ORIGINAL PAPER/PŮVODNÍ PRÁCE

There Is a Difference in Patients' Opinions and Scientific Evidence Regarding Robot Assisted Total Joint Arthroplasty: a Questionnaire

Rozdíl mezi názory pacientů a vědeckými důkazy ohledně roboticky asistované totální artroplastiky kloubu: dotazník

KADIR UZEL[1], NESRULLAH AZBOY[2], KEREM EDIP BAŞARIR[3], ALP EREN KILIÇKAP[4], SÜHA BERKHAN BAYIN[5], İBRAHIM AZBOY[1]

[1] Medipol Mega University Hospital, Department of Orthopaedics and Traumatology, Bağcılar/İstanbul, Turkey

[2] Iskenderun district health directorate, Hatay, Turkey

[3] Bayrampasa State Hospital, İstanbul, Turkey

[4] Şile State Hospital, İstanbul Turkey

[5] Mimar Sinan State Hospital, İstanbul, Turkey

Corresponding author:

Kadir Uzel, MD
Medipol Mega University Hospital
Department of Orthopaedics and Traumatology
342124 Bağcılar/İstanbul, Turkey

dr.k.uzel21@gmail.com

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ABSTRACT

Purpose of the study

This study aimed to evaluate patients' knowledge and opinions about robotic total hip arthroplasty (THA) and total knee arthroplasty (TKA).

Material and methods

In order to assess patients' knowledge and opinions about robotic THA and TKA surgery, a descriptive questionnaire consisting of a total of 17 questions assessing patients' demographic information (age, gender, education level, occupation, income level, marital status) and their knowledge and opinions about robotic surgery was designed and applied to 200 participants by face-to-face interviews.

Results

The mean age of participants was 62.6 ± 7.1 years (range: 43–82), with 53% female. Among participants, 39% were university graduates, 9% were healthcare professionals, and 61.5% had an income between 10,000-20,000 Turkish lira. 60% (n = 120) had information about robotic surgeries, primarily sourced from newspapers, TV (35%), and social media (33%). 68.3% believed robotic surgery positively impacts surgical outcomes, and 77.5% preferred robotic surgery for knee and hip procedures. Those informed via social media had a mean age of 57.6 ± 6.5 years, while those informed through patient recommendations had a mean age of 64.0 ± 6.9 years (p = 0.001). Higher education levels correlated with increased knowledge of robotic surgery (p = 0.001), as did private-sector employment and higher income (p = 0.001, p = 0.001).

Conclusions

This study is an important step to understand the awareness and attitudes of robotic surgery among patients. There is a difference between the level of knowledge of the participants about robotic surgery and real scientific facts. Lack of knowledge and misconceptions about robotic surgery may affect patients' decision-making processes. Orthopaedic surgeons has responsibility to evaluate the new technological products in the light of strong scientific evidence when recommending to their patients. Also, media sources and social media platforms should maintain accurate information on emerging technologies.

Key words: robotics surgery, total knee arthroplasty, total hip arthroplasty, patient's perspectives.

INTRODUCTION

Total joint arthroplasty (TJA) provides improvement in quality of life by reducing pain and improving function with has high success rates. The frequency of TJA is increasing due to increasing life expectancy, unhealthy lifestyle, obesity, and other factors (15, 20, 22). After TJA complications such as limb length discrepancy, implant malposition, impingement

Table 1. **Questionnaire questions evaluating patients' knowledge and opinions about robotic surgery**

