TIMING OF TOURNIQUET RELEASE IN TOTAL KNEE ARTHROPLASTY AND ITS EFFECT ON POST OPERATIVE COMPLICATIONS

Awal Hakeem[1], Sanaullah[2], Syed hamad Ali shah banor[3], Mohammad Arif Khan[3]

ABSTRACT

Objective: To evaluate whether early tourniquet release in total knee arthroplasty in better than late tourniquet release in decreasing total blood loss, transfusion requirements, duration of tourniquet, duration of surgery, total hospital stay, post operative pain and early post operative complications.

Material and Method: This study was conducted at department of orthopeadic and spine surgery hayatabad medical complex Peshawar and a private clinic from January 2013 to July 2016. A total of 38 knees (36 patients) were included in the study and were divided into two groups containing 19 knees (18 patients) each. Group A included patients in whom tourniquet was released after components fixation and group B included patients in whom tourniquet was released after complete wound closure. Inclusion criteria were, patients suffering from osteoarthritis, rheumatoid arthritis or any other type of knee arthritis. Exclusion criteria was patients suffering from thromboembolic disease or previous history of DVT, anticoagulant treatment, ischemic heart disease or cardiovascular surgery, bleeding or coagulation disorder, previous surgery of knee and age more than 80 years were excluded from the study. Blood loss and other variables were noted in each group.

Results: Mean age of the patient in both groups was 58.6+/-8.2 years (42-80 years) 28 TKA patients were female(74%) and 10 (26%) were male patients. 04 knees (11%) were operated as simultaneous bilateral procedures while 34 knees (89%) as a single TKA at a time. Right knee was operated in 20 patients (53%) and left knee in 18 patients (47%).mean pre operative hemoglobin (HB%) was 12.4g/dl in both the groups while post operative HB was 9.6 g/dl in group A and 9.9 g/dl in group B. average blood loss in group A was 756 ml and in group B it was 734 ml which in statistically insignificant. Transfusion requirements were comparable in both the groups. Two wound complications were noted in group B, one patient was conservatively treated with antibiotics and second patient required exploration of the wound which revealed a bleeder in posterior capsule, which was treated accordingly.

Conclusion: Early tourniquet release does not decrease total blood loss in total knee arthroplasty but post operative recovery is good and hence hospital stay in decreased.

INTRODUCTION

Total knee replacement is the standard treatment modality for most of medically fit patients suffering from osteoarthritis, rheumatoid arthritis or any other form of knee arthritis.[1] Patients usually present with symptoms in both knees and if medically fit can be operated bilaterally in the same setting. Bilateral TKA have several advantages, like decreased cost of treatment and complete relief of symptoms in both knees. However patients having co morbidities should be operated in separate sessions because chances of bleeding and life threatening complications are high in these patients. Lot of scientific work has been done on reducing peri operative blood loss. Average blood loss in a unilateral TKA ranges from 0.5L to 2L.[2,3] In bilateral TKA and in medically unfit patients blood loss can be too high and may lead to serious complications.[4] Different techniques have been used to decrease peri operative blood loss in TKA patients. These techniques include use of tourniquet,[5,6] injection tranexamic acid,[7] autologus blood transfusion,[8] intra operative conservation of blood and use of hypotensive anaesthesia.[9] use of tourniquet not only decreases intra operative blood loss but also provide a dry clean operative field. As most of TKA implants are cemented so dry bones ensure good fixation of both femoral and tibial components. Hence tourniquet indirectly contributes in longevity of TKA components. Use of tourniquet not only decreases requirements for blood transfusion but also avoids transfusion related complications. Major complications of transfusion are allergic reactions, other immunological reactions, disease transmission from donor to recipient. Although use of tourniquet is helpful but there are some complications related with its use like decrease post operative

[1] Department of orthopedic and trauma Khyber teaching hospital Peshawar.
[2] Department of orthopedic and trauma pak international medical college hayatabad Peshawar.
[3] Department of orthopedic and spine surgery hayatabad medical complex Peshawar.

