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ORIGINAL ARTICLE

Tranexamic Acid versus Dexmedetomidine for Improving Surgical Field Quality During Spine Surgeries

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ABSTRACT

Background: Spine procedures are linked to a significant risk of bleeding and blood transfusions, which can result in poor vision during the procedure and adverse clinical results. According to earlier research, several pharmacological medications can be utilized to minimize blood loss and enhance operative field visibility during spine procedures. **Aim:** This study aimed to improve the quality of the surgical field by employing intravenous tranexamic acid or dexmedetomidine to reduce blood loss in patients having spine procedures. **Methods:** This prospective randomized double-blind control clinical study was conducted at the Anesthesia, Intensive Care and Pain Management Department, Faculty of Medicine, Zagazig University Hospitals on 78 patients who underwent lumbar decompression and fixation surgery at 2 levels. They were divided into the control, tranexamic acid, and dexmedetomidine groups. The primary outcome is the effect of tranexamic acid and dexmedetomidine on improving surgical field quality, while the secondary outcome is the effect of tranexamic acid and dexmedetomidine on hemodynamics, and their side effects. **Results:** Tranexamic acid had the upper hand in decreasing the amount of blood loss and blood transfusion than other drugs, while dexmedetomidine achieved more hypotensive and bradycardiac effects. Side effects were more in the dexmedetomidine group than other groups, represented mainly as hypotension and bradycardia. The duration of surgery was shorter in the tranexamic acid group than in other groups. Emergence and discharge times were longer in the dexmedetomidine group than in other groups. **Conclusions**: In spine surgeries, tranexamic acid and dexmedetomidine were more effective than the control group in decreasing blood loss and blood transfusion with superiority of tranexamic acid than dexmedetomidine.

Keywords: Tranexamic Acid, Dexmedetomidine, Surgical Field Quality, Spine Surgeries.

INTRODUCTION

There is always a significant danger of bleeding and blood transfusions during spine surgeries, particularly complex and multilevel spine surgeries. According to reports, the most commonly reported procedure involving major hemorrhage is spine surgery. Excessive blood loss might lead to increased transfusion-related problems following surgery and impaired visibility during the procedure [1].

Improving the surgical field is particularly crucial in spine procedures since key and extremely delicate neurologic structures are located nearby. Reduced bleeding makes surgery safer in this area because it allows for better visualization of the operating field, which reduces the risk of nerve damage at the root level. It also makes the surgeon's job easier technically and helps them cut down on operating time, which further reduces bleeding [2].

Numerous hemodynamic strategies, biological and chemical drugs such as desmopressin, aprotinin, tranexamic acid, epsilon, aminocaproic acid, and dexmedetomidine, as well as controlled blood pressure lowering and epidural block, might reduce bleeding [3].

Tranexamic acid inhibits fibrinolysis, which lowers blood loss. It inhibits fibrinolysis by binding to plasmin and plasminogen's lysine receptor sites, which isolate plasminogen from the fibrin surface [4].

Tranexamic acid has been demonstrated to be helpful in reducing perioperative and traumatic bleeding as well as the need for blood transfusions in a variety of specialties, including orthopedic, obstetric, urologic, and cardiac procedures [5].

A very specific α 2-adrenoceptor agonist is dexmedetomidine. It produces a sympatholytic action by hyperpolarizing noradrenergic neurons, triggering an inhibitory feedback loop, and decreasing norepinephrine release through the activation of Central nervous system pre- and post-synaptic α2-adrenoreceptors [6].

Due to its advantageous qualities, such as sedation without respiratory depression and effects that spare opioids, dexmedetomidine has been utilized extensively as an anesthetic adjuvant in anesthesia practice. It lowers blood pressure and heart rate by lowering sympathetic tone. Thus, the hemodynamic stability and hypotensive effects lessen intraoperative hemorrhage. Moreover, it reduces the stress reactions following surgery [7].

Aim of the work: this study aims to improve surgical field quality by decreasing blood loss in patients undergoing spine surgeries by using intravenous tranexamic acid or dexmedetomidine.

METHODS

This prospective randomized double-blind control clinical study was carried out at Zagazig University's Faculty of Medicine's Anesthesia, Intensive Care, and Pain Management Department Hospitals from December 2023 to June 2024 with Institutional Review Board (IRB number 11228-8-10-2023) approval. This study was registered in ClinicalTrial.gov NCT06587620. Each patient signed a written informed consent form 78 adult males and females who had an age range from 21–60 years, ASA I & II, BMI range from 18.5–30 kg/m2, underwent elective two-level lumbar decompression and fixation surgeries under general anesthesia, with operation time less than four hours, were included in the study.

