ABSTRACT

Objectives: The standard surgical method for primary gonarthrosis in advanced stages is total knee arthroplasty (TKA), despite the risk of bleeding that requires transfusion. Blood transfusions are potentially dangerous. The aim of this study was to determine whether there is a statistical difference in the amount of bleeding and the need for transfusion between patients who received and did not receive perioperative local tranexamic acid in TKA.

Methods: The hospital data system was used to access the data of patients who underwent TKA in our clinic between January 2015 and January 2022 with a diagnosis of gonarthrosis. Patients who underwent TKA and had gonarthrosis as the primary diagnosis were included in the study. They were separated into two groups: A control group (Group C) and a group that received perioperative local tranexamic acid (Group LTXA). The amount of bleeding was compared by taking into account patients’ hemogram follow-ups, the amount of blood from their drains, and their transfusion needs during the postoperative period.

Results: The findings demonstrated that TKA patients who received local tranexamic acid administration experienced a significant decrease in perioperative blood loss and needed lesser transfusions.

Conclusion: The findings of our investigation are consistent with other studies and are in favor of the usage of TXA in TKA. To validate our findings and establish the ideal TXA dosage and administration method in TKA, additional research is required.

Keywords: Blood transfusion, hemoglobin, surgical drain, total knee arthroplasty, tranexamic acid

Please cite this article as "Cam N, Balkanli B, Altuntas Y, Kanar M, Ozdemir HM. The Effect of Local Tranexamic Acid Administration on Blood Loss and Transfusion in Total Knee Arthroplasty: A Retrospective Study. Med Bull Sisli Etfal Hosp 2023;57(2):245–249".
Tranexamic acid (TXA) is a synthetic lysine amino acid derivative that binds to plasminogen and inhibits the deterioration of fibrin. After its discovery in the 1960s, it began to be commonly used as an antifibrinolytic agent in orthopedic surgery, and the use of tranexamic acid in TKA has increased. TXA is used locally, systemically, or in combination to decrease blood loss and the need for transfusions after TKA.

The aim of this study was to determine whether there is a statistical difference in the amount of bleeding and the need for transfusion between patients who received and did not receive perioperative local tranexamic acid in TKA.

Methods

This retrospective study included all patients diagnosed with gonarthrosis between January 2015 and January 2022 who met the inclusion criteria: Aged 60–80 years and who underwent primary TKA due to gonarthrosis. Patients with secondary gonarthrosis due to infection, trauma, or rheumatologic or systemic diseases with joint involvement were excluded from the study. Patients who received IV or combined TXA during primary TKA were also excluded from the study. Data about the patients were accessed from the hospital database. The hemogram results of all the patients were evaluated preoperatively and on postoperative days 1 and 3. Surgical drains were applied to all the patients, and the drain volumes were monitored before being removed on the first postoperative day.

All the surgeries were performed using a tourniquet and under spinal anesthesia. One group received local application of 2 g tranexamic acid onto the open wound over the knee joint after cemented TKA. After the application, the incision site was anatomically sutured and the tourniquet was terminated. After 2 h, a drain was clamped and activated. This group was defined as the local tranexamic acid group (Group LTXA). The drain was clamped and turned on 2 h later in the second group, which was not administered tranexamic acid following cemented TKA. This group was identified as the control group (Group C). The inclusion criteria were satisfied by 38 patients in Group C and 39 patients in Group LTXA.

Retrospective analysis of the patient demographics, including age and gender, and the treatments performed in the outpatient clinic, was conducted. Perioperative and postoperative 24-h hemoglobin (Hg) levels were compared. The average amount of blood from the surgical drain after total knee replacement and the significance of the difference in averages between the groups were examined. The relationship between postoperative blood transfusion amounts and tranexamic acid application was also investigated between the groups.

