

THE EFFECT OF TRANEXAMIC ACID IN PRIMARY TOTALHIP ARTHROPLASTY

*El-Zaher Hassan El-Zaher, Ahmed Salem Eid, Saleh Gameel Mansour and Mohamed Eissa Hassan**

ABSTRACT:

Orthopedic Surgery Department
Faculty of Medicine - Ain
Shams University, Cairo, Egypt

* Specialist registrar in the
department of orthopedic
surgery, El-Helal hospital, Cairo,
Egypt.

Corresponding Author:

Mohamed Eissa Hassan
Mobile +201006208927

E-mail:

Mohamedeissa85@yahoo.com

Received: 22/6/2020

Accepted: 20/7/2020

Online ISSN: 2735-3540

Back ground: In this Randomized Controlled Trials clinical study, we report results of the effect of tranexamic acid intravenous administration and local injection on transfusion rate and perioperative blood loss in primary total hip replacement.

Aim of the Study: The aim of this study is to evaluate the effect of tranexamic acid intravenous administration and local injection on transfusion rate and perioperative blood loss in primary total hip replacement

Patients and methods: The study will include 30 patients in each of the 2 groups.

Group (1) Including 30 cases (control group).

Group (2) Including 30 cases managed by I.V and local TXA injection. We compare between both group as regard transfusion rate and perioperative blood loss.

Results: Patients in the TXA group had significantly higher postoperative hemoglobin (10.34 vs 9.78 g/dl, $P<0.102$), lower hemoglobin changes (1.88 vs 2.52 g/dl, $p<0.001$), higher postoperative hematocrit (34.37 vs 31.46 L/L, $P<0.009$), lower hematocrit changes (6.17 vs 7.36 L/L, $p<0.001$), lower total blood loss (906 vs 1208 ml, $P<0.001$), lower transfusion rate (6.7 %vs 26.7%, $P<0.038$), no statistically significant difference between 2 groups regarding demographic data (weight and sex), There was no difference among the 2 groups regarding to the rates of deep vein thrombosis. No patients had thromboembolic complications.

Conclusion: In the present study, I. Vcombined with topical administration of TXA significantly reduced postoperative blood loss in patients having a primary unilateral THA. The calculated blood loss was 25% lower in patients who were managed with TXA as compared with the placebo, with a mean difference of approximately 300 ml. Patients in the TXA group had significantly higher postoperative hemoglobin than placebo patient higher postoperative hematocrit lower transfusion rate decreased about 20 %.

Keywords: Total hip arthroplasty, tranexamic acid, intravenous, blood loss;

INTRODUCTION:

Total hip arthroplasty (THA) can produce significant blood loss necessitating a transfusion. While numerous protocols have been utilized in order to minimize

blood loss, allogenic blood transfusions are still necessary. It has been well documented that these transfusions are not without substantial side effects in some patients. Patients may experience a transfusion

reaction, volume overload, prolonged convalescence, and a risk of disease transmission⁽¹⁾. Furthermore, transfusions significantly increase costs⁽²⁾.

Reducing blood loss and the need for blood transfusions surrounding orthopedic surgery remains a major concern among clinicians during the perioperative period⁽³⁾.

Many interventions have been developed over the past decade to achieve this goal including hypotensive anesthesia and various blood salvage technique. In addition, pharmacologic approaches have become more popular in recent years. Tranexamic acid has seen a renaissance among patient requiring orthopedic surgery, with numerous populations showing clinical efficacy and cost effectiveness⁽⁴⁾.

In recent years, there have been several studies on the effectiveness of tranexamic acid (TXA), a fibrinolytic inhibitor, for reducing intraoperative and postoperative blood loss in THA^(5,6).

AIM OF THE STUDY:

The aim of this study is to evaluate the effect of tranexamic acid intravenous administration and local injection on transfusion rate and perioperative blood loss in primary total hip replacement.

PATIENTS AND METHODS:

It is a Randomized controlled trials clinical study, where 60 patients will be conducted for primary THR. Ethical approval was obtained prior to the initiation of the study. All operations were done in Ain Shams University hospitals by first author and followed up in the period between 2016 and 2019.