1) AGE?	
2) GENDER?	
3) EDUCATION LEVEL?	A. Primary school
	B. Middle school
	C. High school
	D. University
	E. Master's degree
	F. PhD and higher
4) EMPLOYMENT STATUS?	A. Private sector (Banker, engineer, lawyer. ...)
	B. Civil servant (All public institutions)
	C. I do not work (Continue from question 6)
5) ARE YOU A HEALTH CARE WORKER?	A. Yes
	B. No
6) SELECT INCOME STATUS	A. <10 000 TL
	B. 10 000–20 000 TL
	C. 20 000–30 000 TL
	D. 30 000–40 000 TL
	E. >40 000 TL
7) HAVE YOU HEARD ABOUT ROBOTIC KNEE AND HIP REPLACEMENT SURGERIES?	A. A. No, I didn't. The survey is over. Thank you.
	B. B. I heard yes. Please continue with the questionnaire.
8) HOW DID YOU HEAR ABOUT ROBOTIC SURGERY?	A. Social media.
	B. Newspapers and TV.
	C. Physician recommendation.
	D. Patient referral.
9) HAVE YOU HAD ROBOTIC SURGERY BEFORE?	A. No.
	B. I had robotic orthopedic surgery.
	C. I had robotic cardiovascular surgery.
	D. I had robotic brain surgery.
	E. I had robotic urology surgery.
	F. I had robotic gastrointestinal surgery.
10) ARE THERE ANY PATIENTS AROUND YOU WHO HAVE UNDERGONE ROBOTIC KNEE AND HIP SURGERY?	A. No.
	B. Yes.
11) HOW DO YOU THINK ROBOTIC SURGERY AFFECTS THE SUCCESS OF THE SURGERY?	A. I think it has a positive effect.
	B. Undecided.
	C. I think it has a negative impact.
12) WHAT DO YOU KNOW ABOUT PERFORMING ROBOTIC SURGERY?	A. The surgeon controls the robot to perform the surgery.
	B. Robot performs the surgery under the supervision of a trained surgeon.
	C. Robot performs surgery on its own.
	D. I don't know.

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13) WOULD THE SIZE OR RISKS OF THE SURGERY AFFECT YOUR DECISION TO CHOOSE ROBOTIC SURGERY?	A. Yes.
	B. No.
14) WHICH FEATURE OF ROBOTIC SURGERY APPEALS TO YOU? YOU CAN CHOOSE MORE THAN ONE OPTION.	A. Shortened recovery time.
	B. Elimination of human error margin.
	C. Less postoperative pain.
	D. Small scar.
15) WHICH OF THE FOLLOWING DO YOU THINK ARE DISADVANTAGES OF ROBOTIC SURGERY?	A. Failure of the robot during surgery.
	B. The robot performs the surgery incorrectly.
	C. Inadequate training of the surgeon.
	D. Communication failure between robot and surgeon.
	E. Prolonged operation time.
	F. Insufficient cleaning and sterilization of the robot.
16) WHAT DO YOU THINK ABOUT THE COST OF ROBOTIC SURGERY?	A. I have no information.
	B. Affordable.
	C. Too much
17) HOW WOULD YOU PREFER YOUR KNEE OR HIP REPLACEMENT SURGERY TO BE PERFORMED?	A. I want an experienced surgeon to do it.
	B. I want the robot to do it on its own.
	C. I would like the surgeon to do it using a robot.

development, implant wear and joint dislocation may occur, which may cause patient dissatisfaction. Robot assisted technologies recently has introduced to minimize complications and increase patient satisfaction (3, 18). Although its clinical benefit has not been proven, the use of robotic surgery in arthroplasty is increasing, especially with the effect of industrial advertising campaigns, and it is predicted that its use in TKA will reach 50% by 2032 (1, 13, 16, 17). As a technology-oriented society, hospitals that adopt new technologies and innovation may naturally be perceived to be better, and therefore patients' demand for robotic assisted TJA may be a strong driving force in a competitive healthcare economy (4). Patients' perceptions or misunderstandings on robotic assisted arthroplasty is critical in shared decision patients process. However, there are very few published studies on patients' interest in and perception of robotic assisted TJA.

In this study, we aimed to evaluate patients' knowledge and opinions about robotic THA and TKA surgery with a questionnaire.

