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Original Article

Chemical Thromboprophylaxis Is Not Necessary to Reduce Risk of Thromboembolism With Tranexamic Acid After Total Hip Arthroplasty

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ABSTRACT

Background: The major concern with the use of tranexamic acid is that it may promote a hypercoagulable state and increase the risk of deep vein thrombosis (DVT) and pulmonary embolism (PE), particularly when chemical thromboprophylaxis is not used. The objective of this study was to ascertain whether tranexamic acid reduces blood loss and transfusion amounts and increases the prevalence of DVT and PE in the patients undergoing primary cementless total hip arthroplasty (THA) without the use of routine chemical thromboprophylaxis.
Methods: There were 480 patients (582 hips) in the control group who did not receive tranexamic acid and 487 patients (584 hips) in the study group who received tranexamic acid. Mechanical compression device was applied without any chemical thromboprophylaxis. Transfusion rates and volumes were recorded. DVT was diagnosed using both sonogram and venogram at 7 or 8 days postoperatively. All patients had pre- and postoperative perfusion lung scanning to defect pulmonary embolism (PE).
Results: Intraoperative (614 vs 389 mL) and postoperative blood loss (515 vs 329 mL) and transfusion volumes (3 units vs 1.5 units) were significantly lower ($P < .001$) in the tranexamic acid group. The prevalence of DVT was 15% (87 of 582 hips) in the control group and 18% (105 of 584 hips) in the tranexamic acid group. No fatal PE occurred in either group.
Conclusion: The use of tranexamic acid reduces the volume of blood transfusion and does not increase the prevalence of DVT or PE in the patients who did not receive routine chemical thromboprophylaxis after primary cementless THA.

Although there are still controversial, numerous studies have confirmed that intravenous tranexamic acid could effectively reduce blood loss and transfusion in total hip arthroplasty (THA) and total knee arthroplasty [1-7]. However, there are concerns that its use can increase the potential risk of deep vein thrombosis (DVT) and pulmonary embolism (PE). Many studies have reported that tranexamic acid did not increase the prevalence of DVT in THA [2,8,9], yet most of these studies used routine chemical thromboprophylaxis in THA. If routine chemical thromboprophylaxis is not used, the risk of thromboembolism and PE may increase with the use of tranexamic acid in THA.

The objective of this retrospective case-control study was to ascertain whether tranexamic acid (1) reduces blood loss and transfusion amounts and (2) increases the prevalence of DVT and PE in the patients undergoing primary THAs without the use of routine chemical thromboprophylaxis.

Materials and Methods

From January 2008 to January 2015, 967 consecutive patients 1166 hips (1 hip in 768 patients, and both hips in 199 patients) underwent primary THAs with mechanical compression only for the prevention of DVT. All adult patients (patients over the age of 20 years) who were scheduled for primary cementless THA at our institute were eligible for inclusion in the study. We excluded patients who had either a history of ischemic heart disease, chronic renal failure on hemodialysis, cerebral infarction, previous DVT, thrombophilia associated with genetic disease or bleeding disorders, and those who were currently receiving anticoagulant

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therapy. All procedures were approved by the internal review board of our institution, and all patients gave informed consent for inclusion in our study. There were 480 consecutive patients (582 hips) in the control group who did not receive tranexamic acid and 487 patients (584 hips) in the study group, all of who received tranexamic acid as part of their operative care. The control group contained 480 patients who had undergone primary cementless THAs from January 2008 to February 2012. The tranexamic acid group contained 487 patients who had undergone primary cementless THAs from March 2012 to February 2015. The reason why we prescribed tranexamic acid to patients from March 2012 was that tranexamic acid was not available to until March 2012.

In the control group, there were 252 men and 228 women with a mean age of 57.4 years (range, 28-92 years). In the tranexamic acid group, there were 257 men and 230 women, with a mean age of 58.1 years (range, 25-96 years). Their characteristics are summarized in Table 1. All patients were asked to discontinue taking aspirin-containing compounds and any other antiplatelet medication 14 days before hospital admission. All procedures were performed by the senior author (Y.H.K.) using a posterolateral approach under epidural normotensive anesthesia. A fully porous-coated cementless Pinnacle acetabular component (DePuy Synthes, Warsaw, IN) with a 32- or 36-mm (inner diameter) Biolox delta ceramic liner (CeramTec AG, Plochingen, Germany) was used in all hips. The acetabular component was press fitted after the under-reaming by 1 mm. The acetabular component was fixed between 35° and 45° inclination and between 21° and 30° anteversion. An ultrashort metaphyseal-fitting anatomic cementless femoral component (Proxima; DePuy, Leeds, United Kingdom) with a 32- or 36-mm Biolox delta ceramic modular head (CeramTec) was used in all hips. Two suction drains were placed in the wound and removed after 48 hours. Patients were allowed to stand on the second postoperative day and then progressed to full weight-bearing activity with crutches as tolerated. They were advised to use crutches for 6 weeks and to use a cane thereafter as needed (Table 2).

