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Decrease Incidence of Blood Transfusion In Hip Arthroplasty Patients Due To Combined Blood Saving Measures.

Bharat Singh[1], Sanjay Srivastava[2]

[1]Associate Professor, D. Ortho, M.S (Ortho), Department of Orthopaedics, Patna medical college and hospital, Patna.
[2]Consultant, D. Ortho, M.ch (Ortho), Department of Orthopedics, Aseem health care and trauma centre, Muzaffarpur.

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ABSTRACT

Background: Hip arthritis is a common and crippling disease causing severe pain, deformity and significant disability. Worldwide arthroplasty is among the commonest orthopaedic surgeries of degenerated hip that can result in considerable blood loss. This results in a postoperative decline in haemoglobin levels of 3.0 to 4.0 gram/decilitre from preoperative haemoglobin levels of 14.0 gram/decilitre on an average. Postoperative anaemia may seriously decrease functional mobility in the early postoperative phase following total hip arthroplasty. In recent years there has been an increasing awareness and positive attitude toward blood-saving measures. Blood-saving techniques can be broadly divided into preoperative, intraoperative and postoperative measures in total hip arthroplasty. Our aim is to assess the Decrease incidence of blood transfusion in hip arthroplasty patients due to combined blood saving measures. **Methods:** The study was a hospital based prospective observational study conducted during the period of March 2015 to august 2017 in the department of orthopedics, Patna medical college and hospital, Patna. Patients between the age of 50-85 years were included who underwent total hip arthroplasty between March 2015 to august 2017 in the department of orthopedics, Patna medical college and hospital, Patna. Patients were selected as per inclusion and exclusion. Surgery was done. Preoperative, intraoperative and postoperative blood saving modality was used in total hip arthroplasty. Blood loss and Blood transfusion assessment was done. **Results:** In this study out of 38 patients, Female were 26 (68.4%) and Male were 12 (31.6%). 26.3 % (10/38) patients were between 50-60 years of age, 47.4 % (18/38) between 61-70 years of age, 21.0 % (8/38) between 71-80 years of age and 5.3 % (2/38) patients above 81 years of age. left total hip replacement was done in 14/38 (36.8%), right total hip replacement was done in 24/38(63.2%) patients. Anaesthesia given was: Combined spinal epidural=22/38(57.9%), spinal anaesthesia+ block=12/38 (31.6 %), spinal anaesthesia=2/38 (5.3 %), general anaesthesia+ block=2/38 (5.3 %). Mean diastolic blood pressure was 81.60 millimetre of mercury pre op and intra op 71.11. Mean systolic blood pressure was 135.51 millimetre of mercury pre op and intra op 98.02. In this study only 1 patient out of 38 patients were subjected to blood transfusion accounting to 2.6 % which was statistically significant. **Conclusion:** Use of combined blood saving measures helps to decrease incidence of blood transfusion in arthroplasty. Due to low incidence of blood transfusion, blood related adverse event is prevented. There was statistically significant reduction in haemoglobin level after operation. There was statistically significant reduction in haematocrit level after operation.

Keywords: Blood Tranfusion, Hip Arthroplasty.

INTRODUCTION

Hip arthritis is a common and crippling disease causing severe pain, deformity and significant disability. Worldwide arthroplasty is among the commonest orthopaedic surgeries of degenerated hip that can result in considerable blood loss. Total hip arthroplasty are associated with a considerable amount of total blood loss of 2300 millilitre on an average, from a preoperative blood volume of approximately 5000 millilitre,[1] which is almost one third of total circulating blood volume. This results in a postoperative decline in haemoglobin levels of 3.0 to 4.0 gram/decilitre from preoperative haemoglobin levels of 14.0 gram/decilitre on an average.[1] Postoperative anaemia may seriously decrease functional mobility in the early postoperative phase following total hip arthroplasty.[2-6] Higher pre- and postoperative haemoglobin levels are considered for better early functional recovery higher, patient satisfaction and shorter hospital stay.[3-6] Of all homologous blood transfusions, 40-50% are given to surgical patients.[4] The transfusion-related risks of allogenic red blood cell transfusions comprise direct infections due to contaminated blood, incompatibility reactions and effects on the