MATERIAL AND METHODS

A descriptive questionnaire was designed to assess patients' knowledge and opinions about robotic assisted total hip arthroplasty (THA) and total knee arthroplasty (TKA). The study was conducted after institutional clinical research ethics committee approval (Decision number: 2023/159). All patients were informed about purpose of the study according to the principles of the Declaration of Helsinki and their written/verbal consent for inclusion was obtained.

Between February 2023 and September 2023, a total of 200 randomly selected patients over the age of 18 who were admitted to the orthopedic clinics of private and public hospitals in Istanbul, Turkey and agreed to participate in the study were surveyed. Participants were informed about the content and purpose of the questionnaire and were asked to complete the questionnaire. All data were collected and analyzed. No financial or educational incentives were given to the participants.

The questionnaire consisted of 17 questions assessing patients' personal information (age, gender, education level, occupation, income level, marital status) and their knowledge and opinions about robotic assisted TJA (Table 1).

Statistical analysis

To measure the distribution normality of the data, we used the Kolmogorov-Smirnov test. Continuous variables were given as mean ± standard deviation. The Chi-square test was used to compare the categorical data of binary groups. A $p < 0.05$ was considered statistically significant. IBM Statistical Package for the Social Sciences (SPSS) version 25.0 (Chicago/Illinois, USA) data package program was used.

Table 2. **Sociodemographic characteristics and knowledge of robotic surgery (N = 200)**

		NUMBER	PERCENTAGE
Gender	Female	105	53
	Male	95	47
Education	Primary school	25	12
	Middle school	46	23.0
	High school	49	24.5
	University	77	39
	Master's degree	3	1.5
Employment status	Private sector	52	26.0
	Civil servant	22	11.0
	I don't work	126	63.0
Are you a health care worker?	No	79	91
	Yes	8	9
	Total	87	100.0
Income status for monthly (Turkish lira)	<10000	76	38.0
	10000–20000	123	61.5
	>20000	1	0.5
Have you heard about robotic knee and hip replacement surgeries?	Yes	120	60.0
	No	80	40.0

RESULTS

Of the 200 patients who participated in our study, 53% were women and the mean age was 62.6 ± 7.1 years (range: 43–82). Of the participants, 39% were university graduates, 63% were not working, 9% were health personnel and 61.5% had an income between 10000–20000 Turkish lira (Table 2). It was observed that 60% of the individuals in our study had information about robot assisted THA and TKA.

Of the 120 patients who had information about robot assisted TJA, 35% had accessed this information from newspapers and TV and 33% from social media (Table 3). The rate of those who thought that robotic surgery positively affected the success of surgery was 68.3%. 81.7% of the participants think that robotic TJA are performed by surgeons who control the robot. The rate of those who want knee and hip surgeries to be performed by surgeons accompanied by a robot is 77.5%.

The mean age of patients who had heard of robotic TJA was significantly higher than those who had not (p = 0.001) (Table 4). The mean age of those who wanted an experienced surgeon to perform TJA was 63.2 ± 7.8, while the mean age of those who preferred the surgeon to use a robot was 60.2 ± 6.5 (p = 0.049). The mean age of those who were informed about robotic TJA through social media was 57.6 ± 6.5, and the mean age of those who were informed through patient recommendations was 64.0 ± 6.9 (p = 0.001).

In our study, 78% of men and 44% of women stated that they had heard of robotic TJA (p = 0.001) (Table 5). As the level of education increased, the level of knowledge about robotic surgery also increased (p = 0.001). It was also found that the level of knowledge was better in those working in the private sector and those with higher income levels (p = 0.001, p = 0.001).

DISCUSSION

This study demonstrated that the majority of the participants were aware of robotic TJA and accessed this information from newspapers, TV and social media. The rates of those who thought that robotic TJA positively affected the success of surgery (68.3%) and those who knew that the robot was controlled by the surgeon during surgery (81.7%) were high. It was also shown that the majority of the participants preferred robotic TJA (77.5%) and thought that the cost of robotic TJA was high (50.8%). However, it was observed that sociodemographic factors such as age, gender, education level, employment status and income level affected the level of knowledge about robotic TJA.