Patients with a history of known medication allergies, disorders of the central nervous system and metabolic disorders, a history or risk of thrombosis or an active thromboembolic conditions, such as pulmonary embolism or deep vein thrombosis, with coagulopathies or medication use that impairs coagulation (INR >1.5, platelets <100,000/microliter of blood), and patients taking B-blockers, were excluded from the study.

Sample size: assuming that mean ± SD of the surgical field's Boezaart quality score for the group of tranexamic acid against dexmedetomidine group in endoscopic sinus surgeries was 1.72 ± 0.88 vs 2.33 ± 0.95 in a similar study (Ahmadi et al., 2023), Using the open epiprogram, the sample size was determined to be 78 patients (26 patients in each group), with a 95% confidence interval and an 80% test power.

Randomization: all patients were randomized using computer generated randomization table in 3 equal groups, each with 26 patients: The control group (group C) received a loading IV infusion of 50 milliliters of saline ten minutes prior to the induction of general anesthesia, followed by a maintenance IV infusion of saline. Ten minutes before general anesthesia was induced, the tranexamic acid group (group T) received a loading dose of 10mg kg of tranexamic acid over ten minutes. This was followed by a maintenance IV infusion of one milligram of tranexamic acid per kilogram per hour. Before the administration of general anesthesia, the dexmedetomidine group (group D) was given a loading dosage of 1 mg kg over ten minutes followed by a maintenance IV infusion of 0.3 to 0.7 mg kg per hour.

Preoperative assessment:

Preoperative interviews were conducted with all participating patients as part of their preoperative preparation. There was discussion over the study's purpose and outcomes. Technique comprehension was checked and highlighted. Informed written agreement was obtained after a history was gathered, a clinical examination was conducted, and all standard Laboratory testing were performed, including coagulation profile, liver and kidney function tests, and complete blood count Eight hours for solid meals and two hours for clear fluids should be fasted before the procedure.

Intraoperative preparation:

Two IV lines were placed; by the "4-2-1 rule" for deficit and maintenance, thirty minutes before surgery, midazolam (0.05 mg/kg) was given, and ringer lactate intravenous fluids were started. Full monitoring, including pulse oximetry, ECG, and non-invasive arterial blood pressure and capnogram, was applied ten minutes before the induction of anesthesia to record basal measurements.

The study drugs were given as follows:

The control group (group C) received a loading IV infusion of 50 milliliters of saline ten minutes prior to the induction of general anesthesia, followed by a saline maintenance intravenous infusion. Ten minutes before general anesthesia was induced, the tranexamic acid group (group T) received a loading dose of 10mg kg of tranexamic acid combined with fifty milliliters of saline. This was followed by a maintenance intravenous infusion of one milligram of tranexamic acid per kilogram per hour. The group dexmedetomidine (group D) received a loading dose of one microgram per kilogram of dexmedetomidine mixed with 50 milliliters of saline before the induction of general anesthesia, followed by a maintenance IV infusion of 0.3 to 0.7 mg kg per hour.

Induction of general anesthesia:

Intravenous fentanyl (2 µg/kg), propofol (2 mg/kg), and rocuronium (1 mg/kg) were administered to all groups. A suitable size cuffed endotracheal tube will be inserted orally and taped after confirming its placement by checking bilateral and equal axillary chest air entry and by capnography. Following induction, the intravenous dosage of paracetamol (15 mg/kg) was administered.

Maintenance of general anesthesia:

All groups received progressive doses of rocuronium 0.5 mg/kg every 45 minutes along with isoflurane inhalation at 1-2 minimal alveolar concentrations (MAC).

Oxygen saturation and hemodynamics (heart rate and mean arterial pressure) were continuously tracked and recorded in all three groups as soon as the procedure began after the patient was positioned, and then every 15 minutes until the procedure was completed. The patient would get 0.5 µg/kg of fentanyl intravenously if their heart rate or mean arterial pressure increased by more than 20% from their baseline levels. IV ephedrine 0.15 mg/kg was used to treat hypotension, which was defined as a drop in mean arterial pressure of more than 20% from baseline. Furthermore, in group D, dexmedetomidine would be halted if mean arterial pressure did not improve quickly, and once mean arterial pressure improved, dexmedetomidine would be re-titrated at a lower dose. The amount of blood loss was measured by measuring the amount of blood absorbed by the surgical pads and sponges as well as the amount of blood lost in the suction container.

