



## The changes in preferences for venous thromboembolism prophylaxis after total joint arthroplasty in Turkey: A survey

Türkiye'de total eklem artroplastisi sonrası venöz tromboembolizm profilaksisi tercihlerindeki değişimler: Bir anket

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### ABSTRACT

**Objectives:** This study aims to investigate the changes in preferences of orthopedic surgeons for venous thromboembolism (VTE) prophylaxis after total knee arthroplasty (TKA) and total hip arthroplasty (THA) and the factors that affect such changes in Turkey.

**Materials and methods:** Turkish Orthopedics and Traumatology Association members (n=2,180) were invited to fill in the questionnaire. A total of 366 orthopedic surgeons responded and completed questionnaire. The questionnaire was comprised of 12 questions investigating the demographics of surgeons, their preferences for VTE prophylaxis, the changes in their preferences over the course of the past three years, and the causes of such changes.

**Results:** In the past three years, 31.1% of surgeons changed their VTE prophylaxis method and 32.7% used risk classifications. The use of low molecular weight heparin (LMWH) decreased from 89.4% to 42.5% and from 85.8% to 44.2% after TKA and THA, respectively. The use of aspirin increased from 10.6% to 43.4% and from 9.7% to 37.2% after TKA and THA, respectively. The use of oral anticoagulants increased from 11.5% to 41.6% and from 10.6% to 39.8% after TKA and THA, respectively. Still, orthopedic surgeons in Turkey preferred LMWH at rates of 75.7% and 74% after TKA and THA, respectively. Congressional presentations were the first (47.7%) among the causes of the changes in preferences for VTE prophylaxis. Preferences of up to 60% of surgeons working at universities were influenced by the American Academy of Orthopedic Surgeons guidelines.

**Conclusion:** In the past three years, approximately one third of orthopedic surgeons changed their preferences for VTE prophylaxis after total joint arthroplasty in Turkey. Changes in preferences were largely in favor of aspirin and oral anticoagulants in parallel to changes in guidelines for VTE prevention.

**Keywords:** Arthroplasty; prophylaxis; questionnaire; Turkey; venous thromboembolism.

### ÖZ

**Amaç:** Bu çalışmada Türkiye'de total diz artroplastisi (TDA) ve total kalça artroplastisi (TKA) sonrası ortopedik cerrahların venöz tromboembolizm (VTE) profilaksisi tercihlerindeki değişimler ve bu değişimlerde etkili olan faktörler araştırıldı.

**Gereç ve yöntemler:** Türk Ortopedi ve Travmatoloji Derneği üyeleri (n=2180) soru formunu doldurmaya davet edildi. Toplam 366 ortopedik cerrah yanıt verdi ve anketi tamamladı. Anket; cerrahların demografik özelliklerini, VTE profilaksisi tercihlerini, son üç yıl içerisinde tercihlerindeki değişimleri ve bu değişimlerin nedenlerini araştırın 12 sorudan oluşuyordu.

**Bulgular:** Son üç yıl içerisinde cerrahların %31.1'i VTE profilaksisi yöntemini değiştirdi ve %32.7'si risk sınıflaması kullandı. Düşük moleküler ağırlıklı heparin (DMAH) kullanımı TDA ve TKA sonrası sırasıyla %89.4'ten %42.5'e ve %85.8'den %44.2'ye düştü. Aspirin kullanımı TDA ve TKA sonrası sırasıyla %10.6'dan %43.4'e ve %9.7'den %37.2'ye yükseldi. Oral antikoagülan kullanımı TDA ve TKA sonrası sırasıyla %11.5'ten %41.6'ya ve %10.6'dan %39.8'e yükseldi. Bununla birlikte, Türkiye'de ortopedik cerrahlar TDA ve TKA sonrası sırasıyla %75.7 ve %74 oranlarında DMAH tercih etti. Venöz tromboembolizm profilaksisi için tercihlerdeki değişimlerin nedenleri arasında kongre sunumları ilk sırada (%47.7) idi. Üniversitelerde çalışan cerrahların %60'a kadarının tercihleri Amerikan Ortopedik Cerrahlar Akademisi kılavuzlarından etkilendi.

