

Pearls to Prevent Peri-Operative Blood Loss in THR & TKR.

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Received: October 2016

Accepted: October 2016

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ABSTRACT

Perioperative blood loss is one of the modifiable factors that have been in focus during the last decade. Major orthopaedic surgeries are associated with significant amount of blood loss in the intra and post operative period. The purpose of reducing the perioperative blood loss protocol is to decrease the need of allogenic blood transfusions and eliminate the transfusion related complications. The protocol can be divided into pre operative risk assessment, pre operative preparation, optimizing the operative technique and post operative management. The strategies used during these periods can decrease the peri operative blood loss. Tranexaemic acids is the most promising agent in this regard by its virtues of cost effectiveness, ease of availability and administration and without increase in the risk of thromboembolic events. Decreased peri operative blood loss translates into reduced need of blood transfusions, better recovery, decreased rate of complications and reduced economic burden.

Keywords: Peri operative blood loss, Tranexaemic acid, Bipolar tissue sealants, Fibrin sealants, Post operative blood transfusions.

INTRODUCTION

Peri-operative blood loss is one of the modifiable factors that have been in focus during the last decade. This single factor has striking effect on complication rate, the recovery, hospital stay and the financial factors. The role of tranexamic acid cannot be overemphasized, which reduces blood loss without adding to the risk of thromboembolic phenomenon. During the last decade blood loss has been considerably reduced resulting in significant decrease in complications associated with blood transfusion such as prolonged hospital stay, transfusion reactions, fluid overload and infection. The article is focused on pearls of reducing blood loss during THR and TKR surgeries during peri-operative period.

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Perioperative blood loss is a modifiable factor which affects the outcome of major orthopedic surgeries. It has a great effect on the patient

satisfaction also. In recent times reducing this blood loss has been the point in focus. Decreased perioperative blood loss translates into better post operative period in terms of decreased swelling and haematoma resulting in better post operative mobilization, increased range of motion, less stiffness and pain. By reducing the blood transfusions, the overall economic burden is lowered. Transfusion reactions can be avoided. Even the autologous blood transfusion is associated with problems like fluid overload, infection and wound healing^[1,2].

Major orthopedic surgeries are associated with significant amount of blood loss in the intra-operative and post-operative period. Post-operative blood transfusions are common for these surgeries. The blood loss is attributed to creation of large bleeding bony surfaces, potential spaces for blood to accumulate, blood transfusions and will to move the joint early in the post-operative period, further increasing the bleeding. The incidence of blood transfusions in post-operative period for patients undergoing THR & TKR is estimated to be between 20 and 50%^[3,4]. It is a well established fact that there are many complications associated with allogenic blood transfusion. A comparison between patients receiving blood transfusion and those who

do not it is found that an increased duration of hospital stay, increased fluid overload, higher incidence of infection and pulmonary complications are associated with the first group of patients^[4-6]. There are many other major complications of blood transfusion^[7].

Blood Loss associated with Total Hip or Total Knee Replacement Surgery.

There are many studies about the amount of blood loss associated with THR and TKR. In primary THR, the blood loss is 3.2+/- 1.3 units while in revision THR it goes up to 4.0+/-2.1 units. In primary TKR, the blood loss ranges from 1000 to 1500ml (8). During bilateral TKR, blood loss may be greater for the second knee and alterations in coagulation have been noted^[8-11].

The purpose of reducing the peri-operative blood loss protocol is to decrease the need of allogenic blood transfusion thus eliminating transfusion related complications. Many protocols have been developed to decrease peri-operative blood loss and decrease the risks of blood transfusion^[12-15]. The protocol can be divided in four parts as pre-operative risk assessment, pre-operative preparation, optimizing operative technique, and proper post-operative management.

PREOPERATIVE RISK ASSESSMENT

Patients undergoing the surgeries are categorized as high risk or low risk for transfusion. The patients for routine primary joint replacement with haemoglobin levels more than 11 are low risk while the patients for a revision surgery are high risk cases. The factors like age, gender and comorbidities should also be considered.