In the tranexamic group, a dose of 1-g tranexamic acid was administered intravenously 15 minutes before the skin incision was made and another dose of 1-g tranexamic acid was administered intravenously 15 minutes before the skin was closed.

Table 1
Patient Demographics.

Parameters	Control Group	Tranexamic Acid Group	*P* Value
Number of patients (hips)	480 (582)	487 (584)	.79[a]
Age (y)	57 (19-92)	58 (21-88)	.67[a]
Gender (M/F)	252/228	257/230	.21[b]
Body mass index (kg/m^2)	25.4 ± 9.6 (24-28)	26.1 ± 8.7 (25-31)	.18[a]
Diagnosis (patients)			
Osteonecrosis	243 (51%)	239 (49%)	
Osteoarthritis	182 (38%)	200 (41%)	
Developmental dysplastic hip	38 (8%)	44 (9%)	
Multiple epiphyseal dysplasia	6 (1%)	4 (1%)	
Femoral neck fracture	6 (1%)	—	
Rheumatoid arthritis	3 (0.6%)	—	
Traumatic arthritis	2 (0.4%)	—	
Prosthesis			
Cup	Pinnacle	Pinnacle	
Stem	Proxima	Proxima	
Bearing	32- or 36-mm Al-delta ceramic	32- or 36-mm Al-delta ceramic	
Mechanical compression device	DVT-3000 impulse system	DVT-3000 impulse system	

DVT, deep vein thrombosis.
[a] Mann–Whitney test.
[b] Chi-square test.

Table 2
Estimated Blood Loss by Group.

Parameters	Control Group	Tranexamic Acid Group	*P* Value
Intraoperative blood loss (mL)	614 (341)	389 (218)	<.001[a]
Postoperative blood loss (mL)	515 (269)	329 (152)	<.001[a]

Results for continuous variables are represented as mean values with standard deviation.
[a] Mann–Whitney test.

Multiple thrombotic risk factors such as smoking habits, congestive heart failure, and cancer were assessed. For mechanical compression prophylaxis against DVT and PE, a DVT-3000 impulse system (DS Maref, Gunpo, Republic of Korea) was used on both legs and thighs for all patients postoperatively. Mechanical compression began on the day of the operation and continued 10-14 days after the operation until the patients were discharged to home. (In our practice, patients can stay in hospital for 10-14 days after the operation.) We applied continuous mechanical pneumatic compression for 4 hours twice a day until the patients were discharged home. We used sleeves which have 3 circumferential air chambers running the length from the ankle to the thigh. The DVT-3000 provides bilateral and graded sequential compression with a fixed cycling rate. The pneumatic compression cycle was set at 12 seconds with a pressure of 40-45 mm Hg applied for 60 cycles per hour.

All these patients received sonogram first and additional venograms to improve the detection rate of DVT using technetium-99m–macroaggregated albumin performed on postoperative day 7 or 8. The criterion for diagnosing DVT was filling defect in a deep vein or defects surrounded by a narrow rim of contrast material. Any readmission for a hospital for thromboembolic complications was recorded.

Both before and after surgery, all patients underwent electrocardiogram and chest radiography, and serial measurements of blood gases and serum enzymes were performed. All had preoperative and postoperative perfusion lung scans using a standardized technique. Results of preoperative examinations were compared with those of examinations conducted 7 or 8 days after surgery to detect new PE. Ventilation lung scanning and computerized tomographic lung scanning were performed only when perfusion lung scans were positive.

Statistical Analysis

To minimize the chance of a type-II error and increase the power of our study, we aimed to detect a minimum difference in the incidence of DVT of 5% with power of 0.90 and a sample-size analysis revealed that 452 hips were needed in each group.

Estimated blood loss and transfusion amounts, age, and body mass index were compared between the 2 groups using Mann–Whitney test. The chi-square test was used to compare gender and the number of patients who had DVT. The Fisher exact test was used to compare the number of patients who had DVT or required allogenic blood transfusion. All the data analyses were performed using SPSS version 19.0 (SPSS Inc). A *P* value <.05 was considered to be statistically significant.

Results

No significant differences were found between the groups regarding their demographic data, including age, gender or body