Recovery period:

The research groups' medications were discontinued fifteen minutes prior to the conclusion of the procedure. To reverse muscular relaxation in all groups, neostigmine (0.05 mg/kg) and atropine (0.02 mg/kg) were administered. After that, the patients were moved to the PACU or post-anesthesia care unit. When an Aldrete score of nine or higher was obtained, all patients were released. The period of time between ending anesthesia and being released to the ward is known as the discharge time.

Data collection:

Throughout the procedure, the surgeon used the Boezaart [8] grading scheme to assess the operational field's visibility: Grade 0: No bleeding cadaveric conditions Grade 1: light

bleeding that can be stopped with suction, Grade 2: little bleeding that occasionally needs suctioning Grade 3: The surgical region is in danger a few seconds after the suction is released, there is some bleeding, and regular suctioning is required. Grade 4: Moderate bleeding poses an imminent threat to the surgical field, regular suctioning is necessary, and Grade 5: Severe bleeding, necessitates continuous suctioning; bleeding occurs more quickly than suction can stop; the surgical field is seriously endangered, and operation is typically not feasible.

The amount of blood in the suction container and the amount of blood absorbed by the surgical pads and sponges were used to quantify the amount of blood loss. A fully soaked pad (15 x 15 cm) can retain 100 to 150 ml of blood, while a fully soaked sponge (4 x 4 cm) may hold 10 ml.

Hemodynamics (heart rate and mean arterial pressure) were measured as a baseline, following induction, following patient placement, and then every 15 minutes until the procedure was completed.

Emergence time is the duration between stopping the anesthesia and the eye-opening in response to the vocal order, and it was recorded.

Discharge time is the period between ending anesthesia and being sent to the ward, and it was noted.

Within two hours after surgery, any adverse symptoms or problems, including bradycardia, tachycardia, hypotension, nausea, vomiting, and shivering, were noted.

Patient characteristics: age, sex, BMI, and ASA status of patients, pre and post-operative hemoglobin and hematocrit levels, and the duration of surgery were recorded.

Ethics Considerations:

This study was ethically approved by the Institutional Reviewer Board (IRB #11228-8-10-2023) in the Faculty of Medicine, Zagazig University at Anesthesia, Intensive Care, and Pain Management Department Hospitals from December 2023 to June 2024. This study was registered in ClinicalTrial.gov NCT06587620. Each patient signed a written informed consent form

Statistical Analysis

The statistical package for the social sciences, or SPSS, version 26 was used to analyze the data. The chi-square test and, when applicable, Monte Carlo tests were used to compare categorical variables, which were presented using their absolute frequencies. Assumptions for parametric testing were validated using the Kolmogorov-Smirnov test. Depending on the type of data, the means, standard deviations, median, and interquartile range were used to characterize quantitative variables. The independent sample t test (for normally distributed data) was developed to compare quantitative data between two groups. The Kruskal Wallis test for non-normally distributed data and the one-way ANOVA test for normally distributed data were used to compare quantitative data between two groups. Tukey HSD and pairwise comparison were performed to identify differences between each of the two individual groups where the difference was significant. $P<0.05$ was chosen as the threshold for statistical significance. There was a highly significant difference if $p\leq0.001$.

RESULTS

Seventy-eight patients were assessed for eligibility. No patients were excluded. They were allocated to three groups; group C, group T, and group D. All patients in the three groups were followed up and analyzed. The groups under study did not differ statistically in terms of age, sex, ASA, or body mass index. (BMI) (Table 1S).

The study groups did not vary statistically in terms of mean arterial blood pressure (MAP) at baseline, 30 minutes intraoperatively, or after induction. Mean arterial blood pressure (MAP) varied statistically significantly across the study groups at post-positioning time, 15 minutes, 45 minutes, and 225 minutes intraoperatively as follows: At post-positioning and from 15 to 210 minutes, MAP was considerably lower in the dexmedetomidine group than in the control group. The MAP of the dexmedetomidine

group was substantially lower than that of the tranexamic acid group at 195 and 210 minutes. The MAP of the control group was noticeably greater than that of the tranexamic acid group at 60, 75, 90, 105, 120, 135, and 180 minutes (Figure 2).

Regarding baseline heart rate (HR), there was a statistically non-significant difference between the studied groups. There was a statistically significant difference between the studied groups regarding heart rate (HR) from post-induction till 225 minutes intraoperative as follows: HR was significantly lower in the dexmedetomidine group than each other group at post-induction, post-positioning, 15, 30, 120, 135, 150, 165, 180, 195 and 210 minutes. HR was significantly higher in control group than the other group at 60, 75, 90, and 105 minutes. HR was significantly lower in the dexmedetomidine group than control group at 45 and 60 minutes (figure 3).