**Sonuç:** Son üç yılda Türkiye'de ortopedik cerrahların yaklaşık üçte biri total eklem artroplastisi sonrası VTE profilaksisindeki tercihlerini değiştirdi. Venöz tromboembolizmin önlenmesi için kılavuzlardaki değişikliklere paralel olarak tercihlerdeki değişiklikler büyük oranda aspirinin ve oral antikoagülanların lehine idi.

**Anahtar sözcükler:** Artroplasti; profilaksi; anket; Türkiye; venöz tromboembolizm.

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Total knee arthroplasty (TKA) and total hip arthroplasty (THA) are the most commonly performed operations in orthopedic surgery. Patient satisfaction and survival rates after total joint arthroplasty (TJA) are satisfactory.<sup>[1]</sup> The number of TJAs are increasing. Venous thromboembolism (VTE) remains as a serious complication following TJA.<sup>[2]</sup> The number of VTEs are also increasing in correlation with the number of operations. This is reflected as increased cost in the country's economy.<sup>[3]</sup>

The optimal method for VTE prophylaxis after TJA remains controversial. In parallel with new surgical techniques, pain management protocols, neuroaxial anesthesia methods, early mobilization, and individualized VTE prophylaxis gained popularity to provide both effective VTE prophylaxis and prevent major and minor bleeding complications.<sup>[4-6]</sup>

Guidelines recommending mechanical and pharmacological methods for VTE prophylaxis are regularly renewed. These include the American College of Chest Physicians (ACCP),<sup>[7]</sup> the American Academy of Orthopedic Surgeons (AAOS),<sup>[8]</sup> and the National Institute for Health and Care Excellence.<sup>[9]</sup> In parallel to new scientific developments, these guidelines sometimes change their recommendations. However, the alignment of orthopedic surgeons with the guidelines may differ due to their experiences and the facilities of the hospitals they work. This issue has been investigated in several studies.<sup>[9,10]</sup> Therefore,

**TABLE I**  
Survey questions

1.	Specify the institution you are working in.
2.	Please indicate your academic position.
3.	How many years have you been a specialist?
4.	How many primary arthroplasty cases do you perform per month?
5.	How many arthroplasty revisions cases do you perform per month?
6.	What are your preferred venous thromboembolism prophylaxis options for knee arthroplasty?
7.	What are your preferred thromboembolic prophylaxis options for hip arthroplasty?
8.	Do you use risk classification to assess the risk of developing venous thromboembolism after arthroplasty?
9.	Did you change your venous thromboembolism prophylaxis method after arthroplasty in the past three years?
10.	What we your previous venous thromboembolism prophylaxis options for knee arthroplasty?
11.	What we your previous venous thromboembolism prophylaxis options for hip arthroplasty?
12.	What we effective in changing your preference for venous thromboembolism prophylaxis?

in this study, we aimed to investigate the changes in preferences of orthopedic surgeons for VTE prophylaxis after TKA and THA and the factors that affect such changes in Turkey.

## MATERIALS AND METHODS

This study was conducted between April 2017 and June 2017. Data of the study were obtained through an online survey from 366 orthopedic surgeons registered in Turkish Orthopedics and Traumatology Association database (n=2, 180) in 2016 and currently performing knee and hip arthroplasty. For this purpose, a draft questionnaire was prepared containing questions about the preferred VTE prophylaxis methods after TKA and THA and changes in preferences in the past three years. Five experienced surgeons operating more than 100 arthroplasties per year were consulted to evaluate the questionnaire. The questionnaire was finalized according to

**TABLE II**  
Demographic data

	n	%
Workplace		
District State Hospital	46	12.6
Provincial State Hospital	54	14.8
Research and Training Hospital	84	23.1
Private Hospital	87	23.9
University Hospital	93	25.5
Academic position		
Operator	238	65.6
Assistant professor	39	10.7
Associate professor	48	13.2
Professor	38	10.5
Expertise time (years)		
0-5	128	35.1
5-10	80	21.9
10-15	48	13.2
15-20	46	12.6
20-30	45	12.3
>30	18	4.9
Number of primary arthroplasty per month		
1-5	144	39.6
5-10	97	26.6
10-20	62	17
20-30	36	9.9
>30	25	6.9
Number of revision arthroplasty per month		
Do not revise	118	32.7
1-5	218	60.4
5-10	19	5.3
10-20	5	1.4
>20	1	0.3

their suggestions. The questionnaire consisted of 12 questions investigating the demographics of surgeons, preferences for VTE prophylaxis, and factors influencing changes in prophylaxis preferences over the past three years (Table I).

