported a rate of non-utilization of (76.9%) of cross-matched blood. This finding was also reported by subsequent studies that reported non-utilization rates of cross matched blood ranging from (43.6%) to (69.7%) (32). Yohanathan et al. found that (28%) of his respondents preferred to order 2 units or more at a time. Other studies also revealed (33-35) that (64 to 78%) of physicians order 2-unit transfusions when a single unit would have sufficed in more than (95%) of cases. Some studies (36, 37) evaluated gastrointestinal procedures and found that more than (40%) of transfusions were unnecessary (as judged by the guidelines). Intra-operative blood transfusion is decreasing with the time because of improved anesthesia and surgical techniques, organ preservation, and the use of intra-operative blood saver (38).

The most indicated facilitators were the availability of scientific evidence that supports the restrictive policy (84%), medicolegal concerns (57%), preference (52%), and institutional protocols (50%). These indicate that doctors perceived the need for improving their awareness through evidence-based guidelines that were adopted by local institutional protocols. Medicolegal concerns to affect the decision of surgeons requires more analysis in future studies.

6. CONCLUSION

Great variations exist between the respondents with regard of blood transfusion practices. Although current clinical guidelines recommend a restrictive transfusion practice, most respondents tended to over-order blood for elective procedures and were not aware of the potential complications of liberal blood transfusion. Blood ordering pattern for elective surgeries should be revised to minimize over-ordering of blood. Health institutions should improve the awareness of surgeons through incorporating supporting evidence, in formulating local institutional guidelines.

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