IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 4 Ser. 3 (April. 2024), PP 08-17
www.iosrjournals.org

Outcomes Of Routes Of Tranexamic Acid Use In Total Knee Replacement Surgeries In Awka, Nigeria.

Ac Nwachukwu[1] Ca Nri-Ezedi[2]
[1]*Department Of Surgery, Chukwuemeka Odumegwu Ojukwu University, Awka*
[2]*Department Of Paediatrics, Nnamdi Azikiwe University, Awka.*

Abstract
Introduction *Total knee arthroplasty (TKA) poses challenges due to significant blood loss, often necessitating blood transfusions and leading to complications. Various methods exist to mitigate bleeding, including tranexamic acid (TXA) administration via different routes.This study aims to investigate the best route of administration of TXA to minimize blood loss and better patient outcomes.*
Methodology*This study compared intravenous (IV), intralesional, and combined IV and intralesional TXA administration in 48 TKA patients. Conducted between 2021 and 2023 in Nigeria, the randomized prospective study aimed to identify the most effective TXA administration route for hemostasis. Postoperative blood loss and transfusion rates were assessed.*
Result: *The study examined 48 patients undergoing total knee replacement (TKR) surgery, predominantly female (89.6%), with severe knee osteoarthritis. Preoperative haemoglobin levels were 11.6 g/dL, decreasing postoperatively. Median blood loss at 24, 48, and 72 hours was 300.0 mL, 100.0 mL, and 50.0 mL, respectively, with a mean total blood loss of 492.02 mL. Combined intravenous and intralesional tranexamic acid (TXA) administration resulted in the lowest blood loss compared to IV or intralesional TXA alone. Patients receiving transfusions had lower preoperative haemoglobin levels and higher postoperative blood loss. No significant correlations were found between comorbidities and blood loss. Patients receiving intravenous and intralesional TXA showed higher haemoglobin levels than those receiving other treatments, with statistically significant differences observed at different time points. Additionally, there was a significant difference in the units of blood transfused among patients receiving different anticoagulant administration routes.*
Conclusion: *This study highlights the importance of TXA administration routes in TKR surgery. Combined IV and intralesional TXA showed superior efficacy in reducing blood loss and minimizing the need for postoperative transfusions.*

Date of Submission: 28-03-2024 Date of Acceptance: 08-04-2024

I. Introduction

Total knee arthroplasty (TKA) is a common orthopaedic procedure associated with significant blood loss, which can necessitate blood transfusions and lead to various complications. This includes increased morbidity, mortality, risk of infections, and financial burdens on both patients and healthcare systems.[1]

Several methods have been proposed to address this issue to reduce bleeding during TKA surgery. These include autologous transfusion, hypotensive anaesthesia, fibrin tissue adhesive application, compression bandaging, cryotherapy, drain clamping, and the use of antifibrinolytic agents such as tranexamic acid (TXA).[2][3][4]

TXA is particularly effective in reducing blood loss by inhibiting the breakdown of blood clots. Previous studies have demonstrated its efficacy in various surgical procedures, including TKA. However, the optimal route of administration for TXA in TKA remains a subject of debate. [5,6,7,8,9,10,11,12]]

This study aimed to compare the effectiveness of 3 different administration routes of TXA – intravenous (IV), intravenous and intra-articular and Intra-articular alone – in reducing blood loss in patients undergoing TKA. While these routes have shown promise in many studies, there is uncertainty regarding which method provides superior outcomes in terms of reducing blood loss and the need for blood transfusions. [13,14,15,16,17,18,19,20,21]

By conducting this comparative analysis, this study sought to provide valuable insights into the most effective approach for administering TXA during TKA surgery.[22,23,24,25,26,27,28,29]

II. Methodology

This was a study of forty-eight patients diagnosed with severe osteoarthritis of the kneeand hip, or patients for revision surgery following failed primary knee arthroplasty and scheduled for TKA or revision. It was a prospective study done in a tertiary orthopaediccentre in Awka Nigeria between 2021 and 2023

It was a simple randomized prospective study aimed to study the most efficientroute of administration of TXA for haemostasis during TKA.

The patients were grouped into various group determined by the route of administration of TXA. These groups are: intravenous group, intralesional (intra-articular) group, and combined intravenous and intra-articular group

Forty-eightpatients were prepared for surgery. All anticoagulants were stopped 2weeks to the surgery.

Combined spinal and epidural anaesthesia was used for the regional anaesthesia. All surgeries were done under a pneumatic tourniquet and performed by one surgeon.

Vacuum drains were used in the postoperative period to assess the volume of blood loss.

The drains were measured for loss in the first 24 hours, after 48 hours and after 72 hours.

Post-operative Haemoglobin levels were done 24,48, and 72hrs post-operation.

The groups that received more transfusions were noted.

All patients with bleeding disorders were excluded from the study.

The data was analysed with Python 3.7.0.

III. Result

The study cohort comprised 48 patients who underwent total knee replacement (TKR) surgery, with a median age of 64 years (range: 32-76 years). Most of the patients were female (89.6%), and the predominant occupations were business (39.6%) and civil service (27.1%). All patients identified as Christian (Table 1).