Name & Address of Corresponding Author
Dr. Bharat Singh
Associate Professor, D. Ortho, M.S (Ortho),
Department of Orthopaedics, Patna medical college and hospital, Patna.

immune system,[5] such as an increased risk of postoperative infection,[6] delay of wound healing and prolonged hospital stay.[7]

In recent years there has been an increasing awareness and positive attitude toward blood-saving measures. Blood-saving techniques can be broadly divided into preoperative, intraoperative and postoperative measures in total hip arthroplasty. The guidance covers three stages in the patient journey where a variety of techniques can be utilised to reduce blood loss and / or the need for allogenic blood transfusion:

- Pre-operative assessment and optimisation.
- Intra-operative blood conservation and cell salvage.
- Post-operative conservation techniques, including indications for transfusion, and postoperative cell salvage.

Although the alternatives discussed previously can be used individually with success, they are most effective when used together in a blood management strategy that is individualized to a specific patient. The aim is assessment of combined blood saving modality in hip arthroplasty.

MATERIALS AND METHODS

The study was a hospital based prospective observational study conducted during the period of March 2015 to august 2017 department of orthopaedics, Patna medical college and hospital, Patna. Patients between the age of 50-85 years were included who underwent total hip arthroplasty between the period of March 2015 to august 2017 department of orthopaedics, Patna medical college and hospital, Patna. Patients were selected as per inclusion and exclusion. Exclusion criteria included history of any allergy to Tranexamic acid or erythropoietin, Acquired disturbance to colour vision, Pre op anaemia (haemoglobin < 10 milligram/decilitre), Pre op use of anti coagulant therapy within 7 days before surgery, History of any fibrinolytic disorder, Requiring intra op anti fibrinolytic treatment, any Coagulopathy, prothrombine time (PTT) >1 and any History of Cerebrovascular accident, Deep vein thrombosis, Pulmonary embolism, Ischemic heart disease(New York heart association class III or IV), Hepatic failure and Metastasis.

On basis of inclusion and exclusive criteria, patient is selected for hip arthroplasty. Investigations were done at the time of first visit and were called for follow up. If haemoglobin was low (10-13 milligram/decilitre) then fresh report (complete blood count, serum iron and ferritin, total iron binding capacity, vitamin B12, folate), if haemoglobin < 10 milligram/decilitre then patient was evaluated haematologically. If haemoglobin within 10-13 milligram /decilitre, patient was treated with preoperative erythropoietin and iron supplement after considering the general condition of patient and patient was made fit for anaesthesia and surgery, taking in mind the comorbid condition.

Patient shifted to operation theatre on the day of surgery. Normothermia maintained (~96.8 degree Fahrenheit). Anaesthesia (spinal, epidural, femoral block, general anaesthesia) given and hypotension maintained during surgery. Antibiotics and Tranexamic acid was given 30 minute prior to surgery.

Technique for total hip arthroplasty

Patient was positioned laterally on the table. Part scrubbed painted and draped. Posterolateral incision was given over the proximal thigh over the greater trochanter. Dissection done and joint reached. Haemostasis achieved by Cautery. Head of femur removed with saw. Acetabular and femoral component prepared. Cementing done and implant inserted. Drain inserted and closure done in layers. Second Tranexamic acid was given 3 hours after the surgery. Patient shifted out of operation theatre in satisfactory condition and monitored. Drain was removed after 48 hours and measured. Complete blood count was send the next day and haemoglobin noted. Dressing was done after 48 hours of surgery and post op x-ray was done. Antibiotic continued until 2nd post op day and stopped. Patient monitored for any adverse event. Patient was discharged on 4rth post op day.

The criterion for transfusion of blood was based upon a number of factors including the pre- and postoperative haemoglobin levels and intraoperative blood loss. The attending surgeons made the decision to transfuse patients with a postoperative haemoglobin level of 8.5-9 gram/decilitre, only if patient had relevant symptoms, such as fainting, tachycardia, or asthenia. Patients with a haemoglobin level >10 gram/decilitre were not transfused.

