

ROLE OF TRANEXAMIC ACID AND DRAINLESS CLOSURE IN DECREASING BLOOD LOSS IN PRIMARY TOTAL KNEE ARTHROPLASTY

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ABSTRACT

Total knee arthroplasty is one of the most successful orthopaedic surgeries to be performed and osteoarthritis is its leading indication. There are various methods advocated to limit the amount of blood loss in this surgery. In our study we have used tranexamic acid and a drainless closure together to decrease the blood loss in primary total knee replacements done for osteoarthritis over a period of one year. This is one of the first studies to use tranexamic acid and a drainless closure together to limit the fall in post operative haemoglobin after a primary total knee replacement for osteoarthritis.

Of the 71 patients who were included in the study, 49 of them had undergone bilateral replacement in the same sitting. All cases received 15 mg/kg of tranexamic acid intravenously 10 minutes before surgery. All cases were done by the same surgeon following similar techniques and similar implants. Prior to closure, tourniquet was released and haemostasis was attained. Closure was done without any suction drain. The haemoglobin level after 24 hours was checked and the difference in preoperative and post operative haemoglobin levels was calculated and was compared with a known standard of 2.39 mg/dl fall in haemoglobin level per knee after total knee replacement. The average fall in haemoglobin per knee was found to be 1.81 mg/dl per knee.

On statistical analysis it was found that there is significant reduction in the fall of haemoglobin levels when a single dose of tranexamic acid given preoperatively was combined with drainless closure.

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INTRODUCTION

Total knee arthroplasty is one of the most successful orthopaedic surgeries performed. Blood loss is a major complication of this surgery. A study by Lotke *et al*¹ concluded that the mean blood loss in TKA, when calculated from the peri-operative drop in haemoglobin, is 1518 ml. Different techniques are being used to reduce the risk of perioperative allogenic blood transfusion in total knee arthroplasty surgery. Despite numerous advances, allogenic transfusion rates still remain high. Transfusion rates follow-

ing unilateral knee replacement range from 4% to 46%, whereas bilateral replacement results in transfusions rates from 31% to 72%.² In this study we are attempting to study the role of tranexamic acid and drainless closure in limiting the blood loss occurring in total knee arthroplasty.

Tranexamic acid, a lysine analog, is an inhibitor of fibrinolysis which acts by competitively inhibiting the conversion of plasminogen to plasmin. It allows mature fibrin clots to be maintained and coagulation to continue uninhibited.³ Most



orthopaedic surgeons routinely use closed-suction drains in total knee arthroplasty. In a survey of American Association of Hip and Knee Surgeons members, 62% always used a drain compared with 24% who never used a drain. 14% used drain occasionally⁴. In theory, a haematoma could impair wound healing, restrict mobilisation and increase the potential for deep infection and pain⁵. Haematomas, however, form despite the presence of a drain which may also provide a portal for bacteria⁶. In addition, a drain may lead to increased blood loss since the tamponade effect on the joint may be reduced.

The best of our literature search did not reveal any other similar study looking into the combined effect of both tranexamic acid and drainless closure in reducing the blood loss in primary total knee replacements.

MATERIALS AND METHODS

In our study, all osteoarthritis patients who underwent primary total knee replacements in our hospital between March 2013 and March 2014 were taken up for the study.

Patients above 75 were excluded as many of these patients have low preoperative haemoglobin levels. Revision knee arthroplasty was excluded due to increased operative time and more invasive procedure. Rheumatoid arthritis and secondary arthritis being inflammatory diseases were expected to cause more bleeding compared to osteoarthritis because of increased blood flow to the inflamed joint. They were also expected to have lower preoperative haemoglobin due to intake of steroids and disease modifying drugs. Any patient with systemic diseases causing anaemia or any one with known adverse reaction to tranexamic acid were excluded.

The patients underwent appropriate preoperative investigations and consultations to rule out any foci of infections and to assess fitness for surgery. The preoperative haemoglobin and packed cell volume (PCV) were noted. Standard technique was used in all cases. Surgery was done under spinal/ epidural anaesthesia in all cases. Preoperatively, tranexamic acid 15 mg/kg was given intravenously 10 minutes before surgery. A pneumatic tourniquet is inflated to a pressure 100 mm Hg above systolic pressure and is maintained throughout the surgery. A medial parapatellar incision was used in all cases. The implant used was Smith and Nephew Genesis II posterior stabilised cemented implant. Before closure, tourniquet was released and all bleeding points were arrested. The closure was done without any suction drain. A compression bandage was given.