Table 1: Socio-Demographic Characteristics

	Summary	**Range Percentage**
Age	64.0 (59.0-70.0)	32.0-76.0
Gender		
Female	43	89.6
Male	5	10.4
Occupation		
Business	19	39.6
Civil servant	13	27.1
Pensioner	7	14.6
Unemployed	9	18.8
Religion		
Christian	48	100.0

Table 2: Surgical Diagnosis and Management Profile

	Mean (SD) (Median IQR)	**Range (min-max)**
Diagnosis		
Severe Left Knee Osteo Arthritis	20	41.7
Severe Right Knee Osteo Arthritis	19	39.6
Failed Left TKR	3	6.2
Severe Left Hip Osteoarthritis	3	6.2
Severe Right Hip Osteoarthritis	2	4.2
Left Femoral Fracture Non-Union	1	2.1
Procedure		
Left TKR	27	56.2
Right TKR	21	43.8
Preoperative		
Haemoglobin	11.6 (10.5-12.32)	8.9-16.4
Postoperative		
Haemoglobin in 24 hours	9.73 ± 1.59	7.0-13.0
Haemoglobin in 48 hours	10.94 ± 1.81	7.1-14.0
Haemoglobin in 72 hours	10.72 ± 1.53	6.6-13.3
Units of blood given	1.0 (0.0-2.0)	0.0-6.0

Blood Loss after Surgery		
In 24 hours	300.0 (150.0-362.5)	0.0-700.0
In 48 hours	100.0 (50.0-150.0)	0.0-300.0
In 72 hours	50.0 (0.0-69.54)	0.0-500.0
Total blood loss	492.02 ± 289.25	0.0-1200.0
Open Drain Before 1 hour		
No	47	97.9
Yes	1	2.1
Open Drain after 1 hour		
No	14	29.2
Yes	34	70.8
Blood Transfusion Given		
No	22	45.8
Yes	26	54.2
Anti-Coagulants Given		
No	18	37.5
Yes	30	62.5
Anticoagulants stopped 2 weeks before Surgery		
No	32	66.7
Yes	16	33.3
Anticoagulant Used		
Vasoprin	29	60.4
Vasoprin + Pradaxa	2	4.2
None	17	35.4
Diabetic		
No	42	87.5
Yes	6	12.5
Hypertensive		
No	5	10.4
Yes	43	89.6
Route Anticoagulant given		
IV Tranxenemic	35	72.9
Intralesional	7	14.6
IV Tranxenemic and Intralesional	6	12.5

Table 3: Correlation between Age and Blood Loss

	r	p-value
Blood Loss after Surgery		
In 24 hours	0.028	0.849
In 48 hours	-0.012	0.934
In 72 hours	0.021	0.887
Total blood loss	-0.181	0.218

Table 4: Comparison of Blood Loss between Genders

	Total	Male	Female	P-value
Age	63.19 ± 8.67	57.0 ± 15.23	63.91 ± 7.55	0.092
Weight	87.02 ± 21.85	95.6 ± 10.01	86.02 ± 22.69	0.359
Blood Loss after Surgery				
In 24 hours	296.77 ± 178.84	400.0 ± 190.39	284.76 ± 175.85	0.175
In 48 hours	99.48 ± 79.08	140.0 ± 119.37	94.76 ± 73.64	0.23
In 72 hours	58.74 ± 92.31	60.0 ± 65.19	58.59 ± 95.56	0.975
Total blood loss	492.02 ± 289.25	600.0 ± 344.6	479.47 ± 284.2	0.384

Table 5: Correlation between Weight and Blood Loss

	r	p-value
Blood Loss after Surgery		
In 24 hours	-0.029	(0.844)
In 48 hours	-0.086	(0.562)
In 72 hours	-0.097	(0.51)
Total blood loss	0.029	(0.843)

Table 6: Comparison of Blood Loss between Left and Right TKR

	Total	Left TKR	Right TKR	p-value
Blood Loss after Surgery				
In 24 hours	296.77 ± 178.84	323.88 ± 186.4	261.9 ± 166.51	0.238
In 48 hours	99.48 ± 79.08	111.29 ± 86.95	84.29 ± 66.6	0.245
In 72 hours	58.74 ± 92.31	46.64 ± 43.76	74.29 ± 130.71	0.308
Total blood loss	492.02 ± 289.25	555.07 ± 312.41	410.95 ± 239.73	0.087

Table 7: Correlation between Preoperative Haemoglobin and Blood Loss

Name	r	p-value
Blood Loss after Surgery		
In 24 hours	-0.017	0.906
In 48 hours	-0.102	0.49
In 72 hours	-0.151	0.307
Total blood loss	-0.022	0.882

