



Surgical practices in total knee arthroplasty in Turkey

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Objective: The aim of this study was to determine the current practices in the total knee arthroplasty (TKA) and the differences of practice among the orthopedic surgeons in Turkey.

Methods: Data in this cross-sectional and descriptive study was collected through a questionnaire from 76 orthopaedic surgeons performing TKA. The questionnaire form contained 57 questions under four main headings, covering the professional properties of the surgeon, pre-surgery approach, surgical technique applied for TKA and the surgical details peculiar to the technique with solutions applied for complication scenarios, and finally the postoperative approach.

Results: It was determined that 39.7% of the TKA applications were performed in operating theatres without laminar airflow or HEPA filters. Nearly 1/5 of the surgeons used more than one antibiotic for prophylaxis, and more than 85% continued prophylaxis use over 3 days. Low-molecular-weight heparin was the most commonly used method for thromboprophylaxis. 94.67% of the surgeons used only the cemented technique in primary TKA. 44% indicated that they performed simultaneous bilateral arthroplasty, 89% did not use any scoring system and 72.37% preferred fixed-bearing and posterior-cruciate-retaining type prosthesis.

Conclusion: Results showed no standardization in TKA surgery among surgeons in Turkey, and important educational deficiencies were noted.

Key words: Surgeon's approach; survey; total knee arthroplasty.

Total knee arthroplasty (TKA) is one of the most frequently applied orthopedic surgical techniques.^[1] More than 400,000 primary TKAs are applied annually in the USA.^[2] Clinical studies demonstrate satisfactory results after TKA. Roberts et al.^[3] reported a survival rate of 92% over 15 years in 4,606 primary total knee prosthesis. In the pain and quality of life questioning, 85.3% of patients expressed satisfaction. Other studies have produced similar survival rates.^[4,5]

Despite positive developments in medical technology and surgical methods, complications related to

TKA, including aseptic loosening, infection, polyethylene wear, instability, patellofemoral pain, technical problems, and periprosthetic fractures are still encountered and may significantly increase morbidity.^[3] Infection has been reported as the most frequent reason for prosthesis failure in the first 12 months.^[3]

Many differences in TKA practices regarding the preoperative approach, surgical technique, materials and metals used and postoperative rehabilitation have been reported.^[6-15] Issues such as which metal causes the least loosening in the long-term, applications with or

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without cement, whether the patellar surface should be changed, the quality and variability of polyethylene inserts, whether inserts should be mobile-bearing or not, stem features, whether or not to incise the posterior cruciate ligaments, thromboprophylaxis and the advantages and disadvantages of unilateral or bilateral surgery are some of the important subjects of discussion we encounter even in routine practices, and a consensus over them still does not exist.^[4,8,9,13-27] These issues result in variable practices among orthopaedic surgeons. Different techniques and methods in patient selection, preoperative preparation, surgical technique and postoperative rehabilitation can affect the outcome due to lack of standardization. Survey studies performed on the approach of orthopedic surgeons to the knee arthroplasty verified differences in TKA practices.^[28-32]

The present study aimed to assess the practices of the orthopedic surgeons who routinely perform TKA and analyze the cause of the differences.

Materials and methods

The data for this cross-sectional descriptive study has been collected from 76 orthopedic surgeons performing knee arthroplasty surgery.

A draft of the questionnaire was prepared with questions related to TKA practice and sent to 3 different orthopedic surgeons who have performed over 50 TKAs annually for a minimum of 10 years. The final form was set in line with their given views and suggestions and contained a total of 57 questions under four main headings. The first main heading (general assessment; 16 questions) questioned the institution where the surgeon worked, specialization training, experience with TKA surgery, TKA surgery training and the mean number of primary and revision TKA surgeries performed annually. The second main heading (22 questions) included questions on preoperative preparation and practices in different scenarios. In the third main heading (12 questions), the surgical technique and solutions for various complication scenarios were questioned. In the fourth main heading (postoperative approach; 7 questions), postoperative practices such as the use of drain, the mean time till discharge and postoperative pain management were questioned.

The questionnaire form was forwarded by two methods to 76 surgeons performing TKA in their routine surgical practice working in the Ministry of Health state hospitals, training and research hospitals, university hospitals or private hospitals. In the first method, preliminary communication with the surgeons was

established and questionnaires were sent by e-mail. In the second method, printed questionnaires were given.