Regarding oxygen saturation over time, there is no statistically significant difference between the groups under study (Table 2S).

There was statistically **significant** reduced blood loss in the tranexamic group compared to the control and dexmedetomidine groups. Additionally, blood loss was **significantly** lower in the dexmedetomidine group compared to the control group. Additionally, there was a statistically **significant** difference between the studied groups regarding blood transfusion as it was **significantly** higher in the control group than other groups; about 23% within the control group versus 0% and 3.8% within tranexamic and dexmedetomidine groups respectively received two units of blood (Table 1).

Hemoglobin and hematocrit levels before and after surgery did not differ statistically significantly among the groups under study. Nevertheless, there was a statistically **significant** decrease in postoperative hemoglobin and hematocrit levels than preoperative levels within each group (Table 2).

There was a statistically **significant** increase in hypotension and bradycardia in the dexmedetomidine group than in other groups (Table 3).

Compared to the control and dexmedetomidine groups, the tranexamic group's surgical duration was statistically significantly shorter. The emergence and discharge times of the dexmedetomidine group were significantly longer than those of the other groups. As, it is the fastest compared to the other sedatives, but it is slow compared to tranexamic acid and saline which do not have sedative effects. The groups under investigation do not differ statistically significantly in terms of surgical field scores. The tranexamic acid group had more patients with a surgical field score of 1 than the other groups. Furthermore, the surgical field score of three was lower in the tranexamic acid group than in the other groups, but this difference was not statistically significant (Table 4).

Table (1) Comparison between the studied groups regarding the amount of blood loss and blood transfusion.

	Control group n=26	Tranexamic acid group n=26	Dexmedetomidine group n=26	KW	p
Blood loss (ml) **Median(IQR)**	650(450 – 825)	280(240 – 312.5)	315(267.5 – 500)	37.968	<0.001**
Tukey HSD	P_1 **0.001****	P_2 **0.038***	**P_3** <0.001**		
Blood transfusion: n (%)				MC	0.038*
None	16 (61.5%)	21 (80.8%)	19 (73.1%)		
One unit	4 (15.4%)	5 (19.2%)	6 (23.1%)		
Two units	6 (23.1%)	0 (0%)	1 (3.8%)		

KW Kruskal Wallis test, χ^2 Chi-square test, MC Monte Carlo test, p1 difference between control group and tranexamic acid group, p2 difference between Dexmedetomidine and tranexamic acid group, p3 difference

between Dexmedetomidine and control groups, *p<0.05 is statistically significant, **p≤0.001 is statistically highly significant.

Table (2) Comparison between the studied groups regarding hemoglobin and hematocrit levels pre and postoperatively.

	Control group n=26	Tranexamic acid group n=26	Dexmedetomidine group n=26	F	p
Hemoglobin (g/dl) **Mean ± SD**					
Pre	12.79 ± 1.04	12.39 ± 1.39	12.15 ± 1.035	1.645	0.2
Post	11.48 ± 1.12	11.72 ± 1.43	11.34 ± 1.45	0.534	0.588
P (t)	<0.001**	<0.001**	<0.001**		
Hematocrit (%) **Mean ± SD**					
Pre	38.41 ± 3.21	37.56 ± 4.32	36.72 ± 3.91	1.256	0.291
Post	34.44 ± 3.43	35.27 ± 4.24	33.97 ± 4.37	0.686	0.507
P (t)	<0.001**t	<0.001**t	<0.001**t		

F One-way ANOVA test, t Paired sample t-test, **p≤0.001 is statistically highly significant.

Table (3) Comparison between the studied groups regarding side effects.

Side effects	Control group **N=26**	Tranexamic acid group **N=26**	Dexmedetomidine group **N=26**	χ^2	p
None	13 (50%)	15 (57.7%)	13 (50%)		
Bradycardia	0 (0%)	1 (3.8%)	2 (7.7%)		
Hypotension	1 (3.8%)	4 (15.4%)	2 (7.7%)	MC	<0.001**
Hypotension/bradycardia	0 (0%)	2 (7.7%)	7 (26.9%)		
Nausea	1 (3.8%)	1 (3.8%)	0 (0%)		
Shivering	3 (11.5%)	1 (3.8%)	0 (0%)		
Tachycardia	4 (15.4%)	0 (0%)	0 (0%)		
Vomiting	4 (15.4%)	2 (7.7%)	2 (7.7%)		

χ^2 Chi square test, MC Monte Carlo test*p≤0.001 is statistically highly significant.

Table (4) Comparison between the studied groups regarding duration of surgery, emergence time, discharge time, and surgical field score.