Patient divided in tow groups first group (control group) 30 cases, second group (study group) 30cases will managed by I.V and local TXA injection.

Preoperative considerations: The baseline level of Hb>10 mg/dl, hematocrit, prothrombin percentage activity (PT), active partial thromboplastin time (APTT), and platelet count will be measured in all participants preoperatively.

Operative Technique: The arthroplasties will be done under spinal or general anesthesia after patient discussion with the anesthesia team.

The tranexamic acid will be administered as one gram infusion within one hour of incision time, simultaneous to the administration of prophylactic antibiotics, as its onset of action 5-15 min., its duration about 3 hr. Another 1 gm of TXA diluted in 100 ml normal saline applied locally at time of wound closure, the drain was clamped for 2 h and then released. The actual blood loss (ABL) will be calculated using modification of the Gross formula .

Postoperative care: Starting antibiotics. For DVT prophylaxis all patients will be maintained on four weeks of a low-molecular-weight heparin administered subcutaneously once daily. Monitor for post-procedure complications. Patients given post-procedure instructions, precautions, and emergency contact information. Post procedure analgesic prescription.

Follow-up: Patients will be followed as outpatients at time of stitches removal postoperatively at which time physical examination and clinical suspicion will be used for DVT screening.

RESULTS:

Patients in the TXA group had significantly higher postoperative hemoglobin (10.34 vs 9.78 g/dl, P<0.102), lower hemoglobin changes (1.88 vs 2.52 g/dl, p<0.001). higher postoperative hematocrit (34.37 vs 31.46 L/L, P<0.009), lower hematocrit changes (6.17 vs 7.36 L/L, p<0.001), lower total blood loss (906 vs

1208 ml, $P < 0.001$), lower transfusion rate (6.7 % vs 26.7%, $P < 0.038$), no statistically significant difference between 2 groups regarding demographic data (weight and sex), There was no difference among the 2 groups regarding to the rates of deep vein thrombosis. No patients had thrombo-embolic complications.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.

- Chi-square (χ^2) test of significance was used in order to compare proportions between qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:
- Probability (P-value)
 - P-value ≤ 0.05 was considered significant.
 - P-value ≤ 0.001 was considered as highly significant.
 - P-value > 0.05 was considered insignificant.

The results of the present study are demonstrated in the following tables and diagrams.

Table (1): Comparison between groups according to demographic data.

Demographic data	Group I: Control (n=30)	Group II: TXA (n=30)	t/ χ^2 #	p-value
Sex				
Female	18 (60%)	16 (53.3%)	0.000#	1.000
Male	12 (40%)	14 (46.7%)		
Weight				
Mean±SD	83.23±12.16	79.07±10.70	1.986	0.164
Range	64_104	63_102		

t-Independent Sample t-test; # χ^2 : Chi-square test p-value > 0.05 NS

This table shows no statistically significant difference between groups according to demographic data.

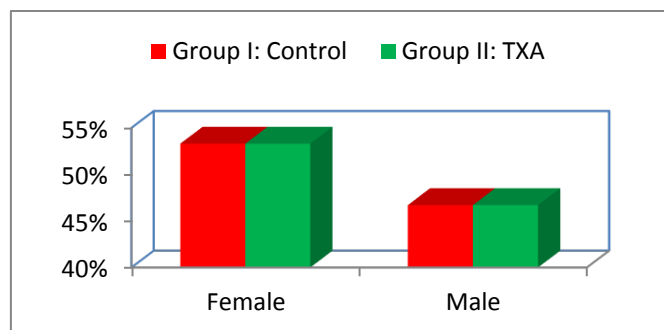


Diagram (1): Bar chart between groups according to sex.

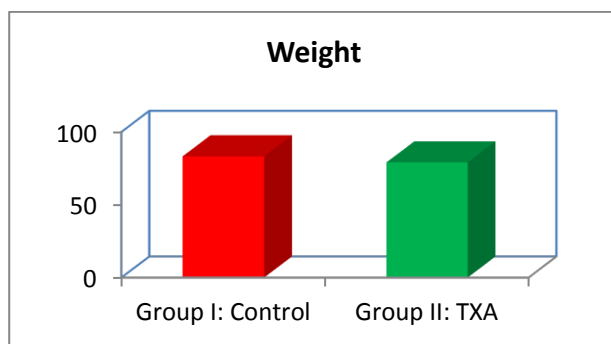


Diagram (2): Bar chart between groups according to weight.