### Statistical analysis

All data were recorded in the IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive statistics and chi-square test were used in the analysis of the data. Values of  $p < 0.05$  were considered statistically significant.

## RESULTS

Of the 366 surgeons participating in the survey, 46 (12.6%) were working in district state hospitals, 54 (14.8%) in provincial state hospitals, 84 (23.1%) in education and research hospitals, 87 (23.9%) in private hospitals and 93 (25.5%) in university hospitals. Regarding academic positions, 238 (65.6%) operators, 39 (10.7%) assistant professors, 48 (13.2%) associate professors, and 38 (10.5%) professors participated in the survey (Table II).

An investigation of the surgeons' preferences for VTE prophylaxis revealed that low molecular weight heparin (LMWH) was the most commonly used method after TKA (75.7%) and THA (74%) (Table III). Of the 366 surgeons participating in the survey, 113 (31.1%) changed their VTE prophylaxis preferences. Surgeons working in the provincial government hospitals preferred to change their VTE prophylaxis method the least (22.2%) while surgeons working in private

hospitals changed the most (40.2%). However, there was no significant difference between surgeons in terms of the hospitals they worked ( $p > 0.05$ ) (Table III). Associate professors changed their VTE prophylaxis method the most (40.4%) while operators changed the least (28.3%). However, there was no significant difference between academic positions in terms of VTE prophylaxis change ( $p > 0.05$ ) (Table IV).

Among the 113 surgeons who changed their VTE prophylaxis, the most preferred agents were aspirin and oral anticoagulants (Table V). In the past three years, aspirin usage increased from 10.6% to 43.4% and from 9.7% to 37.2% after TKA and THA, respectively. In the same period, the use of oral anticoagulants increased from 11.5% to 41.6% and from 10.6% to 39.8% after TKA and THA, respectively. Aspirin was preferred most by professors (54.2%) and least by operators (32%). Oral anticoagulants were preferred most by assistant professors (42.8%) and least by professors (25%).

Factors influencing VTE prophylaxis changes were congressional presentations (46%), followed by problems encountered by patients when using drugs (40%) and colleagues' practices (39%) (Table VI).

Regarding academic positions, professors mostly considered AAOS guidelines (58.3%), while associate professors considered research studies (73.7%) to change their VTE prophylaxis method after TJA (Table VII).

According to the institutions of surgeons who changed their VTE prophylaxis, 60% of surgeons

TABLE III

Venous thromboembolism prophylaxis preferences

Preference	Knee		Hip	
	n	%	n	%
Warfarin	1	0.3	0	0
LMWH 15 days	156	42.6	89	24.3
LMWH 30 days	127	34.7	185	50.5
Oral anticoagulant agent 15 days	25	6.8	5	1.4
Oral anticoagulant agent 30 days	35	9.6	55	15
Mechanical leg pump	29	7.9	28	7.7
Aspirin 100 mg 2x1 (2 weeks)	11	3	9	2.5
Aspirin 100 mg 2x1 (6 weeks)	35	9.6	30	8.2
Aspirin 300 mg 2x1 (2 weeks)	4	1.1	3	0.8
Aspirin 300 mg 2x1 (6 weeks)	6	1.6	9	2.5
LMWH + aspirin	51	13.9	46	12.6
Only mechanic prophylaxis	4	1.1	3	0.8
Vena cava filter	3	0.8	4	1.1
Others	20	5.5	21	5.7

LMWH: Low molecular weight heparin.