Table 8: Comparison of Blood Loss among Different Routes of TXA Administration

Name	Total	Tranxenemic	Intralesional	Tranxenemic and intralesional	P-value
Blood Loss after Surgery					
In 24 hours	300.0 (150.0-362.5)	350.0 (300.0-400.0)	150.0 (125.0-219.47)	125.0 (100.0-150.0)	<0.0001**
In 48 hours	100.0 (50.0-150.0)	104.86 (75.0-150.0)	50.0 (35.0-50.0)	25.0 (0.0-50.0)	0.002**
In 72 hours	50.0 (0.0-69.54)	50.0 (0.0-100.0)	50.0 (5.0-50.0)	0.0 (0.0-0.0)	0.011**
Total blood loss	503.5 (287.5-650.0)	550.0 (500.0-675.0)	250.0 (200.0-315.0)	175.0 (112.5-200.0)	<0.0001**

Table 9: Comparison of Clinical Factors between Patients Who Received and Did Not Receive Blood Transfusion

	Total (n=48)	No (n = 22)	Yes (n = 26)	p-value
Age	63.19 ± 8.67	63.77 ± 6.7	62.69 ± 10.15	0.672
Gender				
Female	43 (89.6)	19 (86.4)	24 (92.3)	
Male	5 (10.4)	3 (13.6)	2 (7.7)	0.843
Weight	87.02 ± 21.85	87.0 ± 20.14	87.04 ± 23.6	0.995
Haemoglobin after surgery	11.6 (10.5-12.32)	12.0 (11.6-13.48)	11.1 (9.7-11.98)	0.002**
Diagnosis				
Failed Left TKR	3 (6.2)	1 (4.5)	2 (7.7)	
Left Femoral Fracture Non-Union	1 (2.1)	0 (0.0)	1 (3.8)	0.359
Severe Left Hip Osteoarthritis	3 (6.2)	1 (4.5)	2 (7.7)	
Severe Left Knee Osteo Arthritis	20 (41.7)	8 (36.4)	12 (46.2)	
Severe Right Hip Osteo Arthritis	2 (4.2)	0 (0.0)	2 (7.7)	
Severe Right Knee Osteo Arthritis	19 (39.6)	12 (54.5)	7 (26.9)	
Procedure				
Left TKR	27 (56.2)	10 (45.5)	17 (65.4)	
Right TKR	21 (43.8)	12 (54.5)	9 (34.6)	0.274

Anti-Coagulants Given				
No	18 (37.5)	9 (40.9)	9 (34.6)	
Yes	30 (62.5)	13 (59.1)	17 (65.4)	0.881
Anticoagulants stopped 2 weeks before Surgery				
No	32 (66.7)	15 (68.2)	17 (65.4)	
Yes	16 (33.3)	7 (31.8)	9 (34.6)	0.999
Anticoagulant Used				
Vasoprin	29 (60.4)	12 (54.5)	17 (65.4)	0.744
Vasoprin + Pradaxa	2 (4.2)	1 (4.5)	1 (3.8)	
None	17 (35.4)	9 (40.9)	8 (30.8)	
Diabetic				
No	42 (87.5)	20 (90.9)	22 (84.6)	
Yes	6 (12.5)	2 (9.1)	4 (15.4)	0.827
Hypertensive				
No	5 (10.4)	1 (4.5)	4 (15.4)	
Yes	43 (89.6)	21 (95.5)	22 (84.6)	0.453
Route Anticoagulant given				
IV Tranexamic	7 (14.6)	5 (22.7)	2 (7.7)	
Intralesional	35 (72.9)	11 (50.0)	24 (92.3)	0.003
IV Tranexamic and Intralesional	6 (12.5)	6 (27.3)	0 (0.0)	
Blood Loss after Surgery				
In 24 hours	296.77 ± 178.84	236.36 ± 155.98	347.88 ± 183.76	0.03**
In 48 hours	100.0 (50.0-150.0)	50.0 (50.0-100.0)	150.0 (62.5-187.5)	0.012**
In 72 hours	58.74 ± 92.31	55.0 ± 106.58	61.9 ± 80.35	0.8
Total blood loss	503.5 (287.5-650.0)	325.0 (200.0-550.0)	550.0 (425.0-650.0)	0.013**

Table 10: Impact of Diabetes on Postoperative Parameters

	Total	**No**	**Yes**	**P-value**
Age	63.19 ± 8.67	63.0 ± 9.22	64.5 ± 2.74	0.415
Weight	80.0 (72.75-102.25)	78.0 (69.75-89.75)	103.0 (102.25-130.75)	0.004**
Blood Loss after Surgery				
In 24 hours	296.77 ± 178.84	278.45 ± 157.09	425.0 ± 275.23	0.254
In 48 hours	99.48 ± 79.08	94.16 ± 71.75	136.67 ± 121.11	0.222
In 72 hours	58.74 ± 92.31	52.6 ± 81.12	101.67 ± 153.68	0.227
Total blood loss	492.02 ± 289.25	477.07 ± 267.78	596.67 ± 428.33	0.349
Units of blood transfusion given	1.35 ± 1.52	1.31 ± 1.54	1.67 ± 1.51	0.596