Table (2): Comparison between groups according to Hb.

Hb.	Group I: Control (n=30)	Group II: TXA (n=30)	t-test	p-value
Preoperative				
Mean±SD	12.30±1.43	12.21±1.16	0.071	0.790
Range	10.2_16.8	10.2_14.8		
Postoperative				
Mean±SD	9.78±1.43	10.34±1.13	2.764	0.102
Range	7.9_14	7.9_12.8		
Difference				
Mean±SD	-2.52±0.73	-1.88±0.49	16.110	<0.001**
Range	-4.4_-1.5	-3.5_-1.11		

*t-Independent Sample t-test; p-value >0.05 NS; **p-value <0.001 HS*

This table shows statistically significant decrease mean of group I compared to group II according to difference of Hb.

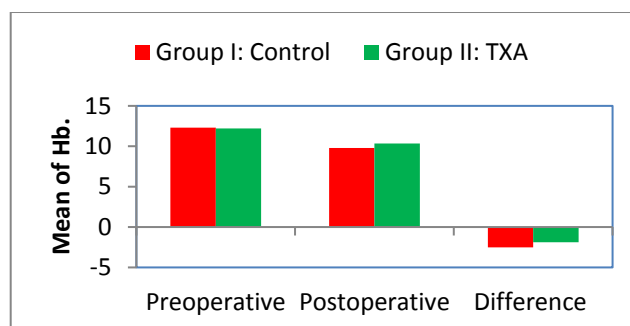


Diagram (3): Bar chart between groups according to Hb.

Table (3): Comparison between groups according to Hct.

Hct.	Group I: Control (n=30)	Group II: TXA (n=30)	t-test	p-value
Preoperative				
Mean±SD	38.83±3.74	40.53±4.98	2.253	0.139
Range	32.5_50.2	33_51.9		
Postoperative				
Mean±SD	31.46±3.62	34.37±4.61	7.355	0.009*
Range	24.9_42.2	27.4_44		
Difference				
Mean±SD	-7.36±1.06	-6.17±1.13	17.860	<0.001**
Range	-9.2_-5	-8.5_-4.2		

*t-Independent Sample t-test; p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS*

This table shows statistically significant decrease mean of group I compared to group II according to postoperative Hct and mean difference of Hct.

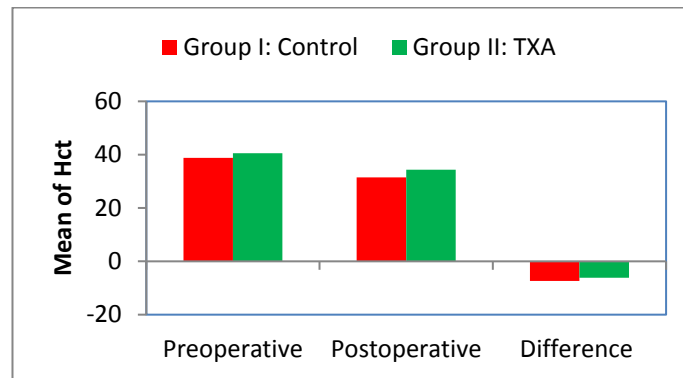


Diagram (4): Bar chart between groups according to Hct.

Table (4): Comparison between groups according to amount of blood loss.

Amount of Blood Loss	Group I: Control (n=30)	Group II: TXA (n=30)	x ²	p-value
Mean±SD	1208.50±139.94	906.87±136.40	71.475	<0.001**
Range	934_1496	746_1381		

x²: Chi-square test; **p-value <0.001 HS

This table shows statistically significant increase mean of group I compared to group II according to amount of blood loss.