	Control group n=26	Tranexamic acid group n=26	Dexmedetomidine group n=26	F	p
Duration of surgery (h) **Mean ± SD**	3.45 ± 0.35	3.11 ± 0.32	3.43 ± 0.27	9.482	<0.001**
Tukey HSD	P_1 **0.001****	P_2 **0.002***	**P_3** 0.95		
Emergence time (min)	13.08 ± 2.08	13.0 ± 1.98	14.58 ± 1.94	5.135	0.008*
Tukey HSD	P_1 0.989	P_2 **0.016***	**P_3 0.023***		
Discharge time (min)	20.19 ± 3.6	19.77 ± 2.8	23.0 ± 3.15	7.822	<0.001**
Tukey HSD	P_1 0.88	P_2 **0.001****	**P_3 0.006***		
Surgical field score: n(%)					
1	2 (7.7%)	8 (30.8%)	5 (19.2%)	5.547	0.236
2	15 (57.7%)	14 (53.85)	14 (53.8%)		
3	9 (34.6%)	4 (15.4%)	7 (26.9%)		

F One way ANOVA test, HSD highest significant difference, χ^2 Chi-square test, p1 difference between the control group and tranexamic acid group, p2 difference between Dexmedetomidine and tranexamic acid group, p3 difference between Dexmedetomidine control groups, *p<0.05 is statistically significant, **p≤0.001 is statistically highly significant.

Table (1S) Patient characteristics among the study groups.

	Control group	Tranexamic acid group	Dexmedetomidine group	χ^2	p
	n=26	**n=26**	**n=26**		
Age (year): Mean ± SD	43.35 ± 6.91	43.27 ± 7.48	43.19 ± 7.25	0.003	0.997
Sex: n (%) **Female** **Male**	 12 (46.2%) 14 (53.8%)	 12 (46.2%) 14 (53.8%)	 12 (46.2%) 14 (53.8%)	 0	 >0.999
BMI (kg/m^2) Mean + SD	24.54 ± 2.49	24.35 ± 2.7	24.42 ± 2.75	0.035	0.966
ASA: n (%) I II	 18 (69.2%) 8 (30.8%)	 15 (57.7%) 11 (42.3%)	 16 (61.5%) 10 (38.5%)	 0.768	 0.681
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	F	p

F One-way ANOVA test, χ^2 Chi-square test, ASA American Society of Anesthesiologists, BMA Body Mass Index.

Table (2S) Comparison between the studied groups regarding oxygen saturation over time.

	Control group n=26	**Tranexamic acid group n=26**	**Dexmedetomidine group n=26**	**F**	**p**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**		
Basal	97.77 ± 1.14	98.23 ± 1.03	98.23 ± 1.03	1.613	0.206
Post-induction	99.38 ± 0.5	99.54 ± 0.51	99.58 ± 0.5	1.065	0.35
Post-positioning	99.73 ± 0.45	99.69 ± 0.55	99.54 ± 0.58	0.956	0.389
15 minutes	99.58 ± 0.5	99.73 ± 0.45	99.73 ± 0.45	0.928	0.4
30 minutes	99.58 ± 0.64	99.5 ± 0.76	99.5 ± 0.76	0.098	0.907
45 minutes	99.27 ± 0.72	99.38 ± 0.8	99.42 ± 0.81	0.274	0.761
60 minutes	99.54 ± 0.65	99.65 ± 0.63	99.65 ± 0.49	0.33	0.72
75 minutes	99.77 ± 0.43	99.69 ± 0.2	99.81 ± 0.4	2.1	0.13
90 minutes	99.62 ± 0.64	99.54 ± 0.71	99.42 ± 0.7	0.523	0.595
105 minutes	99.58 ± 0.76	99.54 ± 0.81	99.62 ± 0.64	0.07	0.923
120 minutes	99.69 ± 0.47	99.81 ± 0.4	99.69 ± 0.47	0.573	0.567
135 minutes	99.42 ± 0.64	99.62 ± 0.64	99.62 ± 0.57	0.839	0.436
150 minutes	99.69 ± 0.47	99.88 ± 0.33	99.77 ± 0.43	1.426	0.247
165 minutes	99.81 ± 0.4	99.92 ± 0.27	99.81 ± 0.4	0.872	0.422
180 minutes	99.77 ± 0.43	99.65 ± 0.49	99.62 ± 0.5	0.752	0.475
195 minutes	100.0 ± 0.0	100.0 ± 0.0	99.86 ± 0.36	2.272	0.114
210 minutes	99.83 ± 0.39	99.83 ± 0.41	99.86 ± 0.36	0.015	0.985
225 minutes	100.0 ± 0.0	99.75 ± 0.46	-	2.022	0.179
240 minutes	100.0 ± 0.0	-	-	-	-