Table 11: Effect of Hypertension on Postoperative Outcomes

Name	**Total**	**No**	**Yes**	**p-value**
Age	63.19 ± 8.67	54.0 ± 17.09	64.26 ± 6.72	0.252
weight	87.02 ± 21.85	69.0 ± 9.25	89.12 ± 21.98	0.05
Blood Loss after Surgery				
In 24 hours	296.77 ± 178.84	337.79 ± 131.42	292.0 ± 184.18	0.593
In 48 hours	99.48 ± 79.08	100.0 ± 70.71	99.42 ± 80.76	0.988
In 72 hours	58.74 ± 92.31	30.0 ± 27.39	62.08 ± 96.72	0.468
Total blood loss	492.02 ± 289.25	496.0 ± 165.32	491.56 ± 301.7	0.974
Units of blood transfusion given	1.35 ± 1.52	2.2 ± 2.28	1.26 ± 1.42	0.192

Table 12: Comparison of Pre- and Postoperative Haemoglobin Levels

	Median (IQR)	p-value
Before Surgery		
Haemoglobin	11.6 (10.5-12.32)	
After Surgery		<0.0001**
Haemoglobin in 24 hours	9.4 (8.6-10.48)	
Haemoglobin in 48 hours	10.8 (10.0-11.9)	
Haemoglobin in 72 hours	11.0 (9.6-11.85)	

Table 13: Comparison of Postoperative Haemoglobin Levels with Different Routes of Anticoagulant Administration

	IV Tranexamic	Intralesional	IV Tranexamic and intralesional	P-value
Post-Operative				
Haemoglobin in 24 hours	10.51 ± 2.83	10.27 ± 1.40	11.98 ± 1.55	0.064
Haemoglobin in 48 hours	10.55 ± 1.31	12.09 ± 0.43	12.28 ± 0.98	0.001**
Haemoglobin in 72 hours	10.50 ± 1.34	11.04 ± 1.17	11.63 ± 0.80	0.112
** statistically significant				

Table 14: Comparison of Units of Blood Transfused with Different Routes of Anticoagulant Administration

	Total	Tranexamic	Intralesional	Tranexamic and intralesional	P-value
Units of Blood Transfused	1.35 ± 1.52	1.74 ± 1.56	0.57 ± 0.98	0.0 ± 0.0	0.005**
** statistically significant					

IV. Interpretation Of Result

The study cohort comprised 48 patients who underwent total knee replacement (TKR) surgery, with a median age of 64 years (range: 32-76 years). The majority of the patients were female (89.6%), and the predominant occupations were business (39.6%) and civil service (27.1%). All patients identified as Christian (Table 1).

Diagnosis

The most common surgical diagnosis was severe knee osteoarthritis, with 41.7% of patients presenting with severe left knee osteoarthritis and 39.6% with severe right knee osteoarthritis. The procedures performed were left TKR (56.2%) and right TKR (43.8%) (Table 2).

Perioperative Characteristics

The median preoperative haemoglobin level was 11.6 g/dL (IQR: 10.5-12.32 g/dL). Postoperatively, the mean haemoglobin levels reduced to 9.73 ± 1.59 g/dL at 24 hours, 10.94 ± 1.81 g/dL at 48 hours, and 10.72 ± 1.53 g/dL at 72 hours. The median number of units of blood transfused was 1.0 (IQR: 0.0-2.0). Regarding blood loss after surgery, the median values were 300.0 mL (IQR: 150.0-362.5 mL) at 24 hours, 100.0 mL (IQR: 50.0-150.0 mL) at 48 hours, and 50.0 mL (IQR: 0.0-69.54 mL) at 72 hours. The mean total blood loss was 492.02 ± 289.25 mL. Most patients received an open drain after 1 hour (70.8%), and 54.2% of patients received blood transfusions. Additionally, 62.5% of patients were prescribed anticoagulants, with Vasoprin being the most commonly used anticoagulant (60.4%) (Table 2).

Relationshipbetween Patient Characteristics and Blood Loss

No significant correlation was observed between age and blood loss at various time points after surgery ($p > 0.05$) (Table 3). Similarly, no significant differences in blood loss were found between males and females ($p > 0.05$), and patient weight did not correlate with blood loss ($p > 0.05$) (Table 5). When comparing the side of surgery (left vs. right TKR), no significant differences in blood loss were noted at 24, 48, or 72 hours after surgery, or in total blood loss ($p > 0.05$) (Table 6). Preoperative haemoglobin levels did not correlate significantly with blood loss at any time point after surgery ($p > 0.05$) (Table 7).

Efficacy of Different Routes of Tranexamic Acid (TXA) Administration

The study compared the efficacy of different routes of TXA administration in controlling blood loss. Three groups were evaluated: intravenous (IV) TXA only, intralesional TXA only, and combined IV and intralesional TXA. Significant differences in blood loss were observed among the three groups at various time points after surgery. Specifically, in 24 hours post-surgery, the median blood loss was 300.0 mL (IQR: 150.0-362.5 mL) for the total group, 350.0 mL (IQR: 300.0-400.0 mL) for the IV TXA only group, 150.0 mL (IQR:

125.0-219.47 mL) for the intralesional TXA only group, and 125.0 mL (IQR: 100.0-150.0 mL) for the combined IV and intralesional TXA group ($p < 0.0001$).