Post operative haemoglobin was recorded and was compared with preoperative value. The difference between the preoperative and postoperative fall in

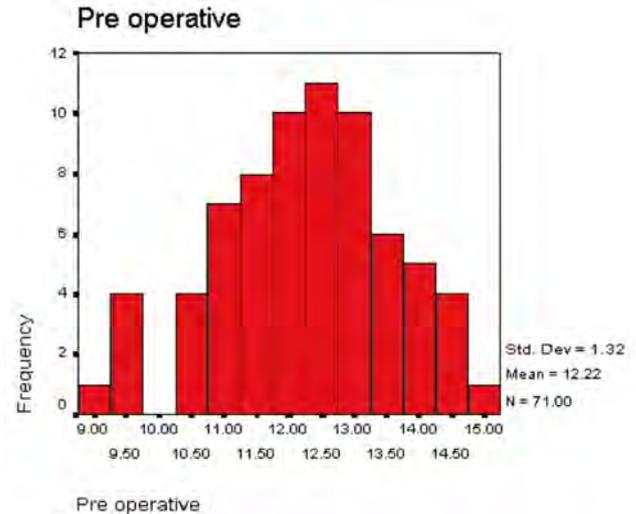


FIGURE 1. Graph Showing Pre operative Hb distribution

haemoglobin was compared with a known fall in haemoglobin of 2.39 as recorded by a prospective study conducted by Narayana Prasad et al⁷ in unilateral primary cemented total knee arthroplasty. The value from this study was used as it was conducted in a comparable population. Anything above this value was taken as significant loss of haemoglobin.

RESULTS

Total of 85 patients had undergone Total knee replacement during March 2013 to March 2014. The number of females was 66 and males 19. Out of these 85 cases, 14 were excluded. The total number of cases included for the study was 71. Majority of the cases 57 (80.3%) were females. Maximum number of patients were between ages of 60–69 with the mean age being 61.5. Bilateral Total knee replacement under a single anaesthesia was done in most cases(69%) and among unilateral cases done, right was more common.(21.1%). The mean preoperative haemoglobin was 12.22g/dl and mean post operative haemoglobin after 24 hours was 9.27g/dl, the difference being 2.95g/dl. The haemoglobin loss per knee is 1.71g/dl where Total Knee Replacement was done in a bilateral setting. The average haemoglobin loss per knee was calculated for both bilateral and unilateral cases and was found to be 1.81g/dl.

DISCUSSION

Total knee replacement is considered to be one of the most successful orthopaedic surgeries done today. There is substantial relief of joint pain, increased mobility, correction of deformity and an improvement in the quality of life of the patients following Total Knee Arthroplasty. The total number of TKA done around the world is increasing as each year passes.

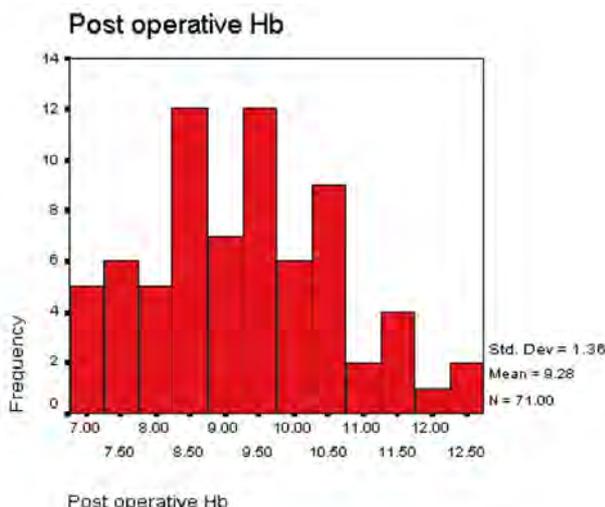


FIGURE 2. Graph Showing Post operative Hb distribution

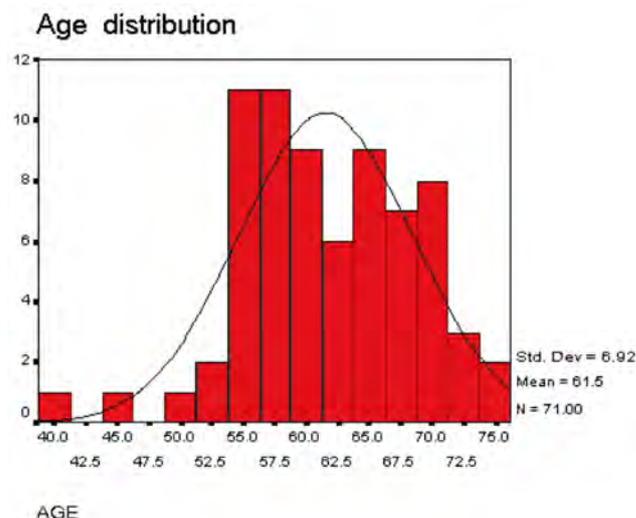


FIGURE 3. Graph Showing Age distribution of the study

In United kingdom alone, there was an increase of 7.3% cases of Total Knee Replacement in 2012 when compared with 2011, with the total number of procedures amounting to 90,842⁸. In United States, the number of knee arthroplasty done was nearly 63% of total joint arthroplasties done in 2012⁹.

