Effects Of Reinfusion Systems On Transfusion Needs After Total Knee Arthroplasty

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Citation

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Abstract

Background: Total Joint arthroplasty can lead to significant blood loss. This loss often requires replacement with banked allogenic or pre-donated antologous blood. Both forms of replacement involve substantial financial cost and can be associated with significant complications to the patient. The purpose of this study was to evaluate the effect that reinfusion of postoperative drained blood has on the transfusion requirements following total knee arthroplasty(TKA) using the ConstaVac re-infusion system.

Methods: A retrospective analysis of 91 consecutive TKA performed at one institution was carried out. 22 cases were excluded. The remaining 69 cases formed the basis of the study. The ConstaVac reinfusion system was used in 43 of these cases and a standard Bellovac drainage system was used in the remaining 26 cases. Data was collected on patient\'s age, side affected, operative duration, tourniquet use, volumes drained and reinfused, transfusion requirements and pre- and post-operative as well as post transfusion haemoglobin levels.

Results: Transfusion of packed red cells was required in 50% of cases in which the standard drainage system was used compared with 19% of cases in which the re-infusion system was used. This result was statistically significant using chi-squared analysis. ($p < 0.05$)

Conclusion: We recommend that a postoperative reinfusion system should be used to decrease the transfusion requirements following TKA.

INTRODUCTION

Total joint arthroplasty is often associated with significant volumes of blood loss. Total blood loss has been demonstrated to be greater in total hip arthroplasty than with total knee arthroplasty, in revision rather than primary surgery, and with uncemented versus cemented joint arthroplasty. [1] This loss frequently necessitates replacement either in the form of banked allogenic or pre-donated antologous blood. Both these forms of replacement involve substantial financial burden to the patient or the health care system, but more importantly can be associated with significant complications to the patient.

Allogenic-banked blood is probably the most widely used form of blood replacement. Adverse effects from this form of transfusion include isoimmunization, haemolytic and febrile reactions, anaphylactic reactions and the risk of transmissible diseases. [2] The most notable of these are the human immunodeficiency and hepatitis viruses, but other potential diseases include cytomegalovirus, Epstein-Barr virus, human T-cell leukaemia/lymphoma virus and malaria.[3] Although the risk of transmission of these diseases has been lowered since the advent of screening of donated blood products it remains as a cause of considerable anxiety amongst patients.

Predonated autologous blood avoids the risk of transfusion-transmitted diseases but it also has recognised problems. Firstly not all patients are suitable candidates for the autologous program due to coexisting premorbidities. It comes at a cost to both patient and health care facility, often allogenic banked blood is required to supplement autologous blood, and a significant number of autologous donated units are often discarded.1 One unit of packed cells costs approximately $250-300 to obtain and give. If this is allogenic banked blood, then there is no direct cost to the individual or the hospital. However if the patient chooses to

donate autologous blood, then he or she is charged $300 per unit. In comparison, non-infusion drains cost $27 and the reinfusion (Constavac) drain $240. We are now using the Bellovac reinfusion drain (cost approximately $165). While avoiding a transfusion may not directly reduce the cost to the hospital, we feel it indirectly benefits society as a whole by decreasing both the overall cost of a Total Knee Arthroplasty and by allowing the banked blood to be utilised in other circumstances.

Numerous other methods aimed at decreasing intraoperative blood loss and peri-operative transfusion requirements have been suggested. They can be divided into pre, intra and postoperative options. Aside from those methods previously described, other pre-operative options include direct blood donor contribution and erythropoietin treatment.

Intraoperative options include regional and hypotensive anaesthesia, improved surgical technique and intraoperative cell salvage. Postoperatively, methods of mobilisation as well as reinfusion systems are options.1

This study attempts to review the effects of post-operative reinfusion of drained blood on transfusion requirements in Total Knee Arthroplasty.

MATERIALS AND METHODS

During the period between July 1998 and December 1999, the Orthopaedic department at Wagga Wagga Base Hospital performed 91 consecutive TKAs'.

The patient records for these cases were reviewed retrospectively and documentation was made concerning patient age, side affected, whether tourniquet was used intraoperatively or not, total operation time, and whether or not cement was used. We also documented whether or not a drain was used, type of drain, amounts collected and reinfused, when drains were removed, pre and postoperative haemoglobin levels, any transfusion requirements and post transfusion haemoglobin levels.

Of the 91 cases, there were 8 in which a drain was not used. There were 14 cases in which the fluid balance records were incomplete. The remaining 69 cases formed the basis of the study. The collated data was analysed by obtaining the mean and standard deviation for each variable. Results were analysed using the student t-test and chi-squared testing with a p value of < 0.05 being considered as significant.