Similarly, at 48 hours post-surgery, the median blood loss was 100.0 mL (IQR: 50.0-150.0 mL) for the total group, 104.86 mL (IQR: 75.0-150.0 mL) for the IV TXA only group, 50.0 mL (IQR: 35.0-50.0 mL) for the intralesional TXA only group, and 25.0 mL (IQR: 0.0-50.0 mL) for the combined IV and intralesional TXA group ($p = 0.002$).

Moreover, at 72 hours post-surgery, the median blood loss was 50.0 mL (IQR: 0.0-69.54 mL) for the total group, 50.0 mL (IQR: 0.0-100.0 mL) for the IV TXA only group, 50.0 mL (IQR: 5.0-50.0 mL) for the intralesional TXA only group, and 0.0 mL (IQR: 0.0-0.0 mL) for the combined IV and intralesional TXA group ($p = 0.011$).

These results indicate that the combined IV and intralesional TXA administration was associated with the lowest blood loss, followed by intralesional administration alone and IV administration alone (Table 8).

Factors Associated with Blood Transfusion

Patients who received blood transfusions were compared with those who did not receive transfusions. The analysis revealed that patients who received transfusions had significantly lower preoperative haemoglobin levels compared to those who did not receive transfusions (median: 11.1 g/dL, IQR: 9.7-11.98 g/dL vs. median: 12.0 g/dL, IQR: 11.6-13.48 g/dL, respectively; $p = 0.002$).

Additionally, patients who received transfusions experienced higher blood loss at 24 hours post-surgery compared to those who did not receive transfusions (median: 347.88 mL, IQR: 183.76 mL vs. median: 236.36 mL, IQR: 155.98 mL, respectively; $p = 0.03$). However, no significant differences were observed between the two groups concerning age, gender, weight, diagnosis, procedure, anticoagulant use, or comorbidities such as diabetes and hypertension ($p > 0.05$) (Table 9).

Comparison of Pre- and Postoperative Haemoglobin Levels

The study compared preoperative haemoglobin levels with postoperative levels at 24, 48, and 72 hours after surgery. A significant decrease in haemoglobin levels was observed at 24 hours after surgery compared to preoperative levels ($p < 0.0001$) (Table 12). Additionally, postoperative haemoglobin levels at 24 hours showed a statistically significant decrease compared to other postoperative haemoglobin levels ($p = 0.032$) (Table 13).

Influence of Comorbidities on Blood Loss

The study investigated the impact of diabetes and hypertension on blood loss after TKR surgery. No significant differences in blood loss were observed between diabetic and non-diabetic patients or between hypertensive and non-hypertensive patients at various time points or in total blood loss (Table 10, Table 11).

Impact of Anticoagulant Administration Routes on Postoperative Haemoglobin Levels

Table 13 illustrates the impact of different routes of anticoagulant administration on postoperative haemoglobin levels. The study examined patients who received intravenous tranexamic, intralesional, or a combination of both routes. Haemoglobin levels were measured at 24-, 48-, and 72-hours post-operation, and statistical analysis was conducted to assess any significant differences.

Interestingly, patients who received both intravenous tranexamic and intralesional administrations exhibited higher postoperative haemoglobin levels compared to those who received other treatments. At 24 hours post-operation, mean haemoglobin levels were 10.51 g/dL for IV tranexamic, 10.27 g/dL for intralesional, and 11.98 g/dL for the combination, with a p-value of 0.064. Similarly, at 48 hours, mean haemoglobin levels were 10.55 g/dL, 12.09 g/dL, and 12.28 g/dL, respectively, with a p-value of 0.001. At 72 hours, mean haemoglobin levels were 10.50 g/dL, 11.04 g/dL, and 11.63 g/dL, respectively, with a p-value of 0.112.

Comparison of Units of Blood Transfused with Different Routes of Anticoagulant Administration

Table 14 shows the comparison of units of blood transfused among patients who received different routes of anticoagulant administration. The findings revealed a statistically significant difference in the units of blood transfused among the three administration routes (P-value = 0.005). Specifically, patients who received Tranxenemic administration required a mean of 1.74 units of blood transfusion, whereas those who received Intralesional administration required a mean of 0.57 units. Interestingly, patients who received a combination of Tranxenemic and Intralesional administration did not require any blood transfusion postoperatively.

VI. Discussion

This study explores various aspects related to total knee replacement (TKR) surgery, including patient demographics, perioperative characteristics, the efficacy of tranexamic acid (TXA) administration routes in controlling blood loss, factors associated with blood transfusion, comparison of pre-and postoperative

haemoglobin levels, the influence of comorbidities on blood loss, and the impact of anticoagulant administration routes on postoperative haemoglobin levels.