PREOPERATIVE PREPARATION

The transfusion requirement risk can be decreased by haemodilution, autologous blood donations and use of erythropoietin. Haemodilution is the method in which part of patients blood is removed just before surgery while maintaining blood pressure, by intravenous fluids followed by giving the blood when the blood loss is complete. Usually this process is carried out by the anaesthetist who transfuses the blood immediately in the post operative period. Further many personnel are required to collect and provide the storage facilities for this process^[16]. Autologous blood donation has recently been criticized on the grounds that there is significant amount of wastage as nearly half of it is not used at all. Further this increases the risk of receiving post operative blood transfusion^[17]. Erythropoietin administration is costly, it requires a schedule of doses which has to be coordinated which may be difficult to follow and the injections

are costly^[18]. Still erythropoietin may be used to boost the preoperative haemoglobin levels.

OPTIMIZING OPERATIVE TECHNIQUE

Tourniquet use. With the use of pneumatic tourniquet, the procedures are performed under ischaemic a condition which significantly activates coagulation and fibrinolysis, finally resulting in significant blood loss necessitating post operative allogenic blood transfusion^[19]. It is proposed that avoiding the tourniquet use conserves blood; as coagulation process will occur in the bleeding tissues during the operation. We can also decrease the paradoxical blood loss which occurs after deflation by avoiding the reflex hyperemia^[20]. The use of tourniquet can decrease the duration of the operation. The amount of blood loss may be similar with or without use of tourniquet; the period of blood loss can be shifted from the intra to post operative period^[21].

The bipolar tissue sealant devices. Significant amounts of blood loss can be avoided both intra and postoperatively, with the use of these devices. Electrocautery can be used with combination further decreasing the intraoperative blood loss. Their use further improves visualization of tissues and decreases the morbidity of surrounding tissues. Although the benefits of reduced pain and swelling from decreased postoperative haematoma are yet to be established. Further the added cost of these devices is a financial burden and their use in primary arthroplasty is thus debatable. In the settings of difficult revision surgeries and patients with coagulation disturbances they may be used^[22]. There is a conflict of evidence for their use in comparison with electrocautery devices, some studies have found reduced blood loss^[23], some have advocated use in selective cases^[22] while some have found no difference^[24].

Tranexaemic acid. It is a synthetic derivative of amino acid lysine which competitively inhibits plasminogen activation thus interferes fibrinolysis, preventing breakdown of clot. Many studies have shown that it does not increase predisposition for clotting and thus incidence of thromboembolism is not significantly increased^[25]. Tranexemic acid works mainly by interfering with fibrinolysis in the local environment and not systemically^[26]. It can be given intravenously, orally or applied topically. In orthopaedic practice it is usually given as IV or applied topically. The recommended dose for IV use in orthopaedic surgeries is 10-15mg/kg, which is usually given just before incision, before inflating the tourniquet (when being used). It may be given as 1gm IV bolus before incision and repeated after 3 hrs. Regarding the choice of use of

tranexemic acid; intravenously, topically or both different studies have been done without any firm conclusion about the superiority of the mode of administration^[27-29]. The advantages of tranexemic acid are its cost effectiveness, it decreases the need for blood transfusions and the administration is simple^[29].

The Fibrin sealants. These are a group of biocompatible and biodegradable agents developed to aid haemostasis and sealing of the tissues during surgery. It is postulated that when applied to raw bony surfaces created during surgery, they will prevent bleeding in the post operative period. Their use positively affects the surgical outcome by reducing the time required for haemostasis, decreased blood loss, decreased complications and thus reducing the no of blood transfusions in the postoperative period^[30].

Post-operative management.

Compression and cryotherapy are known to decrease the blood loss post operatively. Suction drains increase the amount of blood loss their use reduce the formation of post operative haematoma collection, they aid in rehabilitation use of CPM increases the amount of blood loss and there is no clinical benefit.

