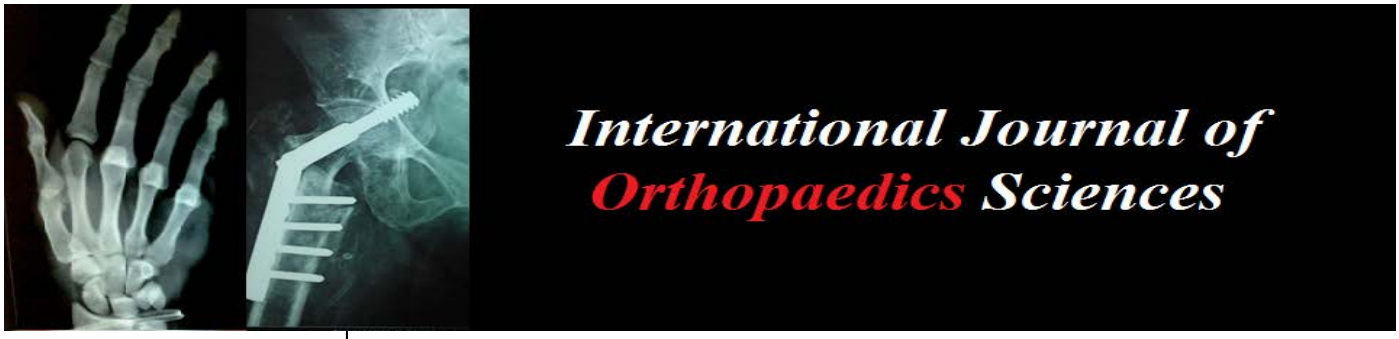

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Comparative evaluation of blood parameters in patients undergoing cephalomedullary nailing for hip fractures

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Abstract
Background: With the rapid increase in the aged population, hip fractures increase rapidly in elderly people and cause a significant social and economic problem. Dynamic hip screw with barrel plate and cephalomedullary nails are the usual methods of internal fixation in these fractures. The former method is associated with significant exposure and dissection for application of the plate. Hip fractures are commonly associated with a relatively large amount of blood loss from the initial injury in addition to blood loss resulting from surgery.
Aim: The current study was conducted with the main purpose to evaluate the concentration of hemoglobin (Hb) and packed cell volume (PCV) in patients undergoing cephalomedullary nailing fixation of hip fractures receiving tranexamic acid (TXA) in comparison with not receiving TXA.
Methods: This is a prospective comparative study done with eligible in-patients (n=71) with hip fractures, planned for cephalomedullary nailing in Department of Orthopaedics and Traumatology, Meenakshi Mission Hospital and Research Centre, Tertiary Health Care Centre, Madurai, Tamilnadu. All eligible patients were divided into two groups *viz.* Group T and Group S. For Group T (TXA Group), intravenous infusion of TXA at the dose level of 15 mg/kg was given at the time of inducing anaesthesia i.e., 15 minutes before skin incision in surgery. For Group S (Saline Group) intravenous infusion of normal saline at the dose level of 15 mg/kg was given at the time of inducing anaesthesia i.e., 15 minutes before skin incision in surgery. The concentration of hemoglobin (Hb) packed cell volume (PCV) was estimated using standardized methods in Group T and Group S and were compared.
Results: Patients who received TXA had significantly ($p<0.05$) lesser fall in Hb concentration and PCV on post-op day 1 and day 2.
Conclusion: Tranexamic acid plays a significant role in reducing postoperative decrease in concentration of Hb and PCV in patients undergoing cephalomedullary nailing fixation of hip fractures but does not necessarily reach the preoperative levels.

Keywords: Tranexamic acid, cephalomedullary nailing, hip fractures, hemoglobin, PCV

Introduction
With the rapid increase in the aged population, hip fractures increase rapidly in elderly people and cause a significant social and economic problem [1]. Intertrochanteric fractures represent one of the common types of hip fractures, and the 1-year mortality rate after intertrochanteric fractures is reported to be approximately 25% [2]. Dynamic hip screw with barrel plate and cephalomedullary nails are the usual methods of internal fixation in these fractures. The former method is associated with significant exposure and dissection for application of the plate [3, 4]. Hip fractures are commonly associated with a relatively large amount of blood loss from the initial injury in addition to blood loss resulting from surgery. A range of between 20-60% of patients require blood transfusions after surgery, which may result in an increase in postoperative infections, increased length of hospital stay [5].
Studies have shown that gender, body weight and height are not good predictors of blood loss. Whereas, a positive correlation exists between operative time, anesthetic technique, operative approach, exposure to nonsteroidal antiinflammatory drugs, and the preoperative hemoglobin and hematocrit levels [6, 7]. The primary concern raised in evaluating blood loss revolves around whether or not the surgical patient requires transfusion.