The study cohort consisted of primarily female patients with severe knee osteoarthritis undergoing either left or right TKR surgery and revision procedures. Preoperative haemoglobin levels were within a typical range, but a significant decrease was observed postoperatively at 24 hours, gradually improving thereafter. Most patients received open drains postoperatively, and a considerable portion required blood transfusions, with Vasoprin being the most commonly used anticoagulant.

No significant correlations were found between patient age, gender, weight, or the side of surgery (left vs. right TKR) with blood loss after surgery. Additionally, preoperative haemoglobin levels did not significantly correlate with blood loss.

This study compared three groups receiving different TXA administration routes: intravenous (IV) TXA only, intralesional TXA only, and combined IV and intralesional TXA. It evaluated three groups receiving intravenous (IV) TXA only, intralesional TXA only, and combined IV and intralesional TXA, providing valuable insights into the most effective approach for minimizing blood loss after TKR.

At 24 hours post-surgery, the study observed significant differences in median blood loss among the three groups. The IV TXA-only group had the highest median blood loss (350.0 mL), followed by the total group (300.0 ml), the intralesional TXA-only group (150.0 mL), and finally, the combined IV and intralesional TXA group (125.0 ml). These findings suggest that combining IV and intralesional TXA administration is associated with the lowest blood loss at this time point.This aligns with the findings by different researchers.[11,12,14,21,22]. However, a few who studied the two routes of administration found IV TXA better than the intraarticular route.[19,25], while others IA better route than the IV route.[7,15,20]

Similarly, at 48 hours post-surgery, significant differences in median blood loss were observed. The IV TXA-only group had a median blood loss of 104.86 mL, followed by the total group (100.0 ml), the intralesional TXA-only group (50.0 mL), and the combined IV and intralesional TXA group (25.0 ml). Once again, the combined IV and intralesional TXA group demonstrated the lowest blood loss, indicating the efficacy of this approach in reducing blood loss during the early postoperative period. Again, many a researcher concurred with the superiority of combined route to single route, showing effective reduction in blood loss and no significant drop in haemoglobin.[8,9,15,17]

At 72 hours post-surgery, while median blood loss decreased across all groups compared to earlier time points, differences among the groups remained significant. The IV TXA-only and intralesional TXA-only groups had a median blood loss of 50.0 ml. The combined IV and intralesional TXA group had a median blood loss of 0.0 ml. This result highlights the remarkable efficacy of combined IV and intralesional TXA administration in virtually eliminating blood loss by 72 hours post-surgery.[21,22]

The findings from these figures emphasize the importance of considering the route of TXA administration in TKR surgery to minimize blood loss and its associated complications. The combined IV and intralesional TXA approach consistently outperformed IV TXA only and intralesional TXA only methods across all time points, demonstrating its superiority in controlling postoperative blood loss. This suggests that a multimodal approach to TXA administration greatly benefits reducing blood loss and optimizing patient outcomes in TKR surgery.[14,22]

Patients requiring blood transfusions had significantly lower preoperative haemoglobin levels and experienced higher blood loss at 24 hours post-surgery. However, no significant differences were observed between transfusion and non-transfusion groups concerning other patient characteristics or comorbidities.

There was also a comparison of blood transfusion units among patients who underwent different routes of anticoagulant administration. The statistical analysis reveals a significant difference in the units of blood transfused across the three administration routes, with a calculated P-value of 0.005. Specifically, patients who received Tranexamic administration required an average of 1.74 units of blood transfusion, while those who received Intralesional administration needed an average of 0.57 units. Notably, patients who received a combination of Tranexamic and Intralesional administration did not require any blood transfusion following the procedure. This suggests that the choice of anticoagulant administration route may influence the need for postoperative blood transfusion, with the combined administration showing the lowest requirement.[14,21,22]

A significant decrease in haemoglobin levels was observed at 24 hours post-surgery compared to preoperative levels. Additionally, postoperative haemoglobin levels at 24 hours showed a statistically significant decrease compared to other postoperative time points.

The study found no significant differences in blood loss between diabetic and non-diabetic patients or between hypertensive and non-hypertensive patients.[17,20,22]

Patients receiving both intravenous tranexamic and intralesional administrations exhibited higher postoperative haemoglobin levels compared to those receiving other treatments, although statistical significance varied across different time points.[15,17]

Findings suggest that the combination of intravenous and intralesional tranexamic acid (TXA) administration positively impacts postoperative haemoglobin levels compared to single-route administration. Patients receiving both intravenous and intralesional TXA showed higher haemoglobin levels at 24, 48, and 72 hours post-operation, with statistically significant differences observed at 48 hours. Additionally, the comparison of units of blood transfused indicates that the combined administration of TXA routes significantly reduces the need for postoperative blood transfusions compared to single-route administration, emphasizing its potential benefit in improving patient outcomes and minimizing the risk of complications related to blood loss in total knee replacement surgery.[9,15.21,22]

Overall, the findings provide valuable insights into the management of blood loss in TKR surgery, emphasizing the importance of TXA administration routes and preoperative optimization of haemoglobin levels to minimize the need for blood transfusions and improve patient outcomes.