All data collected were processed using the SPSS 16.0 (SPSS Inc., Chicago, IL, USA) statistical package. Descriptive statistics, one-way analysis of variance (one-way ANOVA) and chi-square analysis were used. P values of less than 0.05 were considered significant.

Results

Surgeons had an average specialization training periods of 12.5 (range: 1 to 30) years. Demographic data and educational status of the participating surgeons are given in Table 1. A significantly higher ratio of surgeons who performed their first operations during residency received their training at university hospitals rather than at training and research hospitals. In terms of continuing education, 41.89% attended a course on TKA surgery and 39.5% considered themselves to be partly qualified in this area. In 2008, 32.9% of surgeons performed fewer than 15 TKA surgeries, 25.0% between 15 and 25 surgeries, 22.4% between 25 and 50 surgeries, and 19.7% more than 50. Moreover, 67.1% performed revision TKA surgeries. Of those, 74.5% performed fewer than 5, 23.5% between 5 and 10, and 2% between 10 and 20 revision TKAs in 2008. Orthopedists who work in private hospitals performed significantly fewer revision surgeries than other surgeons ($p < 0.002$).

Nearly half of TKA applications (39.7%) were performed in surgery rooms with no laminar airflow or HEPA filter (Table 1). Approximately 1/5 of the surgeons used more than one antibiotic for prophylaxis and more than 85% continued prophylaxis for more than 3 days (Table 1). A variety of responses were given and it was understood that there was no standard application.

The ratio of surgeons who applied thromboembolic prophylaxis was high (98.7%) and the most frequently used prophylaxis was low-molecular-weight heparin (LMWH) (Table 1). 94.67% applied primary TKA as only cemented, 2.67% applied uncemented TKA, and the rest applied both methods. In the revision TKA surgeries reported, cement with antibiotics was applied in every case at a rate of 66.7%, never used at a rate of 11.1% used in some cases/situations at a rate of 22.2%. The rate of those who used cement with antibiotics in the primary TKA in every case was 24%, who never used it was 40%, and who used it in some cases/situations was 36%.

The surgeons used tourniquet to a great extent (96%) and more than half (56%) did not operate on both knees

Table 1. Demographic data, the properties of the surgery room, and differences of applications.

	Person	Percentage		Person	Percentage
Workplace			Prophylaxis type		
University	9	11.8	LMWH + other additional prophylaxis (+,-)	73	97.33
Training hospital	14	18.4	Only LMWH	20	26.66
State hospital	43	56.6	LMWH + elastic bandage (or varsity sock) + early mobilization	36	48
Private hospital	10	13.2	Aspirin	2	2.66
Specialty training			Warfarin	2	2.66
University	42	55.3	Foot pump	8	10.66
Training & Research Hospital (State)	27	35.5	Thromboembolic prophylaxis period		
Training & Research Hospital (SSK: Social Security Institution)	7	9.2	0-10 days	17	25
How did I learn knee arthroplasty?			11-20 days	27	39.71
From my specialist / instructor	47	63.5	21 days or more	24	35.29
From my senior	9	12.16	Patella change		
From abroad	5	6.76	I never change it	34	46.57
Another domestic center	19	25.68	I always change it	1	1.37
Other - myself	5	6.76	Sometimes, depending on the situation	38	52.06
When did you perform knee arthroplasty for the first time?			Routine patellar denervation		
During my? assistantship	42	55.26	Yes, I do it	59	79.7
The first 5 years of my assistantship	23	30.3	No, I don't do it	12	16.2
5 years after I became a specialist	11	14.5	Sometimes	3	4.1
Surgery room properties			Drape		
Featureless	29	39.7	Containing an antiseptic additiv	42	56
With laminar flow	24	32.9	Not containing an antiseptic additive	23	30.67
HEPA-filtered	18	24.7	Other (not using, sometimes)	10	13.33
With laminar flow + HEPA-filtered	2	2.7	Leg shaving method		
Antibiotic prophylaxis			Razor blade	66	88
I do it	75	98.7	Depilatory	2	2.67
I don't do it	1	1.3	Electric charged shaver	4	5.33
Antibiotic preferences			Other (bistoury, not using it, etc.)	3	4
Single	59	81.9	Leg shaving time		
Double	13	18.1	The night before the operation	22	29.33
Antibiotic prophylaxis period			In the surgery room	28	37.33
0-2 days	8	11.43	In the morning of the operation day in the service	19	25.33
3-5 days	45	64.3	Other (Not doing it, in a different time, etc.)	6	8
6 days or more	17	24.3	Thromboembolic prophylaxis		
Thromboembolic prophylaxis			I apply prophylaxis	75	98.7
I apply prophylaxis	75	98.7	I do not apply prophylaxis	1	1.3
I do not apply prophylaxis	1	1.3			