Statistical Analysis

The data analyses of the study were conducted using the “Statistical Package for the Social Science (SPSS) for Windows” statistical software version 23.0 (SPSS, Chicago, IL, USA) on a computer. A probability value of p<0.05 was regarded as statistically significant in all analyses. Numerical data were expressed as mean and standard deviation, whereas categorical and ordinal data were expressed as percentages (%). The Shapiro–Wilks test was used to determine whether numerical data have a normal distribution. Student’s t-independent and Student’s t-paired tests were used to compare groups for numerical measured variables with normal distribution.

Results

Group C consisted of 38 patients, including 32 (84%) females and 6 (16%) males, with an average age of 68 years. Of these, 18 patients underwent TKA due to the right knee osteoarthritis and 20 patients due to the left knee osteoarthritis. A total of 39 patients in the tranexamic acid group (Group LTXA), 30 (77%) were female and 9 (23%) were male, and the mean age was 70.5 years. The group included 19 patients who had TKA for the right knee osteoarthritis and 20 patients who had TKA for the left knee osteoarthritis.

The mean perioperative Hg measurement in Group C was 13.28 g/dL, and it was 10.93 g/dL 24 h after the surgery. In Group LTXA, the mean perioperative Hg was 13.33 g/dL, and it was 11.95 g/dL 24 h after the surgery. Both Group LTXA and Group C showed statistically significant variations between the perioperative and postoperative measures (p<0.001) (Table 1).

| Table 1. Preoperative and postoperative 24th h mean the level of hemoglobin (Hg) |
|---------------------------------------------|------------------|------------------|----------|
|                                            | Group C (n=38)   | Group LTXA (n=39)| p        |
| Preoperative mean Hg level (g/dL)          | 13.28            | 13.33            | 0.000*   |
| Postoperative 24th h mean Hg level (g/dL)  | 10.93            | 11.95            | 0.000*   |

*p<0.001; Hg: Hemoglobin; n: Number of patients.
In Group C, the average amount of blood from the surgical drain at 24 h postoperatively was 103.03 mL compared with 71.54 mL in Group LTXA. The difference in the volume of blood from the surgical drain was statistically significant, \((p<0.001)\) (Table 2).

In Group C, the mean value of the first 24-h Hg drop was 2.34 g/dL, while in Group LTXA, it was 1.38 g/dL. In Group C, the mean value of the total Hg drop was 3.44 g/dL, whereas in Group LTXA, it was 2.57 g/dL. The first 24-h Hg drop \((p<0.001)\) and total Hg drop \((p<0.05)\) were much greater in Group C than in Group LTXA and were statistically significant (Table 3).

In Group C, 36.8% of the patients did not receive a blood transfusion, 34.2% received one unit of blood, 23.7% received two units, 2.6% received three units, and 2.6% received four units. In Group LTXA, the proportion of patients who did not receive blood transfusion was 89.7%, whereas 7.7% and 2.6%, respectively, received 1 unit and 2 units of blood transfusion. There was a statistically significant relationship between the total amount of transfusion in Group LTXA and Group C \((p<0.001)\) (Table 4).

**Discussion**

In several studies, tranexamic acid has been used locally, systemically, or in combination to decrease blood loss and the need for transfusions after TKA.\(^{[9,10]}\) Local administration of tranexamic acid is as effective as systemic and combined approaches. However, there is no consensus on the route of administration, dose and when it should be administered.\(^{[9,11]}\) Concerns about tranexamic acid’s possible connection to thromboembolic events arise from how it is administered. Recent research, however, has failed to demonstrate a relationship between these events and the route of administration.\(^{[12-18]}\)

The results of this study indicate that the administration of perioperative tranexamic acid locally during TKA can dramatically minimize blood loss and the requirement for blood transfusions. The findings of this study are in accordance with prior studies that demonstrated tranexamic acid’s effectiveness in minimizing blood loss during TKA.\(^{[15,17,19-21]}\)

The results showed a statistically significant difference between the groups that received local tranexamic acid administration and those that did not in terms of the initial

---

**Table 2.** Postoperative 24th h mean surgical drain level (ml)

<table>
<thead>
<tr>
<th></th>
<th>Group C (n=38)</th>
<th>Group LTXA (n=39)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Surgical drain (ml)</td>
<td>103.03</td>
<td>71.54</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

*\(p<0.001;\) ml: Milliliter; n: Number of patients.