RESULTS

Of the 83 cases in which a drain was utilised, there were 14 cases in which the post-operative fluid balance records were incomplete. In the remaining 69 cases there were 26 cases in which a bellovac drain was used and 43 cases where a constavac drain was used. The data between these two groups was compared. (See tables 1 and 2)

Table 1: Patient Population Data

Table 2: Haemoglobin levels and Transfusion Requirements

The mean age in the bellovac group was 68 years compared with 71 years in the constavac. The bellovac group had 20 right knees and 6 left knees. The constavac group had 30 right knees and 13 left knees. Twenty-five of the 26 bellovac cases utilised a tourniquet intra-operatively. A tourniquet was utilised in all 43 Constavac cases.

The mean total operative time was 105 minutes (bellovac) against 96 minutes(constavac). In all the bellovac cases both tibial and femoral components were cemented insitu. In the constavac group 19 cases were cemented and 24 cases were of the so-called hybrid variety (cemented tibial component and uncemented femoral component).

In the bellovac group the mean preoperative haemoglobin level was 136. The mean volume of drainage collected was 397 mls, and the drains were removed at a mean of 4 days postoperatively. The mean postoperative haemoglobin level for all cases in the group was 98. The mean postoperative haemoglobin for the cases in this group given a transfusion was 84. A blood transfusion was required in 13 of the 26 cases (50%). A mean of 2.08 units was transfused and mean post-transfusion haemoglobin was 110.

In comparison, the constavac group had a mean preoperative haemoglobin of 135 and a mean volume of drainage collected of 768 mls. Of this a mean of 418 mls was reinfused according to the constavac protocol. The drains were removed at a mean of 1.6 days post-operatively, and a mean postoperative haemoglobin level for all the cases in this group was 106. The mean postoperative haemoglobin for the cases in this group that required a transfusion was 89. A blood transfusion was required in 8 of the 43 cases (19%). A mean of 2.13 units was transfused and mean post-transfusion haemoglobin was 112.

The difference in transfusion requirements between the two groups (43% and 19%) was statistically significant using chi-squared analysis with a p value of 0.05. Analysis using the unpaired students t-test demonstrated no significant difference between the two study groups with respect to age

(p=0.1), operation duration (p=0.05), preoperative haemoglobin (0.9), postoperative haemoglobin in those cases that required a transfusion (p=0.3), post-transfusion haemoglobin (p=0.7), the number of units transfused (p=0.9) and the number of days post surgery that the drain was removed (p=0.1). There was a significant difference between the post-operative haemoglobins (p=0.04) and the drainage volumes (p=0.0001) when comparing the two groups. In the 14 cases with an incomplete fluid balance chart that were not included when collating the data, all of these cases utilised a drain postoperatively. Half used a bellovac and half used a constavac drainage system. Five of these cases required a blood transfusion, 4 in the bellovac group and 1 in the constavac group. If these cases were included when using transfusion requirements as the end point then of the 33 cases using a bellovac drain, 17 required a transfusion (51.5%) as compared with 9 transfusions in the 50 constavac cases (18%).

DISCUSSION

The process of autotransfusion has been described as early as the 1930's. Its initial descriptions were mainly associated within the field of cardiothoracic surgery.[10,11,12] Only in the more recent past has its application been investigated with respect to the benefits of its use in orthopaedic surgery.

Elderly patients in general tolerate a low haemoglobin level less well than patients of a younger age group. Normal haemoglobin is important not only for the healing of tissues, but also for optimal post-operative cardiorespiratory function and rehabilitation. As the elderly are the target population and principal beneficiaries from total joint arthroplasty, methods at reducing and replenishing blood loss are important in achieving optimal clinical results.

Allogenic banked blood, through screening procedures, is a safe option of blood replacement. A low but definite risk of disease transmission is a cause of great angst amongst patients and their families.

Autologous predonated blood has been shown to be effective at meeting the transfusion requirements for major orthopaedic procedures.[8] It is however not suitable for all patients, is expensive and time consuming, and if changes are made to surgical schedules the donated blood may expire and be wasted. Micropore rheological data has shown that postoperative filtered blood from total knee arthroplasty is suitable for reinfusion purposes.[7] Numerous studies have shown reinfusion of postoperative drainage blood to be associated with no major deleterious reactions 4,[9] or untoward effects on haemostasis or the coagulation system.[6]

Transfusion of blood is frequently required during and after total joint arthroplasty. Our study has highlighted that postoperative reinfusion systems have a role to play in decreasing the transfusion requirements following total knee arthroplasty.

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