TABLE IV

Comparison of changes in venous thromboembolism prophylaxis and use of risk classification in terms of institutions and academic positions

	VTE prophylaxis change				p	Risk classification usage				p
	Yes		No			Yes		No		
	n	%	n	%		n	%	n	%	
<b>Workplace</b>										
District State Hospital	12	26.7	33	73.3	0.17	7	16.3	36	83.7	0.01
Provincial State Hospital	12	22.2	42	77.8		16	29.6	38	70.4	
Education and Research Hospital	23	27.7	60	72.3		30	36.1	53	73.9	
Private Hospital	35	40.2	52	59.8		28	32.2	59	67.8	
University Hospital	30	32.6	62	76.4		37	40.2	55	59.8	
<b>Academic Positions</b>										
Operator	67	28.3	170	71.7	0.35	54	23.0	181	77.0	0.00
Assistant professor	14	35.9	25	74.1		13	33.3	26	66.7	
Associate professor	19	40.4	28	59.6		28	59.6	19	40.4	
Professor	12	32.4	25	67.6		23	62.2	14	37.8	

VTE: Venous thromboembolism.

working at universities changed their VTE prophylaxis due to the AAOS guidelines, while surgeons working at education and research hospitals preferred congressional presentations and colleagues' experiences equally (52.2%). On the other hand, 48.6% of surgeons working at private hospitals changed

their VTE prophylaxis due to congress presentations, while surgeons working at provincial state hospitals preferred congressional presentations and problems encountered by patients when using drugs (58.3%) equally. In addition, 66.7% of surgeons working at county state hospitals changed their prophylaxis

TABLE V

Previously and currently preferred venous thromboembolism prophylaxis methods of 113 orthopedic surgeons who changed their prophylaxis preferences over past three years

Prophylaxis preference	Total knee arthroplasty				Total hip arthroplasty			
	Current		Previous		Current		Previous	
	n	%	n	%	n	%	n	%
Warfarin	0		2	1.8	0		2	1.8
LMWH 15 days	31	27.4	56	49.6	13	11.5	37	32.7
LMWH 30 days	21	18.6	46	40.7	38	33.6	62	54.9
Oral anticoagulant agent 15 days	16	14.2	10	8.8	5	4.4	4	3.5
Oral anticoagulant agent 30 days	31	27.4	4	3.5	40	35.4	9	8
Mechanical leg pump	8	7.1	6	5.3	10	8.8	6	5.3
Aspirin 100 mg 2x1 (2 weeks)	5	4.4	6	5.3	4	3.5	2	1.8
Aspirin 100 mg 2x1 (6 weeks)	18	15.9	2	1.8	14	12.4	2	1.8
Aspirin 300 mg 2x1 (2 weeks)	3	2.7	0	0	3	2.7	0	0
Aspirin 300 mg 2x1 (6 weeks)	3	2.7	0	0	5	4.4	1	0.9
Heparin + aspirin	28	24.8	6	5.3	22	19.5	8	7.1
Only mechanics	0	0	1	0.9	0	0	1	0.9
Vena cava filter	1	0.9	1	0.9	1	0.9	1	0.9
Others	10	8.8	4	3.5	9	8	4	3.5

LMWH: Low molecular weight heparin.

TABLE VI

Factors effective on changing venous thromboembolism prophylaxis preferences

Factors	n	%	95% CI
Congress presentations	52	46	37-55
Problems encountered during drug use	46	40	32-49
Practices of colleagues	44	39	30-48
Scientific articles	43	38	29-47
AAOS guideline	41	36	28-45
ACCP guideline	21	19	12-26
NICE guideline	12	10	6-17
Bleeding complication	15	13	8-20

CI: Confidence interval; AAOS: American Academy of Orthopedic Surgeons; ACCP: American College of Chest Physicians; NICE: National Institute for Health and Care Excellence.

TABLE VII

Relationship between academic positions and factors that affect venous thromboembolism prophylaxis changes

	AAOS Guideline		ACCP Guideline		Congress presentations		Scientific articles		Problems encountered during in drug use		Experiences of colleagues	
	n	%	n	%	n	%	n	%	n	%	n	%
Operator	16	23.7	7	10.4	29	43.3	16	23.9	31	46.3	29	43.3
Assistant professor	5	35.7	1	7.1	7	50.0	6	42.9	5	35.7	7	50.0
Associate professor	13	68.4	8	42.1	12	63.2	14	73.7	7	36.8	7	36.8
Professor	7	58.3	5	41.7	4	33.3	6	50.0	2	16.7	1	8.3

AAOS: American Academy of Orthopedic Surgeons; ACCP: American College of Chest Physicians.  
Note: Surgeons were offered to choose more than one cause.

due to problems encountered by patients when using drugs as reference.