There has been a remarkable increase in advertisements about robotic TJA by hospitals and technology manufacturers. Accordingly, robotic TJA gained a momentum despite its high costs (1, 4). These two factors affect the perspectives and informed decision-making of patients who do not have sufficient medical knowledge about robotic TJA. In our study, it was observed that the majority of the participants had information about robotic TJA and accessed this information mostly through newspapers, TV and social media. It was also observed that those with higher education and income levels had more information about robotic TJA and women had less information about robotic TJA. In a study conducted by Jassim et al. on the extent to which patients understood robotic and navigation systems in orthopedic surgery in the UK, it was reported that the responses did not differ significantly with age and gender (12). We found some differences in these responses due to sociocultural differences in our Türkiye. As the level of education increases, the opportunity to access information naturally increases. Although social media use was higher in young people, interestingly, the mean age of patients who had heard about robotic TJA was significantly higher than those who had not. This may be due to the fact that arthroplasty surgeries related to osteoarthritis are performed more frequently in the elderly and the recommendations of patients who have undergone similar surgery. The fact that those who were informed about robotic TJA via social media were younger may be associated with the higher

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Table 3. **The level of knowledge of the participants about robotic surgery (N = 120)**

		NUMBER	PERCENTAGE (%)
How did you hear about robotic surgery?	Social media	39	33
	Newspapers and TV	42	35.0
	Physician recommendation	33	27
	Patient referral	6	5.0
Are there any patients around you who have undergone robotic knee and hip surgery?	No	72	60.0
	Yes	48	40.0
How do you think robotic surgery affects the success of the surgery?	I think it has a positive effect	82	68.3
	Undecided	37	30.8
	I think it has a negative impact	1	0.8
What do you know about performing robotic surgery?	The surgeon controls the robot to perform the surgery	98	81.7
	Robot performs the surgery under the supervision of a trained surgeon	10	8.3
	Robot performs surgery on its own	1	0.8
	I don't know	11	9.2
Would the size or risks of the surgery affect your decision to choose robotic surgery?	Yes	107	89.2
	No	13	10.8
What do you think about the cost of robotic surgery?	I have no information	51	42.5
	Affordable	8	6.7
	Too much	61	50.8
How would you prefer your knee or hip replacement surgery to be performed?	I want an experienced surgeon to do it	27	22.5
	I would like the surgeon to do it using a robot	93	77.5

Table 4. **Assessment of participants' age and their opinion regarding robotic surgery**

		AVG ± SD	P
Have you heard about robotic knee and hip replacement surgeries?	Yes	65.2 ± 6.6	**0.001**
	No	60.9 ± 6.9	
Are there any patients around you who have undergone robotic knee and hip surgery?	No	61.4 ± 6.7	0.285
	Yes	60.0 ± 7.3	
Would the size or risks of the surgery affect your decision to choose robotic surgery?	Yes	60.7 ± 6.7	0.239
	No	63.1 ± 8.7	
How would you prefer your knee or hip replacement surgery to be performed?	I want an experienced surgeon to do it	63.2 ± 7.8	**0.049**
	I would like the surgeon to do it using a robot	60.2 ± 6.5	
How did you hear about robotic surgery?	Social media	57.6 ± 6.5	**0.001**
	Newspapers and TV	63.2 ± 6.4	
	Physician recommendation	61.3 ± 6.8	
	Patient referral	64.0 ± 6.9	

Avg: average

Table 5. **Comparison of the participants' knowledge about robotic knee and hip surgeries and their sociodemographic characteristics**

		ROBOTIC KNEE AND HIP REPLACEMENT SURGERIES				
		NO, I HAVEN'T HEARD		YES, I HEARD		P
		NO	%	NO	%	
Gender	Female	59	56.2	46	44	**0.001**
	Male	21	22.1	74	78	
Education	Primary school	21	84.0	4	16.0	**0.001**
	Middle school	28	60.9	18	39.1	
	High school	26	53.1	23	46.9	
	University	5	6.5	72	93.5	
	Master's degree	0	0.0	3	100.0	
Employement status	Private sector	10	19.2	42	80.8	**0.001**
	Civil servant	6	27.3	16	72.7	
	I don't work	64	50.8	62	49.2	
Income status (TL)	<10000	56	73.7	20	26.3	**0.001**
	10000–20000	24	19.4	100	80.6	

TL: Turkish lira

frequency of internet and social media use in this age group (8) and the increasing rate of advertisements on social media.