Allogenic transfusions must provide optimal blood perfusion for recovery of the surgery but minimized to avoid fluid overload, respect ethical/religious concerns, and reduce exposure to bloodborne pathogens [8, 9]. Autologous blood transfusions have their own unique risks including iatrogenic anemia, and increased cost per unit of blood when compared to allogenic blood [10-12].

Furthermore, postoperative anemia may contribute to poor wound healing, infection, delay in recovery of joint function, and delayed rehabilitation [13]. There is a relative lack of data which shows the pattern of blood loss and its effect in the occurrence of anemia in the postoperative period in patients undergoing total hip arthroplasty. Moreover, to the best of our literature knowledge there are scarce of studies on blood parameters especially concentration of hemoglobin (Hb) and packed cell volume (PCV) in patients undergoing cephalomedullary nailing fixation of hip fractures. With this background, the current study was designed with the main aim to evaluation of the concentration of hemoglobin (Hb) and packed cell volume (PCV) in patients undergoing cephalomedullary nailing fixation of hip fractures receiving tranexamic acid (TXA) in comparison with not receiving TXA.

Materials and Methods

Ethical Approval

This study was approved by the Institutional Research and Ethics board of Meenakshi Mission Hospital and Research centre, Madurai, Tamilnadu.

Study Area and Patients

All eligible in-patients (n=71) with hip fractures, planned for cephalomedullary nailing in Department of Orthopaedics and Traumatology, Meenakshi Mission Hospital and Research Centre, Tertiary Health Care Centre, Madurai, Tamilnadu.

Study Design

This is a prospective comparative study done to assess the efficacy of tranexamic acid in reducing blood loss in patients with cephalomedullary nailing surgery in hip fractures. All eligible patients who are willing to be in compliances with the inclusion criteria were included in the study. The inclusion criteria are as follows; he/she i). should willing to provide consent, ii). Patients with acute intertrochanteric femur fracture, iii). Patients with basicervical neck of femur fracture. and iv). Patients over the age of 18 years.

All eligible patients were divided into two groups *viz*. Group T and Group S. For Group T (TXA Group), intravenous infusion of TXA at the dose level of 15 mg/kg was given at the time of inducing anaesthesia i.e., 15 minutes before skin incision in surgery. For Group S (Saline Group) intravenous infusion of normal saline at the dose level of 15 mg/kg was given at the time of inducing anaesthesia i.e., 15 minutes before skin incision in surgery.

Methodology

15 mg/kg of TXA (cyklokapron) diluted in 100 mL of normal saline was infused intravenously over 10 minutes about 15 minutes before skin incision.

Operative procedure: All operations were performed by six experienced Orthopaedic surgeons. Prophylactic antibiotics were administered 30-60 min before operation. Either spinal or general anesthesia was administered, and the patients were positioned on the fracture traction table. Reduction was performed under C-arm fluoroscopy. Intramedullary nail or Proximal femoral nail was inserted using the minimally invasive technique. After closed reduction, an approximately 5 cm longitudinal skin incision was made proximal to the femoral greater trochanter. The tip of the greater trochanter was exposed by incision of the fascia and the gluteus medius. A guide wire was introduced into the femoral medullary canal from the lateral aspect of the greater trochanter, and the intramedullary nail or Proximal femoral nail was inserted through the guidewire. The blade was located in the lower half of the femoral head and neck in the anteroposterior view and centrally in the lateral view; the tip was inserted 5-10 mm into subchondral bone. The distal locking screw was inserted under an aiming device and was statically locked.

Postoperative management: Antibiotic prophylaxis was administered routinely for 48 hours postoperatively. The volume of fluid transfusion was determined by the surgeon in charge according to the patient's blood pressure and amount of oral intake. Low-molecular-weight heparin was administered routinely every 24 hours postoperatively for 2 weeks to prevent thromboembolism. Active functional exercises were encouraged from postoperative day 1. The continuous passive motion was started in all patients on the second postoperative day. Partial weight-bearing with a walker was started within 1-week postoperatively in stable fractures treated with satisfactory reduction and internal fixation; in those with unstable fractures, this was started 2–3 weeks postoperatively.

The concentration of hemoglobin (Hb) packed cell volume (PCV) was estimated using standardized methods in Group T and Group S and were compared.

Statistical Analysis

Data were edited manually, entered in MS-Excel (Office 365 Version) and analyzed using SPSS version 20. The continuous variables were expressed as Mean and Standard deviation. Categorical variables were expressed as frequency and percentage. Independent sample t-test was used to find the significance difference between groups. Univariate and Multivariable analysis, Chi-square test and Fisher's exact tests were used to find out association between the categorical variables. $P<0.05$ was considered as statistically significant.

Results

Patients who received TXA (Group T) had lesser fall in Hb concentration on post-op day 1 (2.90-1.00 = 1.80) than the control group (Group S) and this difference was found to be statistically significant (Table 1).