Calculation of total blood loss

Loss of blood at the end of the operation was recorded by measuring the volume in the suction apparatus. Consequently, we estimated postoperative blood loss by calculating the patient's blood volume (PBV) using the method of Nadler et al. (1962).(8)

- PBV = (k1 × height3 (metre)) + (k2 × weight (kilogram)) + k3
- For male patients: k1 = 0.3669, k2 = 0.03219, and k3 = 0.6041
- For female patients: k1 = 0.3561, k2 = 0.03308, and k3 = 0.1833
- Multiplying the patient blood volume (PBV) by the haematocrit (Hct) gives the red blood cell (RBC) volume. Thus, a change in the red blood cell volume can be

calculated from a change in the haematocrit level, as follows:

- Total RBC volume loss = PBV × (Hct preoperative − Hct postoperative)
- Transfusions (mean volume per unit = 285 millilitres) were taken into account by calculating the total blood loss as follows:
- Total blood loss (Litre) = Total RBC volume loss + (Number of units transfused × 0.285) ÷ ((Hct preoperative + Hct postoperative) ÷ 2).

Statistical analysis plan

Data were analysed using statistical analysis system (SAS) 9.2 and 15.0 statistical package for social sciences, version 15.0 (SPSS) package.

RESULTS

Chart 1.distribution of study sex wise.
In this study out of 38 patients, Female were 26 (68.4%) and Male were 12 (31.6%).
Chart 2.distribution of study age wise
In this study 26.3 % (10/38) patients were between 50-60 years of age, 47.4 % (18/38) between 61-70 years of age, 21.0 % (8/38) between 71-80 years of age and 5.3 % (2/38) patients above 81 years of age.
Chart 3.distribution of study as per surgery
Left total hip replacement = 14/38 (36.8%), right total hip replacement = 24/38(63.2%),
Chart 7. Comparison of study as per type of anaesthesia used
Combined spinal epidural=22/38(57.9%), spinal anaesthesia+ block=12/38 (31.6 %), spinal anaesthesia=2/38 (5.3 %), general anaesthesia+ block=2/38 (5.3 %)
Chart 8. Comparison of study as per mean pre/intra op diastolic blood pressure
Mean diastolic blood pressure was 81.60 millimetre of mercury pre op (minimum-60 millimetre of mercury and maximum-104 millimetre of mercury) and intra op 71.11 (minimum-60 millimetre of mercury and maximum-90 millimetre of mercury).
Chart 9. Comparison of study as per mean pre/intra op systolic blood pressure
Mean systolic blood pressure was 135.51 millimetre of mercury pre op (minimum-110 millimetre of mercury and maximum-180 millimetre of mercury) and intra op 98.02 (minimum-90 millimetre of mercury and maximum-110 millimetre of mercury).
Chart 10. Comparison of study as per transfusion done
In this study only 1 patient out of 38 patients were subjected to blood transfusion accounting to 2.6 % which was statistically significant.
Chart 12. Comparison between preop and postop values of haemoglobin
Pre operative =12.78 ± 1.19, Post operative =11.27 ± 1.14, t=15.2, S, P<0.001
Conclusion: There was significant reduction in haemoglobin after operation.
Chart.13 comparison between preop and postop values of haematocrit
Pre operative =38.80 ± 3.99, Post operative =34.62 ± 3.60, t=13.5, S, P<0.001
Conclusion: There was significant reduction in haematocrit after operation.