in the same session. Scoring systems for pre or postoperative evaluation were not used by 89% of participants and most of those using a scoring system worked at university or training and research hospitals ($p < 0.0001$). In terms of how assistant technicians are employed, 14.9% said that "They regularly join my surgeries but only prepare the instruments", 55.4% said, "They regularly join my surgeries and they prepare and exchange the instruments", 16.2% said "They regularly join my surgeries, prepare the instruments and perform surgical assistance", 9.5% said "Two technicians regularly join my

surgeries; one of them prepares and exchanges the instruments and the other performs surgical assistance", and 4.1% said "They get into the surgery room but do not take part in the operation". No surgeon declared that they 'never work with an assistant technician'.

24.32% of the surgeons used a single glove, 66.22% used double gloves and 6.76% used gloves with special protection. Incision types used were as follows; middle longitudinal (86.5%), lateral longitudinal (2.7%), and to the medial lengthwise (10.8%). Surgeons reported that for the capsular incision they preferred the medial para-

patellar (97.3%), subvastus (1.35%), and medial parapatellar or subvastus depending on the situation (1.35%). Knee position utilized while closing the capsule at the end of the surgery was reported as; 21.6% at more than 90° of flexion, 55.4% at less than 90° of flexion, 18.4% said they closed it at extension, and 4.1% did not take flexion or extension into consideration. Most surgeons did not replace the patella (Table 1). 48.68% of the surgeons used perioperative pressured washing, 39.47% did not, and 11.84% used it if available.

While 72.37% of the participants used fixed type prosthesis protecting the posterior cruciate ligaments, 22.37% expressed a preference for fixed prosthesis protecting the posterior cruciate ligaments without including other choices. The rate of those who favored mobile type prosthesis protecting the posterior cruciate ligaments was 48.68% and 14.47% used this method as the only alternative. Again, 14.47% reported that they used both fixed prosthesis protecting the posterior cruciate ligaments and mobile prosthesis protecting the posterior cruciate ligaments. 3.9% preferred mobile prosthesis incising the posterior cruciate ligaments as the only alternative. The rate of those who preferred mobile type prosthesis incising posterior cruciate ligaments was 21.05%.

The preoperative patient status and approaches to TKA in the presence of additional disorders and complications are given in Tables 2 and 3.

A great majority of the surgeons (96%) used drains. The average hospitalization period of the patients was 6.88 (range: 2 to 15) days. Postoperative rehabilitation was overseen by 78.38% of surgeons, by a physiotherapist in 13.5%, a physical therapist in 5.41%, and in a combination of physiotherapist and surgeon in 2.7%. The use of a continuous passive movement (CPM) device was used by 30.2% of surgeons.

Discussion

More than half of the surgeons participating in the survey worked in state hospitals, approximately 10% in universities, roughly 20% in research and training hospitals, and nearly 15% in private hospitals. These rates are similar to the distribution of orthopedists working in Turkey. A little more than half of the orthopaedic surgeons who filled in the questionnaire performed their first TKA during their residency and the remaining half after becoming specialists. When the participants were asked to evaluate their own educational status, the fact that approximately 40% did not consider themselves to be entirely qualified in this surgical technique is an important indicator. Additionally, approximately 60% have not attended any courses related to the subject. We believe that the fact that almost half of those who apply a serious surgery such as TKA do not feel sufficiently trained yet is an issue which the specialty associations, Ministry of Health, and other institutions should focus

Table 2. The effects of different disorders and situations on the surgical indications of the orthopedic surgeons.