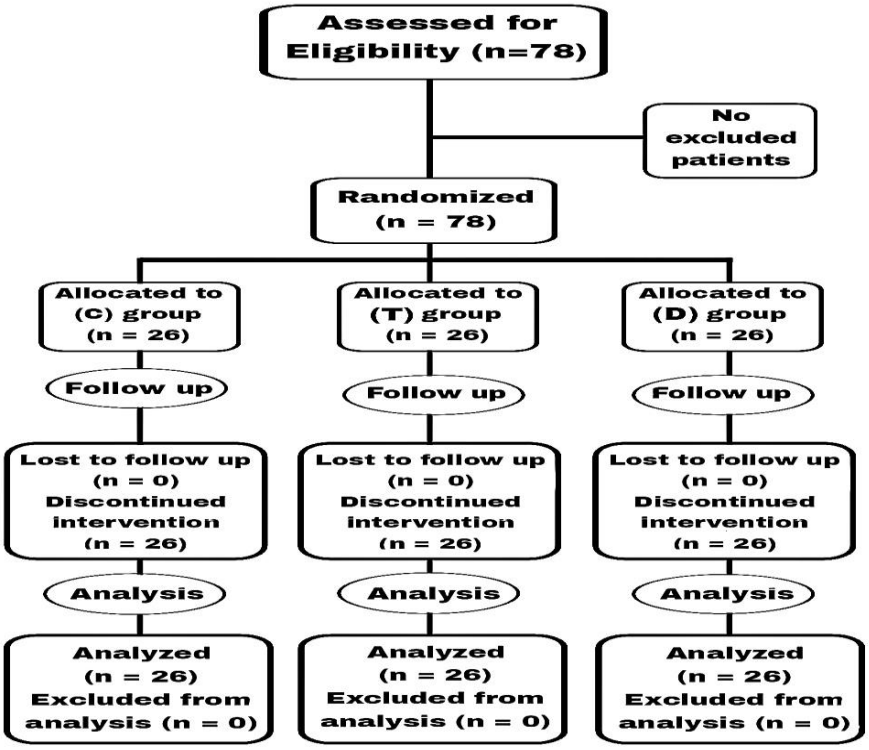

Figure (1): Study flow chart (Consort)

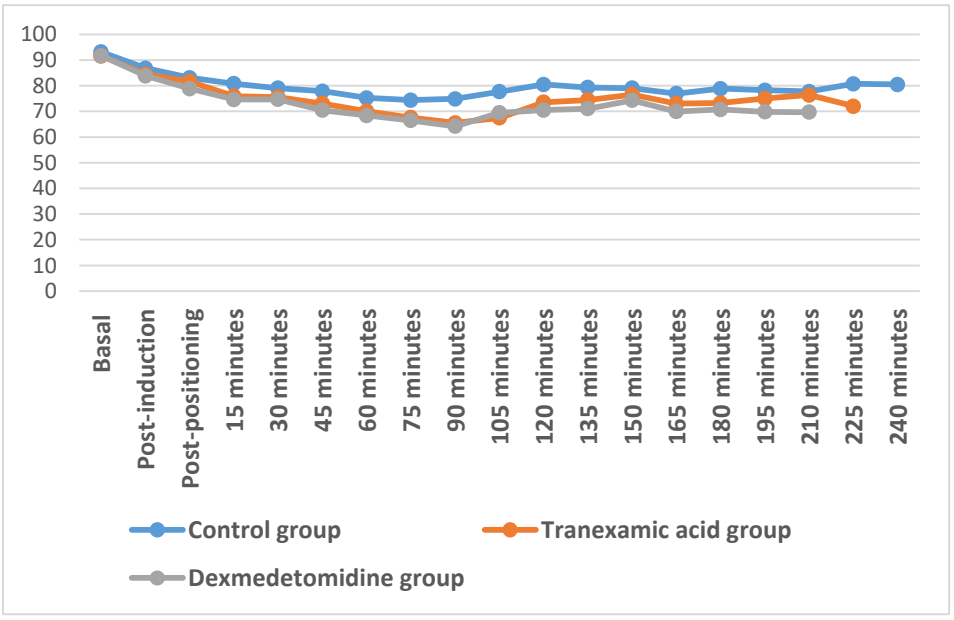

Figure (2) Multiple line graph showing comparison between groups regarding mean arterial blood pressure over time