Of the surgeons participating in the survey, 118 (32.7%) were using a risk classification system to choose a VTE prophylaxis method. Risk classification system was most used by surgeons working at university hospitals (40.2%) and least used by surgeons working at district state hospitals (16.3%) ( $p < 0.05$ ). Regarding academic positions, professors used risk classification the most (62.2%) while operators used the least (23%) ( $p < 0.05$ ) (Table III).

## DISCUSSION

In this study, we found that the usage of aspirin for VTE prophylaxis increased from 10.6% to 43.4% and from 9.7% to 37.2% after TKA and THA, respectively. We also found that the usage of oral anticoagulant increased from 11.5% to 41.6% and from 10.6% to 39.8% after TKA and THA, respectively.

Venous thromboembolism is a serious complication after knee and hip arthroplasty.<sup>[7]</sup> Hence, VTE prophylaxis is recommended after TKA and THA. However, potent anticoagulants used in VTE

prophylaxis have been reported to cause bleeding,<sup>[11]</sup> wound problems,<sup>[12]</sup> hematoma,<sup>[12]</sup> reoperation,<sup>[13]</sup> and infection.<sup>[12]</sup> Moreover, potent anticoagulants did not reduce the incidence of symptomatic VTE and mortality.<sup>[14]</sup> The multimodal prophylaxis which includes early onset of mobilization, use of intermittent pressure devices for mechanical prophylaxis, and use of aspirin have gained popularity by providing effective VTE prophylaxis and reducing risk of bleeding.<sup>[1,15-17]</sup> Numerous studies using this method have been published in last two decades. The organizations that prepare guidelines for VTE prophylaxis started to take these studies into consideration. AAOS issued a guideline in 2007 which recommended the use of aspirin 325 mg twice daily for six weeks for patients at standard risk of pulmonary embolism (PE) and major bleeding, those with a standard risk of PE and elevated risk of major bleeding, and those with an elevated risk of PE and major bleeding groups separately.<sup>[18]</sup> In 2011, AAOS suggested that any of the anticoagulants may be preferred considering bleeding and VTE prophylaxis in balance.<sup>[19]</sup> The seventh and eighth editions of the ACCP guidelines, published in 2004 and 2008,

respectively, recommended against the use of aspirin for VTE prophylaxis in patients undergoing arthroplasty.<sup>[20,21]</sup> However, the ninth ACCP guideline published in 2012 recommended mechanical prophylaxis, aspirin and oral anticoagulants for VTE prophylaxis.<sup>[7]</sup> Although few studies have reported discrepancies between the ACCP guideline and clinical practice after major orthopedic surgery,<sup>[22,23]</sup> the compliance of orthopedic surgeons with these changes in clinical practice guidelines needs to be adequately explored. In a meta-analysis published in 2016, the compliance with ACCP recommendations after major orthopedic surgery increased over time; however, post-discharge compliance was reported to be inadequate.<sup>[24]</sup> A survey conducted with 222 orthopedic surgeons in Korea in 2011-2012 reported that the rate of routine VTE prophylaxis was 60.4%, the rate of prophylaxis according to the patient's health status was 19.4%, and the rate of no prophylaxis was reported as 20.2%. In the same study, compression bandages were the most commonly used method (72.9%), and direct factor Xa inhibitors were pharmacologically the most preferred drugs (46.9%).<sup>[25]</sup> Another survey conducted in Australia in 2009 reported that 98% of orthopedic surgeons prefer pharmacological prophylaxis and largely use LMWH (TKA 84%, THA 79%).<sup>[26]</sup> Moreover, a survey conducted in 2008 showed that 85% and 89% of orthopedic surgeons read ACCP and AAOS guidelines in the USA, respectively. However, the majority of participants agreed with the AAOS guideline (88%) instead of the ACCP guideline (30%).<sup>[27]</sup> Again, in this study, the aspirin preference rate for VTE prophylaxis after arthroplasty in the USA was lower than 1%. On the other hand, a survey conducted at the American Association of Hip and Knee Surgeons meeting in 2016 reported that aspirin was the most preferred agent for VTE prophylaxis in patients undergoing arthroplasty (80%).<sup>[28]</sup> These factors may explain why the use of aspirin has increased in recent years: adequate VTE prophylaxis in most patients,<sup>[29]</sup> less bleeding and no requirement for monitoring,<sup>[30]</sup> being inexpensive and safe,<sup>[31,32]</sup> causing less wound problems,<sup>[33]</sup> reducing the risk of periprosthetic infection<sup>[34]</sup> and strong recommendations in favor of aspirin in recent clinical practice guidelines.<sup>[7,18]</sup>