Address for correspondence:
Dr Awal Hakeem
Assistant Professor Department of orthopedic and trauma Khyber teaching hospital Peshawar.
Email: awalhakeem38@yahoo.com
Cell no.0333 9144432

muscle strength and thigh fat necrosis, post operative pain and increased analgesia requirement, nerve palsies,thromboembolism, DVT, patella maltracking,wound complications and rehabilitation complications.[10] There is some debate whether to use tourniquet or not in modern arthroplasty practice, and if using it then whether to release it after component fixation or after complete wound closure. Each modality has its advantages and disadvantages as mentioned earlier. In our study we compared the results of early and late release of tourniquet in terms of average blood loss per TKA, transfusion requirement, duration of surgery, duration of tourniquet application and major complications. In early release group (group A) tourniquet was released after components fixation and in late release group (group B) after complete closure of wound.

MATERIAL AND METHODS

This study was conducted at department of orthopeadic and spine surgery hayatabad medical complex Peshawar and a private clinic from January 2013 to July 2016. All patients suffering from osteoarthritis, rheumatoid arthritis or any other type of knee arthritis were included in the study. Patients suffering from thromboembolic disease or previous history of DVT, anticoagulant treatment, ischemic heart disease or cardiovascular surgery, bleeding or coagulation disorder, previous surgery of knee and age more than 80 years were excluded from the study. Revision TKA, surgery requiring additional procedures and patients unwilling for the study were also excluded from the study. A total of 38 knees (26 patients) were included in the study and were divided into two groups containing 19 knees (18 patients) each. Group B included patients in whom tourniquet was released after complete wound closure and group A in whom tourniquet was released after components fixation. All patients fulfilling inclusion criteria were admitted for TKA, complete history and examination was done. Laboratory investigations including full blood count (FBC), platelet count, prothrombin time(PT), activated partial thromboplastin time(APTT), fasting blood sugar, random blood sugar and urine routine examination was done. Chest X rays, electrocardiogram (ECG) and echo-cardiogram were done for anesthesia fitness. Cardiologists and anesthesiologists opinions were taken in all cases. Patients were admitted two to three days before surgery for complete workup. One to two units of packed cells were arranged prior to surgery. All arthroplasty patients were kept in specialized chambers. All patients were advised to take shower with chlorhexidine solution or soap and surgical dress was provided night before surgery. Clopidogrel was stopped three to four days before surgery and was restarted on fourth post operative day. They were kept nil by mouth (NBM) from mid night. All arthroplasties were kept first on OT list. All surgeries were performed in specialized operation theater with modern germ free environment. Combined epidural and spinal anesthesia was used in most of the patients. Standard protocol was used for application of tourniquet with a pressure of approximately 350 to 380 mmHg. Disposable drapes and gowns were used in all cases. Strict scrubbing techniques were followed. Same surgical techniques and implants of the same company were used in all cases. In group A tourniquet was released after complete closure of wound while in group B tourniquet was released soon after components fixation and then visible bleeders were coagulated. Thorough wound lavage was done in all cases. Tourniquet time and total surgery time was noted, blood loss in the form of drained blood and soaked gauzes was noted. Drains were used in all cases and kept for approximately 24 to 48 hours depending upon continuous filling of drains. Johns dressing was used in all cases. Hemoglobin (HB) and haematocrite (Hct) was repeated on first and third post operative day. Patients were transfused with a blood when HB of 8.5gm/dl or below was noted in young and healthy patients. Elderly patients or patients with cardiovascular comorbids were transfused in HB range of 8.5 to 10 gm/dl.some patients required intra operative blood transfusions particularly those with bilateral TKA. All patients were kept on continuous epidural analgesia for first two days and then switched to oral or intra venous analgesia. Patients were mobilized on first post operative day while range of movement exercises was started on second post operative day. Deep venous thrombosis, thromboembolism and wound complications were assessed daily in hospital and at two weeks and six weeks post operatively at follow up visits. For DVT suspicion Doppler ultra sound was used while for thromboembolism CT pulmonary angiogram was used. Patients were discharged on third or fourth post operative day. They were regularly followed and information was filled in proformas.data was assessed using SPSS version 20.p value <0.05 was considered significant.