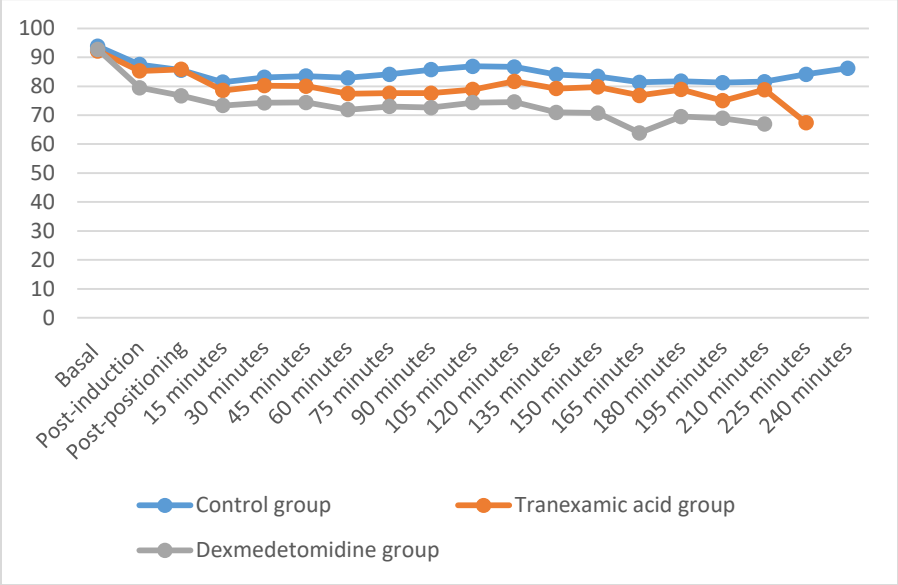

Figure (3) Multiple line graph showing a comparison between groups regarding heart rate over time.

DISCUSSION

Due to the proximity of important and extremely delicate neurologic structures, improving the surgical field is particularly important for spine surgeries. By enhancing vision of the surgical area, reducing the danger of nerve damage at the root level, improving the surgeon's technical comfort, and cutting down on operating time, less bleeding makes this form of surgery safer [2].

Epidural blocks, local vasoconstrictors, controlled blood pressure reduction, and chemical and biological medications such as tranexamic acid, aprotinin, desmopressin epsilon, aminocaproic acid, and dexmedetomidine are some hemostasis techniques [3].

Examining the effects of dexmedetomidine, saline, and tranexamic acid on hemodynamics, blood loss, blood transfusion, and the decline in hemoglobin and hematocrit after surgery, surgical duration, and surgical field quality in patients undergoing lumbar decompression and fixation surgery at two levels was the goal of the current study. In this study, 78 adult patients were randomly assigned to three equal groups, each consisting of 26 patients.

According to the findings, tranexamic acid outperformed other research medications in reducing blood loss and blood transfusions, furthermore, dexmedetomidine produced greater hypotensive and bradycardiac effects. Compared to other groups, the tranexamic acid group showed shorter surgical, emergence, and discharge times. The surgical field scores of the three groups did not differ statistically significantly.

Regarding the degree of hemoglobin and hematocrit decline, blood transfusions, and blood loss, our research showed that the tranexamic group experienced much less blood loss than the control and dexmedetomidine groups. Furthermore, compared to the control group, it was much lower in the dexmedetomidine group. The control group received far more blood transfusions than the other groups. Within each group, hemoglobin and hematocrit levels decreased statistically significantly after surgery compared to preoperative values.

A study conducted by Yu et al. [9] in patients undergoing brain meningioma resection, showed that tranexamic acid was preferable because it significantly reduced blood loss. According to Sun et al. [10], patients undergoing total knee arthroplasty experienced less blood loss and no increased risk of complications when receiving tranexamic acid.

These results were validated by research by Alhomoud [11] who showed that tranexamic acid reduced capillary oozing, thus increasing the operative field visibility. It may be an efficient and cheap method to control bleeding during laparoscopic sleeve gastrectomy. These results support our findings.

Furthermore, in research comparing dexmedetomidine and tranexamic acid in endoscopic sinus surgery to enhance surgical field quality, Ahmadi et al. [3] found that the dexmedetomidine group consistently experienced a considerably lower rate of bleeding than the control group. Additionally, according to Ruku et al. [2], in the dexmedetomidine group, there was significantly reduced intraoperative blood loss than the nitroglycerin and esmolol groups as measured using the Modified Gross Formula. In a different study by Rokhtabnak et al., [12], the dexmedetomidine group experienced less bleeding than the MgSO4 group. These findings concur with our findings as well.