	Effects negatively		Does not effect	Effects positively	
	-2	-1	0	+1	+2
	n (%)	n (%)	n (%)	n (%)	n (%)
Obesity	28 (40)	29 (41.43)	10 (14.29)	3 (4.29)	0
Patient older than 70	12 (17.65)	22 (32.35)	27 (39.71)	3 (4.41)	4 (5.88)
Patient younger than 50	41 (60.29)	16 (23.53)	8 (11.76)	1 (1.47)	2 (2.94)
Psoriasis	24 (32.88)	27 (36.99)	21 (28.77)	1 (1.37)	0
Severe vascular disease	55 (82.09)	9 (13.43)	3 (4.48)	0	0
Well-functioned knee arthrodesis	45 (66.18)	15 (22.06)	3 (4.41)	3 (4.41)	2 (2.94)
Varus-valgus instability	8 (11.59)	32 (46.38)	25 (36.23)	3 (4.35)	1 (1.45)
The fact that high tibia osteotomy has been performed	11 (15.28)	32 (44.44)	25 (34.72)	3 (4.17)	1 (1.39)
Extensor mechanism disorder	37 (50.68)	32 (43.84)	3 (4.11)	1 (1.37)	0
Urinary infection	43 (60.56)	22 (30.99)	5 (7.04)	1 (1.41)	0
Tooth abscess	48 (66.67)	20 (27.78)	3 (4.17)	1 (1.39)	0
Patient with a walking distance over 1 km	23 (32.39)	18 (25.35)	11 (15.49)	12 (16.90)	7 (9.86)
The fact that there is no laminar airflow or HEPA filter	19 (25.68)	25 (33.78)	23 (31.08)	4 (5.41)	3 (4.05)
Presence of advanced osteoporosis	12 (16.67)	40 (55.56)	19 (26.39)	1 (1.39)	0
Presence of coxarthrosis on the same side	16 (22.22)	33 (45.83)	19 (26.39)	4 (5.56)	0
Presence of coxarthrosis on the opposite side	9 (12.5)	18 (25)	39 (54.17)	5 (6.94)	1 (1.39)
Hemophilic arthropathy	57 (78.08)	9 (12.33)	4 (5.48)	3 (4.11)	0

on and that available courses should be evaluated, modified and further attendance encouraged.

Nearly 40% of TKA applications are performed in standard surgery rooms without antimicrobial properties such as HEPA filters and laminar airflow. In 2005, Malik et al. reported that all orthopedic surgeons in England performed these operations in operating theatres with a vertical laminar airflow system.^[29] Considering the catastrophic results from infections following TKA, that nearly half of these operations are still performed without special protection is an important point. In their questionnaire study, Malik et al. observed that approximately 1/3 of orthopedists (26.7%) administered a single dose of antibiotic during induction and 70.7% gave three doses of antibiotics.^[29] In this study, we found that only 2.6% of orthopedists maintained antibiotic prophylaxis after the first 48 hours and nearly 87% applied antibiotic prophylaxis for a period of more than 3 days. Moreover, nearly 1/5 of the surgeons (18.1%) used a second antibiotic for prophylaxis. This dramatic difference might be explained by the knowledge of surgeons of the lack of antimicrobial properties in the operating theatres. However, that operations continue to be performed in poor conditions is another point to be reviewed. When asked to evaluate the effect of a laminar airflow or HEPA filter in the operating theatre, nearly half evaluated this as a negative factor while approximately 40% stated that the absence of a HEPA filter or laminar airflow does not

negatively affect surgical applications (Table 2). An assessment and comparison of the cost of a single or three doses of antibiotics during induction, antibiotics applied over 3 days and application of multi-antibiotics and an inventory of money spent treating postoperative infections would be valuable. Statistical data with respect to the number of TKAs carried out per year and the rate of postoperative infections is insufficient. Sufficient data may demonstrate that money spent on the treatment of infections developed as the result of TKAs performed in poor conditions may exceed that of improving conditions in the operating theatre.

Nearly all participating surgeons (98.7%) applied thromboprophylaxis. Approximately 1/3 (26.6%) used one chemical agent only. Early mobilization, elastic bandage or compression stockings in addition to the chemical agents was practiced by 48%. The rate of those using a foot pump was 10%. In a 2001 study published by Mesko et al., evaluating TKA approaches of orthopedists in the United States of America, all surgeons used both chemical and mechanical thromboprophylaxis methods during hospitalization.^[33] In another study in 2005, 66% of surgeons used mechanical and chemical thromboprophylaxis methods together.^[29] In terms of the medicine used, many differences were found when compared with American and European studies. Warfarin was predominately used in the American literature while the usage of warfarin in Turkey is a low 2.6%. LMWH

Table 3. The approach of those participating in the survey towards different complication scenarios.