Table 1: Comparision of hemoglobin profile on post-operative day 1

Variables	Group T	Group S	P-Value
Pre-Op Hb	10.30 ± 2.30	11.60 ± 2.00	0.010
Post-Op Day 1 Hb	9.30 ± 2.00	8.70 ± 1.80	0.252
Mean Difference	1.00	2.90	

Values are expressed as Mean ± S.D; n=71

Patients who received TXA (Group T) had lesser fall in Hb concentration on post-op day 2 (2.20-0.50 = 1.70) than the control group (Group S) and this difference was found to be statistically significant (Table 2).

Table 2: Comparision of hemoglobin profile on post-operative day 2

Variables	Group T	Group S	P-Value
Pre-Op Hb	10.30 ± 2.30	11.60 ± 2.00	0.010
Post-Op Day 2 Hb	9.80 ± 1.80	9.40 ± 1.50	0.390
Mean Difference	0.50	2.20	

Values are expressed as Mean ± S.D; n=71

Patients who received TXA (Group T) had lesser fall in PCV on post-op day 1 (8.10-2.80 = 5.30) than the control group (Group S) and this difference was found to be statistically significant (Table 3).

Table 3: Comparision of hemoglobin profile on post-operative day 1

Variables	Group T	Group S	P-Value
Pre-Op PCV	32.10 ± 7.00	35.40 ± 6.50	0.045
Post-Op Day 1 PCV	29.30 ± 6.00	27.30 ± 5.70	0.153
Mean Difference	2.80	8.10	

Values are expressed as Mean ± S.D; n-71

Patients who received TXA (Group T) had lesser fall in PCV on post-op day 2 (5.80-1.20 = 4.60) than the control group (Group S) and this difference was found to be statistically significant (Table 4).

Table 4: Comparision of hemoglobin profile on post-operative day 2

Variables	Group T	Group S	P-Value
Pre-Op PCV	32.10 ± 7.00	35.40 ± 6.50	0.045
Post-Op Day 2 PCV	30.90 ± 5.80	29.60 ± 5.30	0.305
Mean Difference	1.20	5.80	

Values are expressed as Mean ± S.D; n-71

Discussion

Due to the lack of studies specifically analysing the validity of estimated blood loss, a ubiquitously used clinical value the current study was conducted with the main purpose to evaluate the concentration of hemoglobin (Hb) and packed cell volume (PCV) in patients undergoing cephalomedullary nailing fixation of hip fractures in patients receiving TXA in comparison with not receiving TXA. Our study findings revealed that patients who received TXA had significantly (p<0.05) lesser fall in Hb concentration and PCV on post-op day 1 and day 2. These finidngs were comparable with literature findings reported by various other research investigators where in the postoperative drops in Hb and PCV have been reported in patients undergoing THA and TKA patients which involved blood transfusion to the patients at various time intervals in relation to the surgery.

Keating *et al*., studied the postoperative drop in Hb separately in unilateral and bilateral TKA patients, and reported it to be 3.85 (%) and 5.42 (%) respectively suggesting that the patients undergoing bilateral TKA had higher drop in Hb compared to the unilateral TKA patients [14]. Whereas, in our study the drop in Hb concentration was found to be 1.80 (%) and 1.70 (%). This difference can be explained by the development of newer techniques over time, such as the routine usage of tranexamic acid. Similarly, Wallis *et al*., reported Hb levels of 13.6±1.3 g% preoperatively, 10.4 ± 1.3 g%, 10.5±1.5 g%, 12.4±1.3 g%, and 12±1.2 g% on postoperative days 1, 7, 28, and 56 respectively [15]. Significant lower Hb levels on day 56 of surgery indicated that the duration taken for the Hb to revert to preoperative levels is more than 56 days.

Prasad *et al*., measured PCV levels in postoperative TKA patients and reported values were 35.9%±4.68% preoperatively, followed by 29.95%±4.12%, 28.7%±3.9%, 9.29%±3.34%, and 29.63%±3.49% postoperatively on days 1, 2, 7, and 14, respectively [16]. In a systematic review of 13 studies involving THA or TKA patients conducted by Spahn reported that the mean decrease in Hb levels was observed from preoperative levels of 13.6±0.4 g% to 10.6 ± 0.8 g% postoperatively [17]. Furthermore, in an another study reported by Ugbeye *et al*., in Lagos revealed that the postoperative Hb loss in THA patients was reported to be 2.1 ± 1.1 g% [18].

Our study has a few limitations like small sample size, restrictive blood transfusion practice, and a short follow-up.

Conclusion

In conclusion the study findings demonstrated that there was significant decrease in concentration of Hb and PCV in patients undergoing cephalomedullary nailing fixation of hip fractures and who did not receive tranexamic acid. Tranexamic acid plays a significant role in reducing postoperative decrease in concentration of Hb and PCV but does not necessarily reach the preoperative levels.

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Conflicts of Interest

None to declare

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