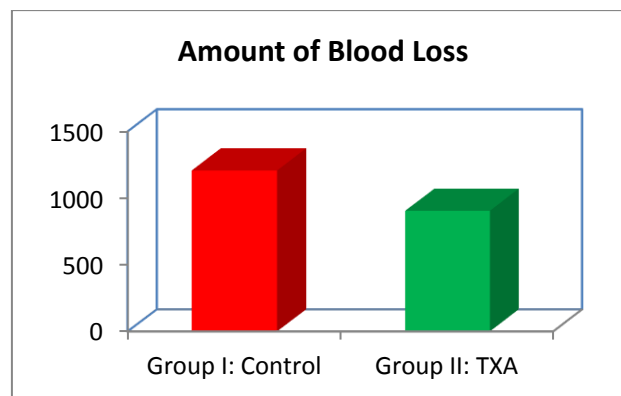


Diagram (5): Bar chart between groups according to amount of blood loss.

Table (5): Comparison between groups according to DVT.

DVT	Group I: Control (n=30)	Group II: TXA (n=30)	x ²	p-value
No	30 (100.0%)	30 (100.0%)	0.000	1.000
Yes	0 (0.0%)	0 (0.0%)		

x²: Chi-square test; p-value >0.05 NS

This table shows no statistically significant difference between groups according to DVT.

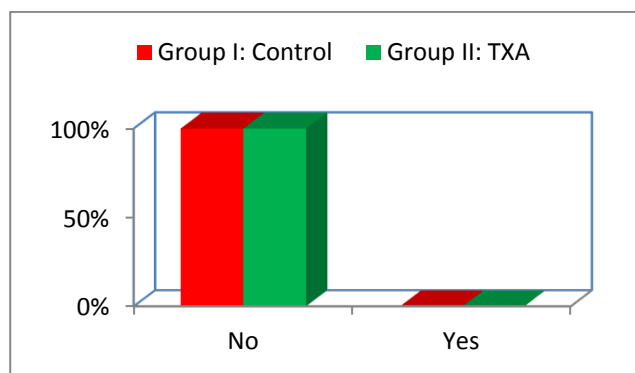


Diagram (6): Bar chart between groups according to DVT.

Table (6): Comparison between groups according to rate of transfusion.

Rate of Transfusion	Group I: Control (n=30)	Group II: TXA (n=30)	x ²	p-value
No	22 (73.3%)	28 (93.3%)	4.320	0.038*
Yes	8 (26.7%)	2 (6.7%)		

x²: Chi-square test; p-value >0.05 NS

This table shows statistically significant difference between groups according to rate of transfusion.

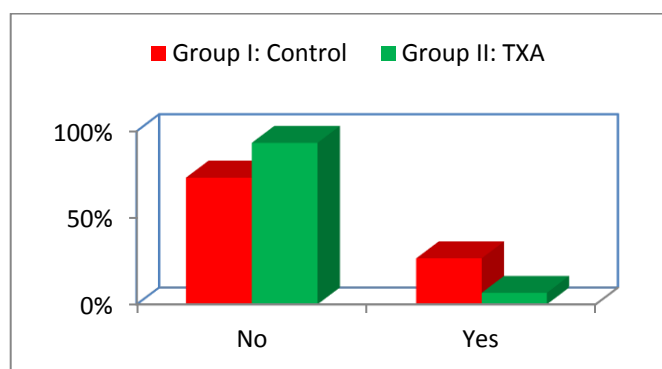


Diagram (7): Bar chart between groups according to rate of transfusion.

DISCUSSION:

In this study, we provide a descriptive and comparative analysis of our experience in using combination of I.V and local TXA on transfusion rate, perioperative blood loss, changes in hemoglobin and hematocrit value and postoperative thromboembolic complications in primary total hip replacement.

1. **Transfusion rate:** Comparing the two groups we found that patients managed with combination of I.V and local TXA showing statically decrease in rate of blood transfusion (6.7 %vs 26.7%, P<0.038), compared with those in the first group.

From other studies *Jianxi Zhu et al.* in their study about Efficacy and safety of tranexamic acid in total hip replacement found that The pooled results illustrated that, transfusion rate was significantly lower than controls. (P<.05).⁽⁷⁾

2. **Perioperative blood loss:** Comparing the two groups we found that patients managed with combination of I.V and local TXA showing statically decrease lower total blood loss (906 vs 1208 ml, P<0.001), compared with those in the first group.