PROTOCOL

We have a protocol which is divided into four parts as described earlier. The first part is identification of the risk factors such as a low haemoglobin concentration. When the Hb% is below 11gms, we give medical treatment to build up the haemoglobin. Intraoperatively we use both IV and topical tranexemic acid. The IV dose of 1gm is given just before inflating the tourniquet. The tourniquet is deflated before the wound closure and bleeding is controlled by using electrocautery. We do not use periarticular injections of epinephrine. Postoperatively we use negative suction drains which clamped immediately and changed six to eight hrs after the surgery. We use compression for controlling the bleeding. We do not use cry therapy. We do not use CPM.

In summary, THR and TKR result in considerable amounts of blood loss and the patients are subjected to increased risks of blood transfusions. Many modalities have been developed to prevent this loss and tranexemic acid is the most significant of them as it decreases the intraoperative blood loss without increasing the risks of thromboembolism.

REFERENCES

1. Sandeep Sahu, Hemlata, Anupam Verma. Adverse events related to blood transfusion. Indian J Anaesth. 2014 sep-oct; 58(5):543-551.

2. RE Domen. Adverse reactions associated with autologous blood transfusions: evaluation and incidence at a large academic hospital. Transfusion. 1998;38:296-300.
3. PJ Joy and SJ Bennet. The appropriateness of blood transfusion following primary total hip replacement. Ann R Coll Surg Engl. 2012 Apr; 94(3): 201–203.
4. Hart A., Khalil JA, Carli A et al. Blood transfusion in primary total hip and knee arthroplasty. Incidence, risk factors, and thirty-day complication rates. J Bone Joint Surg Am. 2014 Dec 3;96(23):1945-51.
5. Bower WF, Jin L, Underwood MJ et al. Peri-operative blood transfusion increases length of hospital stay and number of postoperative complications in non-cardiac surgical patients. Hong Kong Med J. 2010 Apr;16(2):116-20.
6. Kalpana Vinod Kelkar. Post-operative pulmonary complications after non-cardiothoracic surgery. Indian J Anaesth. 2015 Sep; 59(9): 599–605.
7. Melanie J Maxwell, Matthew J A Wilson. Complications of blood transfusion. Contin Educ Anaesth Crit Care Pain. (2006) 6 (6): 225-229.
8. John J Callaghan, Andrew Spitzer. Blood Management and Patient Specific Transfusion Options in Total Joint Replacement Surgery. Iowa Orthop J. 2000; 20: 36–45.
9. Bould M, Freeman B, Pullyblank A, et al. Blood loss in sequential bilateral total knee arthroplasty. J Arthroplasty. 1998; 13:77–79.
10. Carson J, Goodnough L, Keating E. Blood products: Maximal use, conservation pre-deposit blood, when to transfuse and Erythropoietin. Course 128; 66th Annual Meeting of the American Academy of Orthopaedic Surgeons; Anaheim, CA. 1999. Presented at Instructional Course Lectures.
11. Toy PT, Kaplan EB, McVay PA, et al. Blood loss and replacement in total hip arthroplasty: a multicenter study. The Preoperative Autologous Blood Donation Study Group. Transfusion. 1992;32:63–67.
12. Friedman R, Zimlich R, Butler J, et al. Preoperative hemoglobin as a predictor of transfusion risk in total hip and knee arthroplasty. 65th annual meeting of AAOS; 1998; New Orleans. Paper 381.
13. Keating EM, Meding JB, Faris PM, et al. Predictors of transfusion risk in elective knee surgery. Clin Orthop. 1998;357:50–59.
14. Larocque B, Gilbert K, Brien B. Prospective validation of a point score system for predicting blood transfusion following hip or knee replacement. Transfusion. 1998;38:932–936
15. Larocque BJ, Gilbert K, Brien WF. A point score system for predicting the likelihood of blood transfusion after hip or knee arthroplasty. Transfusion. 1997;37:463–467.
16. D. Lee , M. Contreras, N. Cross, MJ Desmond et al. British Journal of Anaesthesia. Guidelines for autologous transfusion. II. Perioperative haemodilution and cell salvage 1997;78: 768–771 .
17. Diane Hazela, Murray Berna , James Bonod et al. Effect of Preoperative Autologous Blood Donation Coupled With Fluid Resuscitation on Transfusion Requirements Following Orthopedic Surgery. J Hematol. 2015;4(2):157-163.
18. Yan Zhao, Chao Jiang, Huiming Peng et al. The effectiveness and safety of preoperative use of erythropoietin in patients scheduled for total hip or knee arthroplasty. Medicine (Baltimore) A systematic review and meta-analysis of randomized controlled trials. 2016 Jul; 95(27): e4122.
19. Ellis MH, Fredman B, Zohar E et al. The effects of tourniquet application, tranexamic acid, and desmo-pressin on the procoagulant and fibrinolytic systems during total knee replacement. J Clin Anesth. 2001; 13:509-513.