RESULTS

A total of 40 knees (38 patients) were initially included in the study, two patients had incomplete data and hence were excluded from study.38 knees (36 patients) were carefully divided into two groups keeping all the variables equally divided into the two groups. These variables were age, gender, type of arthritis, comorbids, weight, socioeconomic class and drug history etc.18 patients (19 knees) were allotted into each group, in group A tourniquet was released after components fixation and in group B after complete closure of wound. Mean age of the patient in both groups was 58.6+/-8.2 years (42-80 years) 28 TKA patients were female(74%) and 10 (26%) were male patients. 04 knees (11%) were operated as simultaneous bilateral procedures while 34 knees (89%) as a single TKA at a time. Right knee was operated in 20 patients (53%) and left knee in 18 patients (47%). Mean pre operative hemoglobin (HB%) was 12.4g/dl in both the groups while post operative HB

Table ; Showing data of both groups

	Early tourniquet release group (group-A)	Late tourniquet release group (group-B)
Age	58.3	58.8
Male	05	05
Female	14	14
Duration of surgery (minutes)	92	81
Duration of tourniquet (minutes)	68	81
Pre operative hemoglobin(gm/dl)	12.4	12.4
Post operative hemoglobin(gm/dl)	9.6	9.9
Blood loss (ml)	756	734
Hospital stay(days)	6.5	8.0
complications	0	04

was 9.6 g/dl in group A and 9.9 g/dl in group B. average blood loss in group A was 756 ml and in group B it was 734 ml which in statistically insignificant. Transfusion requirements were comparable in both the groups. Two wound complications were noted in group B, one patient was conservatively treated with antibiotics and second patient required exploration of the wound which revealed a bleeder in posterior capsule, which was treated accordingly. Both these patients had normal recovery of wound and knee function in subsequent follow up visits. Mean tourniquet time was 68 minutes in group A and 81 minutes in group B. mean duration of surgery was 92 minutes in group A and 81 minutes in group B. analgesia requirements and difficulty in post operative rehabilitation was decreased in groups A as compared to group B. mean hospital stay was 6.5 days in group A and 8.0 days in group B which was statistically significant.

DISCUSSION

Tourniquet use in limbs surgery not only decreases intra operative blood loss but also provide a dry clean operative field. [11] A clean and dry field ensure good components fixation but long term components survival in early vs late tourniquet release groups has not been completely known. Although modifications and improvements in tourniquet use has decreased its complications, still its use not without hazards. Tourniquet palsy and soft tissue damage has been reported in approximately 0.15% of cases.[12] Fat necrosis, muscle damage, post operative pain and hence increased requirements of analgesia, decreased range of motion in early post operative period are other documented complications in the literature.[5,10] Thromboembolic complications and increased bleeding tendencies have been noted in some studies. Elderly patients, female patients and patients with comorbids are prone to tourniquet related complications. Regarding blood loss in TKA patients initial studies showed that intra operative tourniquet release decreases total blood loss in these patients. Further studies could not reach to a statistical difference of blood loss between early and late tourniquet release groups. Recently studies has shown that early tourniquet release not only increase operation time but also total blood loss in TKA patients.[13] Calculation of blood loss may be difficult particularly in cases where no drain is used. There are different techniques of blood loss calculation, some techniques are easy and simply calculate operative and post operative blood loss. Other techniques use complex calculation equations using pre operative and post operative HB% and hematocrite levels and patients weight and height values. In our study we calculated blood loss from intra operative blood collection in suction drains, from blood soaked surgical swabs and post operative drain readings. Although we tried to calculate total blood loss perfectly, studies have shown that actual blood loss may be much more than calculated values. In some cases apparent blood loss can be up to 50% of actual blood loss.[14] However early tourniquet release provide an opportunity to localize a bleeder and coagulate it, hence decreases chances of hematoma formation and its related complications like infection and wound problems. In our study total duration of surgery was increased in early release group as compared to late release group and tourniquet time was decreased in early release group than late release group which is similar to other national and international studies.[15] Mean blood loss, fall in HB% and transfusion requirements were more in early tourniquet release group than late tourniquet release group. Age and gender distribution was similar to other local studies. Ratio of unilateral to bilateral TKA was high as compared to other local studies. Total hospital stay in our study was decreased to other local studies, the reason may be that most of our patients were in relatively young age groups and most of the surgeries were performed unilaterally. Comparing hospital stay between the two groups group A patients had significantly decreased hospital stay as compared to group B. The reason may be decreased post operative pain and analgesia