The majority of the participants think that robotic TJA positively affects the success of surgery, but also acknowledge that its cost is high. Although collaboration between industry and surgeons is very important for innovation, the financial relationship may have an impact on physicians' preferences. In a review of 54 studies on robotic-assisted TJA, DeFrance et al. observed that 91% of the studies had an author conflict of interest and that the authors of the studies reporting more successful results in with robotic assisted TJA compared to surgeries performed with traditional techniques were in a conflict of interest and had higher average industry payments per author (6). In a systematic review comparing agents used in venous thromboembolism prophylaxis, it was shown that the results of industry-sponsored studies reported more favorable results than studies without industry support (2). Therefore, it is necessary to carefully examine whether these studies are industry-sponsored or not. Although the margin of error in bone incisions made with robotic TJA is less, its superiority over conventional surgery in terms of functional outcomes and long-term survival, which are the two main indicators of surgical success, has not been proven (3, 5, 7, 9, 10, 17). On the other hand, it has been shown that the cost of robotic surgery is significantly higher and operation time is longer. Also pin hole related fractures, pin site infections, vascular and nerve injuries may develop due to the use of pins (11, 14, 19, 21). This study shows that the level of knowledge of the participants about robotic TJA and the scientific evidence are different. In a study by Abdelaal et al. on the perspectives and expectations of patients in robotic-assisted TKA, 60.3% of the participants were informed about robotic TKA, 20% of them heard about robotic TKA from the internet and social media, 11.8% heard about it from family and friends and 10.7% heard about it from TV. It was also stated that more than half of the participants (55.3%) believed that hospitals offering robotic TKA were superior to others. However, 39% of the participants stated that their preference for robotic TKA would change if surgeons had a conflict of interest. The authors concluded that patients have limited knowledge and vague understanding of the risks and benefits of robotic surgery technology (1). In the light of these data, the high rate of patients requesting robotic-assisted TJA can be interpreted as an indication that patients are not well informed about the advantages and disadvantages of robotic TJA. Patients with insufficient medical knowledge on this subject can be enabled to make more informed decisions and increase their satisfaction. In addition, the results of this study will help health policy makers to ensure that the process of adaptation to robotic technologies is carried out within the framework of reasonable and sustainable cost and optimum efficiency.

This study has some limitations. The limited number of patients selected from only one province of Turkey and the lack of consideration of cultural and geographical differences constitute the limitations of the study. Especially in patients living in underdeveloped and low-educated regions, sensation and knowledge about robotic TJA may be much more limited and inaccurate. In addition, the responses of the participants may have been subjective, and the questions included in the questionnaire may have been insufficient to reflect the real

opinions of the participants. Therefore, generalization of the results may be limited. Therefore, it is important to conduct similar studies in the future with a higher proportion of participants in different regions and cultural contexts.

CONCLUSIONS

This study is an important step towards understanding the awareness and attitudes of robotic TJA among patients. There is a discrepancy between the level of knowledge of the participants about robotic TJA and scientific evidence. Lack of knowledge and misconceptions about robotic TJA may affect patients' decision-making processes. One of the responsibilities of orthopaedic surgeons is to critically evaluate new technological products in the light of convincing scientific evidence when recommending and using them. Patients should be counseled accordingly with unbiased and accurate information. ■

Data availability

Authors confirm the availability of the data and materials used in this study for any future request.

Ethics approval and consent to participate

This research has been approved by the IRB of the authors' affiliated institutions. (Decision number: 2023/159).

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