20. Ashir Ejaz,, Anders C Laursen, Andreas Kappel et al.Faster recovery without the use of a tourniquet in total knee arthroplasty. *Acta Orthop*. 2014 Aug; 85(4): 422–426.
21. Huang ZY, Pie FX, Ma J et al.comparison of three different tourniquet application strategies for minimally invasive total knee arthroplasty: a prospective non randomized clinical trial. *Arch Orthop Trauma Surg*. 2014;134:561-570.
22. Bryan M Saltzman, Julius K Oni. A Review of Bipolar Sealer ,Use in Modern Total Joint Arthroplasty. *Ann Orthop Rheumatol*. 2(2): 1015 (2014).
23. Geier KA .The bipolar sealing device: reducing blood loss in orthopaedic surgery. *Orthop Nurs*: 2005 May-Jun;24(3):224-6.
24. Plymale MF, Capogna BM, Lovy AJ, et al. Unipolar versus bipolar haemostasis in total knee arthroplasty : a prospective randomized trial. *J Arthroplasty*. 2012;27:1133-1137.
25. Christopher Kim, Sam Si-Hyeong Park, J Roderick Davey. Tranexamic acid for the prevention and management of orthopedic surgical hemorrhage: current evidence. *J Blood Med*. 2015; 6: 239–244.
26. Ellis MH, Fredman B, Zohar E,et al.. The effects of tourniquet application, tranexamic acid, and desmo-pressin on the procoagulant and fibrinolytic systems during total knee replacement. *J Clin Anesth*. 2001; 13:509-513.
27. Gomez-Barrena E, Ortega-Andreu M, Padilla-Eguiluz NG, Pérez- Chrzanowska H, Figueredo-Zalve R. Topical intra-articular compared with intravenous tranexamic acid to reduce blood loss in primary total knee replacement: a double-blind, randomized, controlled, noninferiority clinical trial. *J Bone Joint Surg Am*. 2014;96(23):1937–1944.
28. Seo JG, Moon YW, Park SH, Kim SM, Ko KR. The comparative efficacies of intrarticular and IV traneximic acid for reducing blood loss during total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc*. 2013;21:1869-1874.
29. Gandhi R, Evans HM, Mahomed SR, Mahomed NN. Tranexamic acid and the reduction of blood loss in total knee and hip arthroplasty: a meta-analysis. *BMC Res Notes*. 2013;6:184.
30. Jackson MR.Fibrin sealants in surgical practice: An overview. *Am J Surg*. 2001 Aug;182(2 Suppl):1S-7S.

How to cite this article: Munde SL, Kamra HT, Jha V, Ahuja K, Middha S, Gulia A. Pearls to Prevent Peri-Operative Blood Loss in THR & TKR. *Ann. Int. Med. Den. Res*. 2017; 3(2):OR01-OR04.

Source of Support: Nil, **Conflict of Interest:** None declared