**Table 3.** Postoperative level of hemoglobin (Hg) drop

<table>
<thead>
<tr>
<th></th>
<th>Group C (n=38)</th>
<th>Group LTXA (n=39)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative first 24-h Hg drop (g/dL)</td>
<td>2.34</td>
<td>1.38</td>
<td>0.000*</td>
</tr>
<tr>
<td>Postoperative total Hg drop (g/dL)</td>
<td>3.44</td>
<td>1.01</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

*\(p<0.001;\) Hg: Hemoglobin; n: Number of patients.

**Table 4.** Distribution of blood transfusion amounts

<table>
<thead>
<tr>
<th></th>
<th>Group C (n=38)</th>
<th>Group LTXA (n=39)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No need blood transfusion (n) (%)</td>
<td>14 (36.8)</td>
<td>35 (89.7)</td>
<td></td>
</tr>
<tr>
<td>1 unit blood transfusion (n) (%)</td>
<td>13 (34.2)</td>
<td>3 (7.7)</td>
<td></td>
</tr>
<tr>
<td>2 unit blood transfusion (n) (%)</td>
<td>9 (23.7)</td>
<td>1 (2.6)</td>
<td></td>
</tr>
<tr>
<td>3 unit blood transfusion (n) (%)</td>
<td>1 (2.6)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>4 unit blood transfusion (n) (%)</td>
<td>1 (2.6)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Total blood transfusion (n) (%)</td>
<td>24 (63.2)</td>
<td>4 (10.3)</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

*\(p<0.001;\) Hg: Hemoglobin; %: Percentage; n: Number of patients.
24-h hemoglobin drop after surgery and the overall hemoglobin decline throughout the hospital stay.\cite{22,23} The usage of tranexamic acid was linked to a reduced hemoglobin decline, indicating that it might help hasten recovery and reduce hospital stays.\cite{19}

The study's findings revealed that the amount of blood draining from the surgical drain in the group without the application of tranexamic acid (Group C) was significantly higher than that in the group with the application of tranexamic acid (Group LTXA). The effectiveness of tranexamic acid in minimizing blood loss during TKA is in line with previous research.\cite{24-26}

The limitations of this research are the retrospective design, the small sample, the fact that it was performed in a single center and the inclusion of only primary cases of gonarthrosis. Another limitation is that the surgeries were performed by different surgeons. Although they are experienced in TKA, some personal surgical differences may have an effect on blood loss.

Conclusion

The use of perioperative local TXA in TKA can dramatically reduce blood loss, lessen the requirement for blood transfusions, and enhance patient outcomes. However, further research is needed to validate our findings and determine the optimal dosage and administration protocol for TXA in TKA.

Disclosures

Ethics Committee Approval: This article does not contain any studies with human or animal subjects performed by the any of the authors.

Patient informed consent: Informed Consent was obtained.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.


References

12. Wei W, Dang S, Duan D, Wei L. Comparison of intravenous and topical tranexamic acid in total knee arthroplasty. BMC Musculoskelet Disord 2018;19:191. [CrossRef]
18. Tzatzairis TK, Drossos GI, Kotsios SE, Ververidis AN, Vogiatzaki TD, Kazakos KI. Intravenous vs topical tranexamic acid in total knee arthroplasty without tourniquet application: a randomized controlled study. J Arthroplasty 2016;31:2465-70. [CrossRef]


23. Guerreiro JPF, Badaro BS, Balbino JRM, Danieli MV, Queiroz AO, Cataneo DC. Application of tranexamic acid in total knee arthroplasty - prospective randomized trial. Open Orthop J;11:1049-57. [CrossRef]