requirements and easy rehabilitation in early tourniquet release group. Surgical wound complications were zero in group A and two in group B. The reason may be prolonged exposure of limb to ischemia and increased post operative swelling. Also chances of post operative hematoma formation are high in late tourniquet release group. One of our patients has wound complication for which exploration of the wound was done; a bleeder in posterior capsule was found and managed accordingly. Second patient with superficial wound complication was treated conservatively with antibiotics. Both patients with wound complication had normal recovery and knee function was good in subsequent post operative visits. There was no mortality, DVT, thromboembolism or tourniquet palsy noted in our study.

Strength of our study is that its design was prospective and only tourniquet effects were studied. Patients who received injection transamine were included in another study. Weakness of our study is that number of patients is small post operative pain and rehabilitation needs proper assessment in both groups. Further studies on the topic are suggested to clear the concept.

CONCLUSION

Early tourniquet release does not decrease total blood loss in total knee arthroplasty but post operative recovery is good and hence hospital stay in decreased.

REFERENCES

1. Van Manen, MD; Nace, J; Mont, MA (November 2012). "Management of primary knee osteoarthritis and indications for total knee arthroplasty for general practitioners". The Journal of the American Osteopathic Association. 112 (11): 709–715.
2. Pierson JL, Hannon TJ, Earles DR. A blood conservation algorithm to reduce blood transfusions after total hip and knee arthroplasty. J Bone Joint Surg Am 2004; 86-A: 1512-8.
3. Wong CJ, Vandervoot MK, Vandervoot SL, Donner A, Zou G, MacDonald JK, et al. A cluster randomized controlled trial of a blood conservation algorithm in patients undergoing total hip joint arthroplasty. Transfusion 2007; 47: 832-41.
4. Townsend HS, Goodman SB, Schurrman DJ, Hackel A, Brock-Utne JG. Tourniquet release: systemic and metabolic effects. Acta Anestthesiol Scan 1996; 40: 1234-7.
5. Salam AA, Eyres KS. Effects of tourniquet during total knee arthroplasty. J Bone Joint Surg 1995; 77: 250-53.
6. Wakankar HM, Nicholl JE, Koka R, D'Arcy JC. The tourniquet in total knee arthroplasty. A prospective, randomized study. J Bone Joint Surg 1999; 81-B: 30-3.
7. Hiippala, ST, Strid LJ, Wennerstrand MI et al. Tranexamic acid radically decreases blood loss and transfusions associated with total knee arthroplasty. Anesth Analg 1997; 84: 839-844.
8. Blumberg N, Kirkley SA, Heal JM. A cost analysis of autologous and allogeneic transfusions in hip replacement surgery. Am J Surg 1996; 171: 324-330.
9. Sharrock NE, Salvati EA. Hypotensive epidural anesthesia for total hip arthroplasty. Acta Orthop Scand 1996; 67: 91-107.
10. Worland RL, Arredondo J, Angles F, Lopez-jimenez F, Jessup DE. Thigh pain following tourniquet application in simultaneous bilateral total knee replacement arthroplasty. J Arthroplasty 1997; 12: 842-52.
11. Rama KR, Apsingi S, Poovali S, Jetti A. Timing of tourniquet release in knee arthroplasty. Meta-analysis of randomized, controlled trials. J Bone Joint Surg 2007; 89-A: 699-705.
12. Horlocker TT, Hebl JR, Gali B et al. Anesthetic, patient, and surgical risk factors for neurologic complications after prolonged total tourniquet time during total knee arthroplasty. Anesth Analg 2006; 102: 950-955.
13. Widman J, Isacson J, Surgical homeostasis after tourniquet release does not reduce blood loss in total knee replacement: a prospective study of 81 patients. Acta Orthop Scand 1999; 70: 268-70.
14. Sehat KR, Evans R, Newman JH. How much blood is really lost in total knee arthroplasty? Correct blood loss management should take hidden loss into account. Knee 2000; 7: 151-5.
15. Barwell J, Anderson G, Hassan A, Rawlings I. The effects of early tourniquet release during total knee Arthroplasty: a prospective randomized double-blind study. J Bone Joint Surg 1997; 79-B: 265-268.