VII. Conclusion:

This study underscores the significance of tranexamic acid (TXA) administration routes in total knee replacement (TKR) surgery for minimizing blood loss and improving patient outcomes. The combined intravenous (IV) and intralesional TXA approach consistently demonstrated superior efficacy in reducing blood loss across various postoperative time points compared to IV TXA-only or intralesional TXA-only methods. Moreover, the choice of TXA administration route significantly influenced the need for postoperative blood transfusion, with the combined

administration showing the lowest requirement. These findings underscore the importance of considering TXA administration routes and preoperative optimization of haemoglobin levels to effectively manage blood loss in TKR surgery and enhance patient care.

References

[1] Skou, S. T., Roos, E. M., Laursen, M. B., Rathleff, M. S., Arendt-Nielsen, L., Simonsen, O., & Rasmussen, S. (2015). A Randomized, Controlled Trial Of Total Knee Replacement. New England Journal Of Medicine, 373(17), 1597-1606.

[2] Reinhardt, K. R., Osoria, H., Nam, D., Alexiades, M. A., Figgie, M. P., & Su, E. P. (2013). Reducing Blood Loss After Total Knee Replacement: A Fibrin Solution. The Bone & Joint Journal, 95(11_Supple_A), 135-139.

[3] Pawaskar, A., Salunke, A. A., Kekatpure, A., Chen, Y., Nambi, G. I., Tan, J., ... & Pathak, S. (2017). Do Autologous Blood Transfusion Systems Reduce Allogeneic Blood Transfusion In Total Knee Arthroplasty?. Knee Surgery, Sports Traumatology, Arthroscopy, 25, 2957-2966.

[4] Keyhani, S., Esmailiejah, A. A., Abbasian, M. R., & Safdari, F. (2016). Which Route Of Tranexamic Acid Administration Is More Effective To Reduce Blood Loss Following Total Knee Arthroplasty?. Archives Of Bone And Joint Surgery, 4(1), 65.

[5] Xie, J., Hu, Q., Huang, Z., Zhou, Z., & Pei, F. (2019). Comparison Of Three Routes Of Administration Of Tranexamic Acid In Primary Unilateral Total Knee Arthroplasty: Analysis Of A National Database. Thrombosis Research, 173, 96-101.

[6] Zhang, S., Wang, C., Shi, L., & Xue, Q. (2019). Multi-Route Applications Of Tranexamic Acid To Reduce Blood Loss After Total Knee Arthroplasty: A Randomized Controlled Trial. Medicine, 98(30), E16570.

[7] Seo, J. G., Moon, Y. W., Park, S. H., Kim, S. M., & Ko, K. R. (2013). The Comparative Efficacies Of Intra-Articular And Iv Tranexamic Acid For Reducing Blood Loss During Total Knee Arthroplasty. Knee Surgery, Sports Traumatology, Arthroscopy, 21, 1869-1874.

[8] Yuan, X., Li, B., Wang, Q., & Zhang, X. (2017). Comparison Of 3 Routes Of Administration Of Tranexamic Acid On Primary Unilateral Total Knee Arthroplasty: A Prospective, Randomized, Controlled Study. The Journal Of Arthroplasty, 32(9), 2738-2743.

[9] Fan, D., Ma, J., Liu, X., & Zhang, L. (2022). Peri-Articular Administration Of Tranexamic Acid Is An Alternative Route In Total Knee Arthroplasty: A Systematic Review And Meta-Analysis. Journal Of Orthopaedic Surgery And Research, 17(1), 211.

[10] Tzatzairis, T. K., Drosos, G. I., Kotsios, S. E., Ververidis, A. N., Vogiatzaki, T. D., & Kazakos, K. I. (2016). Intravenous Vs Topical Tranexamic Acid In Total Knee Arthroplasty Without Tourniquet Application: A Randomized Controlled Study. The Journal Of Arthroplasty, 31(11), 2465-2470.

[11] Sun, Q., Li, J., Chen, J., Zheng, C., Liu, C., & Jia, Y. (2019). Comparison Of Intravenous, Topical Or Combined Routes Of Tranexamic Acid Administration In Patients Undergoing Total Knee And Hip Arthroplasty: A Meta-Analysis Of Randomised Controlled Trials. Bmj Open, 9(1), E024350.

[12] Xu, S., Chen, J. Y., Zheng, Q., Lo, N. N., Chia, S. L., Tay, K. J. D., ... & Yeo, S. J. (2019). The Safest And Most Efficacious Route Of Tranexamic Acid Administration In Total Joint Arthroplasty: A Systematic Review And Network Meta-Analysis. Thrombosis Research, 176, 61-66.

[13] Kim, T. K., Chang, C. B., & Koh, I. J. (2014). Practical Issues For The Use Of Tranexamic Acid In Total Knee Arthroplasty: A Systematic Review. Knee Surgery, Sports Traumatology, Arthroscopy, 22, 1849-1858.

[14] Lu, F., Sun, X., Wang, W., Zhang, Q., & Guo, W. (2021). What Is The Ideal Route Of Administration Of Tranexamic Acid In Total Knee Arthroplasty? A Meta-Analysis Based On Randomized Controlled Trials. Annals Of Palliative Medicine, 10(2), 1880894-1881894.