Our survey demonstrated that the use of oral anticoagulants for VTE prophylaxis has also increased in the last three years. A recent randomized controlled trial revealed that aspirin has similar efficacy compared with apixaban (an oral anticoagulant) in patients undergoing THA and TKA.<sup>[35]</sup> Bloch et al.<sup>[36]</sup> compared dabigatran (an oral anticoagulant) and multimodal

prophylaxis (LMWH during hospitalization and aspirin during discharge) and found that dabigatran causes significantly increased leakage from the wound ( $p < 0.001$ ) and higher rates of VTE ( $p = 0.047$ ). Similarly, rivaroxaban has been reported to cause more hidden blood loss and more wound problems compared with LMWH and aspirin.<sup>[33]</sup> We believe that it may be more rational to use oral anticoagulants in cases with high risk of VTE to avoid complications such as bleeding and wound problems.

Our study demonstrated that LMWH is still the most preferred VTE prophylaxis method (75.7% and 74% following TKA and THA, respectively) in Turkey. Three years ago, these rates were 92.1% and 88.5% after TKA and THA, respectively. The reasons for decreased LMWH use may be attributed to higher cost, subcutaneous use, bleeding complications and recommendations of recent guidelines in favor of other modalities such as aspirin, oral anticoagulants, and mechanical prophylaxis.

This study showed that congress presentations (46%) were most effective factor in changing preferences for VTE prophylaxis. Therefore, it may be useful to present the current changes in VTE prophylaxis guidelines at congresses to increase awareness among orthopedic surgeons.

Risk assessment methods have been used to individualize VTE prophylaxis in patients undergoing arthroplasty. Nam et al.<sup>[37]</sup> have used a risk assessment method and reduced the use of more potent anticoagulants by 70%, while keeping symptomatic VTE risk low. A recent study by Parvizi et al.<sup>[5]</sup> used the United States Inpatient Sample data and identified 1,721,806 patients undergoing arthroplasty, among whom 15,775 (0.9%) developed VTE postoperatively. According to this study, hypercoagulability, metastatic cancer, stroke, sepsis and chronic obstructive pulmonary disease had the highest risk scores. Patients with any of these conditions were found to have a VTE risk greater than 3% postoperatively. Using this model, the authors have developed an iPhone operating system (Apple Inc., Cupertino, California) application (VTEstimator, MedApp LLC, Wilmington, Delaware) so that low and high-risk patients can be identified and the appropriate method for VTE prophylaxis may be selected.

According to our study, 32.2% of surgeons use risk assessment methods in Turkey. Surgeons working at university hospitals (40.2%) and professors (62.2%) use risk assessment methods most commonly. Considering that the majority of surgeons do not use

risk assessment methods in Turkey, presenting this issue in training programs and congresses may be useful to raise awareness.

Our study has several limitations. Firstly, we did not classify the participants according to their work region. However, in an era of Internet and webinars, knowledge is easily accessible in all geographic regions. Secondly, the rate of revision surgery among the majority of participants was low. Hence, the results may not adequately reflect the VTE preferences in revision arthroplasties.

In conclusion, one-third of orthopedic surgeons have changed their preferences for VTE prophylaxis over the past three years in Turkey. Congressional presentations, difficulties experienced by patients when using drugs, and AAOS guidelines were found to be the most influential on the changes. In parallel to clinical practice guidelines, changes were in favor of aspirin and oral anticoagulants. It may be helpful to emphasize the risk assessment and individualized VTE prophylaxis concepts and present such changes at training programs and congresses. We suggest that Turkish Orthopedic Association may perform a survey regarding VTE prophylaxis among all orthopedic surgeons in Turkey. Also, the VTE study group may be activated and may prepare a guideline for VTE prophylaxis in patients undergoing TJA.

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