From other studies *Konig et al.* in their study Topical tranexamic acid reduces blood

loss and transfusion rates in total hip and total knee arthroplasty found that The mean blood loss was significantly more in the patients that did not receive TXA in both the THA surgeries. In the THA patients, the blood loss was 345mL less when TXA was used⁽⁸⁾.

3. Changes in hemoglobin: In our study TXA group had significantly higher postoperative hemoglobin (10.34 vs 9.78 g/dl, $P < 0.102$), lower hemoglobin changes (1.88 vs 2.52 g/dl, $p < 0.001$). compared with those in the first group.

In other studies *Shang J. et al.* in their study about Combined intravenous and topical tranexamic acid versus intravenous use alone in primary total hip arthroplasty: A meta-analysis of randomized controlled trials. Found that A total of five RCTs met the inclusion criteria were included. The meta-analysis indicated that there was statistically significant difference favoring the combined group in hemoglobin drop⁽⁹⁾

4. Changes in hematocrit value: Regarding hematocrit there is higher postoperative hematocrit (34.37 vs 31.46 L/L $P < 0.009$), lower hematocrit changes (6.17 vs 7.36 L/L, $p < 0.001$). in TXA group compared with those in the first group.

In other studies *Yi Zeng et al.* in their study Intravenous Combined with Topical Administration of Tranexamic Acid in Primary Total Hip Arthroplasty:

A Randomized Controlled Trial found that this trial included 100 patients (50 in each group). Patients in the TXA group had significantly higher postoperative hematocrit (0.32 vs 0.27 L/L, $P < 0.01$), lower hematocrit changes (0.1 vs 0.14 L/L, $P < 0.01$)⁽¹⁰⁾.

5. Thromboembolic complications: in our study No patients had thromboembolic complications.

In other studies *Jing, Yang et al.* in their study tranexamic acid administration in

primary total hip arthroplasty. There was no difference among the 3 groups with regard to the rates of deep vein thrombosis or pulmonary embolism⁽¹¹⁾.

Conclusion:

In the present study, I. Vcombined with topical administration of TXA significantly reduced postoperative blood loss in patients having a primary unilateral THA. The calculated blood loss was 25% lower in patients who were managed with TXA as compared with the placebo, with a mean difference of approximately 300 ml. Patients in the TXA group had significantly higher postoperative hemoglobin than placebo patient higher postoperative hematocrit lower transfusion rate decreased about 20 % no statistically significant difference between 2 groups regarding demographic data (weight and sex), no perioperative thromboembolic complication.

REFERENCES:

1. Sukeik M, Alshryda S, Haddad FS, et al. (2011): Systematic review and meta-analysis of the use of tranexamic acid in total hip replacement. *J Bone Joint Surg Br* .
2. Shander A, Hofmann A, Ozawa S, et al. (2010): Activity-based costs of blood transfusions in surgical patients at four hospitals. *Transfusion*.
3. Sharrock NE, Mineo R, et al. (1993): The effect of two levels of hypotension on intraoperative blood loss during total hip arthroplasty.
4. Huang F, Wu D, Ma G, et al. the use of tranexamic acid to reduce blood loss and transfusion in major orthopaedic surgery. *J Surg Res* (2014).
5. Ralley FE, Berta D, Binns V, et al. One intraoperative dose of tranexamic acid for patients having primary hip or knee arthroplasty. *ClinOrthopRelat Res* (2010).
6. Zufferey PJ, Miquet M, Quenet S, et al. Tranexamic acid in hip fracture surgery: a randomized controlled trial. *Br J Anaesth* (2010).