	1	2	3	4
	n (%)	n (%)	n (%)	n (%)
If the condyle or supracondylar area in the femur is fractured	13 (18.84)	4 (5.80)	1 (1.45)	51 (73.91)
Vein injury in the popliteal area	6 (8.70)	37 (53.62)	10 (14.49)	16 (23.19)
Detachment of patellar ligament from tuberosity of the tibia	28 (41.18)	2 (2.94)	1 (1.47)	37 (54.41)
Fracturing the patella	28 (41.79)	2 (2.99)	2 (2.99)	35 (52.24)
If varus instability is detected in flexion after cementing	15 (21.43)	2 (2.86)	7 (10)	46 (65.71)
If varus instability is detected in extension after cementing	12 (18.18)	2 (3.03)	6 (9.09)	46 (69.70)
If the thinnest insert causes loss of extension	15 (22.39)	2 (2.99)	5 (7.46)	45 (67.16)
If patellofemoral incompatibility occurs	12 (19.05)	2 (3.17)	3 (4.76)	46 (73.02)
If excess varus/valgus laxity is observed when the test prosthesis is placed	14 (20.29)	0	3 (4.35)	52 (75.36)
If excess recurvatum is noticed when the test prosthesis is placed	15 (22.06)	0	4 (5.88)	49 (72.06)
Excessively performed distal femoral incision	17 (25)	0	5 (7.35)	46 (67.65)
If the patella cannot be turned after the capsule is opened	23 (32.86)	0	0	47 (67.14)
If infection is suspected when the capsule is opened	1 (1.45)	59 (85.51)	1 (1.45)	8 (11.59)
If a tumoral lesion is suspected when we reach the knee joint	0	55 (78.57)	0	15 (21.43)
If collateral ligament injury occurs	12 (17.14)	3 (4.29)	4 (5.71)	51 (72.86)

1. "I continue without changing the technique I use."

2. "I cancel arthroplasty and terminate the surgery."

3. "I have no idea."

4. "I change my technique and then I continue."

is used by approximately 98% of surgeons in Turkey but only by 15% in the United States. LMWH carries higher costs than other medications. Similar studies take financial costs into consideration, lowering the rate of usage of LMWH. In addition, the use of mechanical prophylaxis is not widely used in our country.

Approaches to various preoperative patient scenarios were also questioned. Generally, answers were in line with the current information in the literature. Approximately 17% answered that a patient age of less than 50 years and 40% answered that a patient with the ability to walk a distance of over 1 km “Does not affect my decision or affects it positively” in terms of prosthesis selection.

In another section, the participants were asked to evaluate complication scenarios that might be encountered during the operation. More than 41% of participants answered “I continue without changing the technique I use” when asked what course of action they would take if the patellar ligament detached from the tuberosity of the tibia. The fact that 10% and 9% of participants, respectively responded with “I have no idea” and 21% and 18%, respectively responded with “I continue without changing the technique” to the question “What do you do if varus instability is determined in flexion or extension after cementing?” is striking. In another noteworthy example, more than 22% of participants answered “I do not change my technique” and more than 7% “I have no idea” to the question “If even the thinnest insert causes loss of extension”. In the 15 complication scenarios asked, an important number of participants did not change their technique or did not have an idea with respect to the solution. This appears to support the concerns related to educational status. Therefore, the information gathered from this study points out the education and knowledge status of the orthopaedic community and may be helpful during the planning of future meetings on strategies on prevention and treatment of complications.

Finally, results showed that 80% of the surgeons questioned applied postoperative rehabilitation by themselves. These findings are in contrast to other similar survey studies. The causes behind the avoidance of rehabilitation, which is crucial for obtaining a successful result following TKA, should be considered. A solution to this problem may be reached through cooperation between orthopedic and physical therapy specialty associations.

The present study is the first investigation made on the attitudes and approaches of orthopedic surgeons to TKA surgery in Turkey. Different applications can be

found in almost all points, including preoperative preparation, antibiotic use and other antimicrobial methods, incision type, and approaches to preoperative scenarios. We believe that the results of this study highlight the need for further studies on these subjects.

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