Regarding MAP, according to the current study, MAP was significantly lower in the dexmedetomidine group than in the control group in most cases. It was also significantly lower in the dexmedetomidine group than in the tranexamic acid group at 195 and 210 minutes.

These findings are consistent with a double-blind clinical experiment conducted by Mathew et al., [14] after trans-sphenoidal pituitary surgery, which showed that in the dexmedetomidine group, there was a substantial drop in mean blood pressure compared to the control group.

Our findings were corroborated by Ruku et al. [2], who compared the effects of dexmedetomidine, nitroglycerin, and esmolol in inducing controlled hypotension during spine surgeries. The study found that the MAP in the dexmedetomidine group was significantly lower than that of the nitroglycerin and esmolol groups until 40 minutes after extubation and during the hypotensive period.

Regarding HR, the current study demonstrates that, for the most part, HR was much lower in the dexmedetomidine group than in the other groups. Furthermore, it was frequently significantly lower in the tranexamic acid group than in the control group.

These findings are consistent with those of Bajwa et al. [14], who produced controlled hypotension using functional endoscopic sinus surgery. The dexmedetomidine group's heart rate was significantly lower than that of the nitroglycerin and esmolol groups at every measurement period.

According to a study on spine surgeries conducted by Ruku et al. [2], which supports our findings, the nitroglycerin group's heart rate was significantly higher than that of the dexmedetomidine and esmolol groups at every time point, with no discernible intergroup differences in heart rate between the dexmedetomidine and esmolol groups at any point in time.

According to the current study, the dexmedetomidine group experienced a considerably higher incidence of hypotension and bradycardia than the other groups. One noteworthy aspect of the therapy groups was that none of the patients experienced serious or potentially fatal side effects.

In a study conducted on endoscopic sinus surgery, Ahmadi et al. [3] discovered that eight patients in the dexmedetomidine group experienced hypotension/bradycardia, while six patients in the tranexamic acid group reported nausea and vomiting, however, the results fell short of the statistically significant threshold.

No significant adverse effects were noted in either of the nitroglycerin, esmolol, or dexmedetomidine groups in Bajwa et al. [14]. Dry mouth was the most common adverse event in the dexmedetomidine group (26%). There was a considerably decreased incidence of postoperative shivering in the dexmedetomidine group.

The current study showed that the tranexamic group had a significantly lower surgical duration than the other groups in terms of emergence time, discharge time, and duration of surgery. Compared to other groups, the dexmedetomidine group experienced much longer emergent and discharge periods.

In Ahmadi et al., [3], While not statistically significant, the dexmedetomidine group had surgery for a longer duration than the tranexamic acid group. Ruku et al. conducted a clinical trial in which [2], the dexmedetomidine group experienced a longer emergence time than the nitroglycerin and esmolol groups, which was statistically significant. Furthermore, the emergence time was considerably shorter for the nitroglycerin and esmolol groups than for the dexmedetomidine group, according to Bajwa et al. [14].

The current study revealed that the tranexamic acid group had a higher number of patients with surgical field score 1 (8 patients) than other groups according to the Boezaart score. Additionally, compared to other groups, the tranexamic acid group had fewer patients with surgical field score 3 (4 patients), although this difference was not statistically significant.

These findings concur with those of Modir et al. [4], who stated that the surgical field score did not significantly differ among the three groups (nitroglycerin), dexmedetomidine, and tranexamic acid). The effects of dexmedetomidine and tranexamic acid on bleeding during rhinoplasty were evaluated by Hassani et al. [16], they discovered that the average surgeon satisfaction level and the effectiveness of tranexamic acid and dexmedetomidine were identical. According to Berenjian et al. [16], dexmedetomidine and tranexamic acid were equally effective. While dexmedetomidine may be a good option for rhinoplasty when the bleeding volume is not significant, tranexamic acid lowers bleeding in big procedures. Our findings are supported by all of these earlier studies.

Tranexamic acid was reported to be useful in reducing blood loss and enhancing the surgical field's quality by Alhomoud [11]. According to Ahmadi et al. [3], the tranexamic acid group's surgical field quality was superior to that of the dexmedetomidine group.

CONCLUSIONS

In spine procedures, tranexamic acid and dexmedetomidine both reduced blood loss and blood transfusions more effectively than the control group, with tranexamic acid being more successful than dexmedetomidine. The three groups' improvements in surgical field score did not differ significantly. Furthermore, tranexamic acid outperformed the control and dexmedetomidine groups in terms of operative time reduction.

Conflicts of Interest

The authors report no conflicts of interest.

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