7. Zhu, Jianxi, Zhu, Yong L, et al. Efficacy and safety of tranexamic acid in total hip replacement: A PRISMA-compliant meta-analysis of 25 randomized controlled trials. Medicine (Baltimore) (2017).
8. Gerhardt Konig, Brian R. Hamlin, et al. Topical tranexamic acid reduces blood loss and transfusion rates in total hip and total knee arthroplasty. J Arthroplasty (2013).
9. Shang J, Wang H, Zheng B, Rui M, and Wang Y. Combined intravenous and topical tranexamic acid versus intravenous use alone in primary total knee and hip arthroplasty: A meta-analysis of randomized controlled trials. J Surg. (2016).
10. Yi Zeng, MD, Hai-Bo Si, MD, Bin Shen, MD et al. Intravenous Combined with Topical Administration of Tranexamic Acid in Primary Total Hip Arthroplasty: A Randomized Controlled Trial Orthopedic Surgery 2017
11. Yi, Zeng, MD; Bin, Shen, MD; Jing, Yang et al. Tranexamic Acid Administration in Primary Total Hip Arthroplasty: A Randomized Controlled Trial of Intravenous Combined with Topical Versus Single-Dose Intravenous Administration. JBJS: June 15, 2016.

تأثير حمض الترانيكساميك في عمليات استبدال مفصل الورك بمفصل صناعي كامل

الظاهر حسن الظاهر، أحمد سالم عيد، صالح جميل منصور، محمد عيسى حسن

مقدمة: في هذه الدراسة السريرية للتجارب المعشاة ذات الشواهد ، نُبلِغ عن نتائج تأثير إعطاء حمض الترانيكساميك في الوريد والحقن الموضعي على معدل نقل الدم وفقدان الدم اثناء وبعد جراحة في استبدال مفصل الورك الأولي.

الهدف من الدراسة: الهدف من هذه الدراسة هو تقييم تأثير إعطاء حمض الترانيكساميك في الوريد والحقن الموضعي على معدل نقل الدم وفقدان الدم اثناء وبعد الجراحة في استبدال مفصل الورك الأولي.

المرضى والطرق: ستشمل الدراسة ٣٠ مريضاً في كل مجموعة من المجموعتين.

المجموعة (١) وتضم ٣٠ حالة (مجموعة المراقبة).

المجموعة (٢) بما في ذلك ٣٠ حالة تدار عن طريق الحقن الوريدي وحقن حمض الترانيكساميك الموضعي. قارنا بين كلتا المجموعتين فيما يتعلق بمعدل نقل الدم وفقدان اثناء وبعد الجراحة.

النتائج: كان لدى المرضى في مجموعة حمض الترانيكساميك هيموغلوبين أعلى بشكل ملحوظ بعد الجراحة (١٠,٣٤ مقابل ٩,٧٨ جم / دل ، $P > 0,102$) ، تغيرات الهيموجلوبين أقل (١,٨٨ مقابل ٢,٥٢ جم / دل ، $P > 0,001$). أعلى نسبة الهيماتوكريت بعد العملية الجراحية (٣٤,٣٧ مقابل ٣١,٤٦ لتر / لتر ، $P > 0,009$) ، تغيرات أقل في الهيماتوكريت (٦,١٧ مقابل ٧,٣٦ لتر / لتر ، $P > 0,001$) ، انخفاض إجمالي فقدان الدم (٩٠٦ مقابل ١٢٠٨ مل ، $P > 0,001$) ، معدل نقل أقل (٦,٧٪ مقابل ٢٦,٧٪ ، $P > 0,038$) ، لا يوجد فرق معتد به إحصائياً بين مجموعتين فيما يتعلق بالبيانات الديموغرافية (الوزن والجنس) ، لم يكن هناك فرق بين المجموعتين فيما يتعلق بمعدلات تجلط الأوردة العميقة. لم يعاني أي مريض من مضاعفات الانصمام الخثاري.

الخلاصة: في هذه الدراسة ، أدت الوريدية مع الإعطاء الموضعي حمض الترانيكساميكالى خفض كبير في فقدان الدم بعد الجراحة في المرضى الذين يعانون من حمض الترانيكساميك الأولية أحادية الجانب. كان فقدان الدم المحسوب أقل بنسبة ٢٥ ٪ في المرضى الذين تم علاجهم باستخدام حمض الترانيكساميك مقارنةً بالعلاج الوهمي ، مع فارق متوسط يبلغ حوالي ٣٠٠ مل. كان لدى المرضى في مجموعة حمض الترانيكساميك هيموغلوبين أعلى بشكل ملحوظ بعد الجراحة من مريض الدواء الوهمي ، وانخفض معدل نقل الهيماتوكريت المنخفض بعد الجراحة بنحو ٢٠٪.