DISCUSSION

The amount of blood loss during hip arthroplasty varied among different reported literarture. A patient's risk of requiring a transfusion during surgery and in the immediate postoperative period is an important element of effective blood management. In this study we tried to assess the decrease incidence of blood transfusion in hip arthroplasty by applied combined blood saving modality during various phases i.e. perioperative, intraoperative and post-operative phase in hip arthroplasty. In this study we found that the combined blood saving measures significantly reduces blood loss and hence decreases incidence of blood transfusion in the patients.
The rate of transfusion (2.60 %) was lower than previously reported in literature. Decrease in haemoglobin level was low as compared to past studies. Decrease in haematocrit level was statistically significant. The lower transfusion rate was not accompanied with any indications of increased complication rate. Preoperative haemoglobin concentration, pre-operative haematocrit, and operating time were the most important risk factors for excessive blood loss and transfusion. There was no bone cement implantation syndrome in our.
The calculated blood loss in our study was much less as compared to that in the study by Rosencher et al (9). They showed that calculated blood loss was significantly higher (1944 millilitre for patients who underwent total hip arthroplasty and 1934 millilitre for patients who underwent total knee arthroplasty) compared with estimates (750 millilitre for patients who underwent total hip arthroplasty and 800 millilitre for patients who underwent total knee arthroplasty)
Visible blood loss in drain was about 50 % of total blood loss in hip arthroplasty which was less as per above study.
The mean haemoglobin drop (and standard deviation) after surgery in our study was also statistically significant with average mean value pre-operative 12.78 +/-1.19, post-operative 11.27+/-1.14. The average drop in mean haemoglobin value was 1.51 gram/decilitre. The average haemoglobin drop after primary total joint arthroplasty in our study was less as compared to

that in the study by Rosencher et al., which showed a mean haemoglobin drop of 2.8 gram/deciliter.[9]

Churchill et al, Grosflam et al, Cushner et al, Prasad et al literature showed that perioperative blood loss is greater in male patients.[10-13]

In our study we could not compare male versus female perioperative blood loss since in our study number of female patients was not comparable to the number of male patient.

Tranexamic acid is commonly used in hip arthroplasty surgery all over world. The use of Tranexamic acid and other anti-fibrinolytic substances is well-studied and known to significantly decrease the number of transfusions in cardiac and orthopaedic surgery.[14]

Our study population received Tranexamic acid according to hospital guidelines, and this may have contributed to low bleeding volumes and low transfusion rates.

Salido et al and Bierbaum et al found that the prevalence of blood transfusion after hip surgery was higher.[5,15] In our study, blood transfusion in hip arthroplasty patients was low (2.60%).

The average blood transfusion rates for hip arthroplasty in studies by Bierbaum et al,[5] Feagan et al,[16] and Pierson et al,[17] were 49%, 27% and 2.1% respectively. Borghi et al. reported allogenic red blood cell transfusion requirements of only 10% for total hip arthroplasty patients.[18]

Our overall transfusion rate was 2.60 %. There was no standard protocol for proceeding with a transfusion in our study. Instead, the decision for blood transfusion was based on the patients overall clinical status and co-morbidities.

In accordance to previous studies by Vuille-Lessard et al , Barr et al, Guerin et al, Meas-Ramos et al,[19-22] we found that a low preoperative haemoglobin was a significant risk factor for receiving allogenic red blood cell transfusions.

In our study 1 patient out of total 38 patients was transfused allogenic blood due to low postoperative haemoglobin level and mild adverse effect which subsided after transfusion.

There was no bone cement implantation syndrome in our study as proper precautions were taken while cementing procedure.

A number of different measures were taken to minimize the need for allogenic transfusions, including maintaining controlled hypotension, Normothermia during surgery, decrease tourniquet time etc in our study we cannot calculate individual contribution in decreasing blood loss during joint arthroplasty. But combined effect of all would have been contributed in decreasing the blood loss and hence decrease transfusion of blood.

In our study there was decrease incidence of blood loss (1 of 38 patients) so combined blood saving modality would have helped to reach the goal of decrease transfusion. One weakness of the present study was the restricted number of patients included, which did not allow further subgroup analysis. The lack of a specific transfusion protocol or transfusion triggers, could also possibly have influenced the results. Our results have shown that following the multiple blood saving modality in pre, intra and post operative period in joint arthroplasty, incidence of blood transfusion can be decrease to significant level.

CONCLUSION

Use of combined blood saving measures helps to decrease incidence of blood transfusion in arthroplasty. Due to low incidence of blood transfusion, blood related adverse event is prevented. There was statistically significant reduction in haemoglobin level after operation. There was statistically significant reduction in haematocrit level after operation.

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