The major indication is osteoarthritis of knee^{8,9}. As expected, rates of Total knee replacement for osteoarthritis increased almost ten times between 1986 and 2003 in Finland and Sweden, but numbers of procedures for rheumatoid arthritis did not rise¹⁰.

In our study only those cases of Total knee replacements done for primary osteoarthritis were included. All cases of Rheumatoid Arthritis, Post traumatic arthritis and Revision TKA were excluded. This is to decrease the differences in the study group and to eliminate confounding factors. The usage of the same make of implants (Smith and Nephew, Genesis II) and procedure done by the same surgeon in all cases also helped us in this aspect.

Total knee replacement is associated with a significant amount of blood loss. Antifibrinolytics such as epsilon-aminocaproic acid, tranexamic acid, and aprotinin have been shown to reduce perioperative blood loss, autologous blood donation and transfusions in major orthopaedic surgeries. Prospective, randomized studies have shown that the use of these agents can be effective in reducing the perioperative blood loss and transfusion requirements in total joint arthroplasty. Aprotinin was temporarily withdrawn worldwide in 2007 after studies suggested that its use increased the risk of complications or death. In February 2012 the European Medicines Agency (EMA) scientific committee reverted its previous standpoint regarding aprotinin, and has recommended that the suspension be lifted¹¹. Although Tranexamic Acid is

comparable to Aminocaproic acid with respect to reducing postoperative blood loss, blood and blood products usage and re-exploration rates¹², the former was preferred as it is cheaper and less allergenic than aprotinin and is more potent than aminocaproic acid¹³

Use of suction drain in orthopedic procedures prevents hematoma formation and reduces the incidence of complications in the wound. But studies have shown that the placement of the drain after total knee arthroplasty does not affect the incidence of complications, mean time of hospitalization and functional recovery.

Moreover, drainage after total knee arthroplasty reduces the tamponade effect and increases blood loss in the wound^{14,15,16}. In our study, in no patients was any suction drain used. Thorough haemostasis was attempted prior to closure by releasing the tourniquet and cauterization of any visible bleeders.

The effect of intravenous tranexamic acid and drainless closure in Total Knee Arthroplasty was studied. Study included 71 patients, 14 males and 57 females, who had undergone Total Knee Arthroplasty for primary osteoarthritis of knee. The percentage of females undergoing primary total knee replacement was very high (80.3%) when compared to standard arthroplasty registries. Percentage of females undergoing total knee replacement in 2012 in United Kingdom was 57%⁸ while that in the United States was 61.5%⁹.

Age of the patients who underwent the surgery and were included in the study is between 44 and 75. Maximum number of patients were between ages of 60–69. The mean age was 61.5. The average age in United states⁹ was 66 while in Canada¹⁷ it was 67 and United kingdom⁸ it was 69.3.

Majority of the cases done in our institution were done in a bilateral setting (69%) while others

were unilateral with an increase in number of right sided cases (21.1%) when compared to left (9.9%). Reduction in hospitalization time, total cost and early rehabilitation are the main advantages of bilateral simultaneous total knee replacement. The overall clinical and radiological outcomes are similar in the simultaneous and staged bilateral total replacement groups^{18,19}. When comparing this with the United kingdom registry the number of bilateral cases were low (<1%), the right side was more commonly done (52%) when compared to left (47%). In our set up bilateral total knee arthroplasty under single anaesthesia was preferred as it helped the patients to bring the total cost and hospital stay when compared to a staged procedure.

The preoperative haemoglobin level showed a mean value of 12.22. Postoperative haemoglobin measured 24 hours after the surgery showed a mean of 9.27 in both bilateral and unilateral cases. The difference was 2.95. The fall in haemoglobin level per knee in bilateral cases was calculated to be 1.71. The overall haemoglobin loss per knee was calculated to be 1.73. The haemoglobin loss per knee was compared to a known fall in level of haemoglobin in Total knee Replacement of 2.39⁷. This difference was statistically significant (p value 0.0000).

There was about 24.26% difference in blood loss when tranexamic acid was used. This blood loss is comparable to other studies where reduction of blood loss of 25% to 50% have been noted^{20,21,22}. None of the patients in our study developed any adverse thromboembolic episodes like deep vein thrombosis, pulmonary embolism or myocardial infarction.

There was no instance of any serious haematoma formation that warranted surgical intervention nor was there any serious bleeding and ecchymosis of wound. This finding was similar to Esler et al¹⁴ who reported no instances of ecchymosis or severe bleeding in their group with no suction but against the findings of Kim et al who reported 60.9% of undrained total knee arthroplasty showed ecchymosis and bleeding with soakage of wound dressings¹⁵ and Holt et al²³ in whom 40% of undrained group required reinforcement of dressings.

CONCLUSION

In our study, the findings suggest that intravenous tranexamic acid combined with drainless closure is safe and effective in reducing blood loss in Total Knee Replacement surgery.

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