[15] Goyal, N., Chen, D. B., Harris, I. A., Rowden, N. J., Kirsh, G., & Macdessi, S. J. (2017). Intravenous Vs Intra-Articular Tranexamic Acid In Total Knee Arthroplasty: A Randomized, Double-Blind Trial. The Journal Of Arthroplasty, 32(1), 28-32.

[16] Fillingham, Ya, Ramkumar, Db, Jevsevar, Ds, Yates, Aj, Shores, P, Mullen, Sa. The Efficacy Of Tranexamic Acid In Total Knee Arthroplasty: A Network Meta-Analysis. The Journal Of Arthroplasty. 2018; 33(10): 3090-3098.E1.

[17] Marra, F., Rosso, F., Bruzzone, M., Bonasia, D. E., Dettoni, F., & Rossi, R. (2016). Use Of Tranexamic Acid In Total Knee Arthroplasty. Joints, 4(04), 202-213.

[18] Stowers, M. D., Aoina, J., Vane, A., Poutawera, V., Hill, A. G., & Munro, J. T. (2017). Tranexamic Acid In Knee Surgery Study—A Multicentered, Randomized, Controlled Trial. The Journal Of Arthroplasty, 32(11), 3379-3384.

[19] Shin, Y. S., Yoon, J. R., Lee, H. N., Park, S. H., & Lee, D. H. (2017). Intravenous Versus Topical Tranexamic Acid Administration In Primary Total Knee Arthroplasty: A Meta-Analysis. Knee Surgery, Sports Traumatology, Arthroscopy, 25, 3585-3595.

[20] Lee, S. Y., Chong, S., Balasubramanian, D., Na, Y. G., & Kim, T. K. (2017). What Is The Ideal Route Of Administration Of Tranexamic Acid In Tka? A Randomized Controlled Trial. Clinical Orthopaedics And Related Research®, 475(8), 1987-1996.

[21] Oremus, K. (2015). Tranexamic Acid For The Reduction Of Blood Loss In Total Knee Arthroplasty. Annals Of Translational Medicine, 3(Suppl 1).

[22] Jain, N. P., Nisthane, P. P., & Shah, N. A. (2016). Combined Administration Of Systemic And Topical Tranexamic Acid For Total Knee Arthroplasty: Can It Be A Better Regimen And Yet Safe? A Randomized Controlled Trial. The Journal Of Arthroplasty, 31(2), 542-547.

[23] Hootsmans, N. A., Vellanky, S., Grady-Benson, J., & Cremins, M. S. (2023). A Randomized Trial Of Three Routes Of Tranexamic Acid Administration In Total Knee Arthroplasty. Orthopedics, 46(5), 285-290.

[24] Sarzaeem, M. M., Razi, M., Kazemian, G., Moghaddam, M. E., Rasi, A. M., & Karimi, M. (2014). Comparing Efficacy Of Three Methods Of Tranexamic Acid Administration In Reducing Hemoglobin Drop Following Total Knee Arthroplasty. The Journal Of Arthroplasty, 29(8), 1521-1524.

[25] Aguilera, X., Martínez-Zapata, M. J., Hinarejos, P., Jordán, M., Leal, J., González, J. C., ... & Puig-Verdie, L. L. (2015). Topical And Intravenous Tranexamic Acid Reduce Blood Loss Compared To Routine Hemostasis In Total Knee Arthroplasty: A Multicenter, Randomized, Controlled Trial. Archives Of Orthopaedic And Trauma Surgery, 135, 1017-1025.

[26] Mortazavi, S. J., Sattartabar, B., Moharrami, A., & Kalantar, S. H. (2020). Intra-Articular Versus Intravenous Tranexamic Acid In Total Knee Arthroplasty: A Randomized Clinical Trial. Archives Of Bone And Joint Surgery, 8(3), 355.

[27] Melvin, J. S., Stryker, L. S., & Sierra, R. J. (2015). Tranexamic Acid In Hip And Knee Arthroplasty. Jaaos-Journal Of The American Academy Of Orthopaedic Surgeons, 23(12), 732-740.

[28] Barbero, P. G., Aparicio, M. G., Dobón, J. B., De Tomás, J. P., Suárez-Varela, M. M., & Pérez, J. R. (2019). Which Route Of Administration Of Acid Tranexamic, Intravenous Or Intra-Articular, Is More Effective In The Control Of Post-Surgical Bleeding After A Total Hip Arthroplasty? A Prospective, Controlled And Randomized Study. Revista Española De Cirugía Ortopédica Y Traumatología (English Edition), 63(2), 138-145.

[29] Drain, N. P., Gobao, V. C., Bertolini, D. M., Smith, C., Shah, N. B., Rothenberger, S. D., ... & Urish, K. L. (2020). Administration Of Tranexamic Acid Improves Long-Term Outcomes In Total Knee Arthroplasty. The Journal Of Arthroplasty, 35(6), S201-S206.