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Retrospective Review of Anesthesia Methods in Total Knee Arthroplasty Surgeries

Total Diz Artroplastisi Ameliyatlarında Uygulanan Anestezi Yöntemlerinin Retrospektif Olarak İncelenmesi

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Abstract

In Turkey, there are few studies conducted on the retrospective evaluation of the perioperative and postoperative effects of anesthesia methods applied in patients undergoing total knee arthroplasty surgery. In this study, our aim is to test the hypothesis that regional anesthesia techniques applied in patients undergoing total knee replacement surgery provide better results than general anesthesia. Ankara Numune Training and Research Hospital Scientific Research Evaluation Commission approved this study. Medical archives and anesthesia records of 247 patients who underwent total knee arthroplasty surgery between January 01, 2012 and December 31, 2012 were retrospectively analyzed. Preoperative, intraoperative and postoperative records were kept. In terms of gender, age, smoking status, ASA level, surgery type, accompanying diseases, mean arterial blood pressure, blood donation status, complications, postoperative intensive care need, operation and discharge times, perioperative morbidity and mortality, it was found that there is no statistically significant difference between the groups studied (p> 0.05). There was a statistically significant difference between groups in terms of the amount of blood given, amount of fluid administered and heart rate (p <0.05). In our study, 247 patients who underwent total knee arthroplasty were analyzed retrospectively. We concluded that there was no significant difference in terms of perioperative morbidity and mortality between regional anesthesia applications and general anesthesia applications in patients with similar age groups and concomitant diseases. We think that more comprehensive meta-analyzes and studies are needed on this subject.

Keywords: Total knee prosthesis, Total knee arthroplasty, Regional anesthesia, General anesthesia

Özet

Total diz artroplastisi ameliyatı geçiren hastalarda uygulanan anestezi metodlarının perioperatif ve postoperatif etkilerinin retrospektif değerlendirilmesi üzerine Türkiye'de yapılan çalışmalar az sayıdadır. Bu çalışmada amacımız total diz protezi ameliyatı geçiren hastalarda uygulanan rejyonel anestezi tekniklerinin genel anesteziye göre daha iyi sonuçlar sağladığı hipotezini test etmektir. Ankara Numune Eğitim ve Araştırma Hastanesi Bilimsel Araştırma Değerlendirme Komisyonu onayı alındı. 01 Ocak 2012 ile 31 Aralık 2012 tarihleri arasında total diz artroplasti ameliyatı geçiren 247 hastanın tıbbi arşivleri ve anestezi kayıtları geriye dönük olarak incelendi. Hastaların preoperatif, intraoperatif ve postoperatif kayıtlar tutuldu. Çalışılan gruplar arasında cinsiyet, yaş, sigara içme durumu, ASA düzeyi, ameliyat şekli, eşlik eden hastalıklar, ortalama arteriyel kan basıncı, kan verilme durumu, komplikasyonlar, postoperatif yoğun bakım ihtiyacı, ameliyat ve taburculuk süreleri, peroperatif morbidite ve mortalite açısından istatistiksel olarak anlamlı bir fark olmadığı bulundu (p> 0.05). Çalışılan gruplar arasında verilen kan miktarı, verilen sıvı miktarı ve kalp hızı açısından istatistiksel olarak anlamlı fark vardı (p <0.05). Çalışmamızda total diz artroplastisi operasyonu geçiren 247 hastanın verileri retrospektif olarak incelendi. Benzer yaş grupları ve yandaş hastalıklara sahip hastalarda rejyonel anestezi uygulamaları ve genel anestezi uygulamaları arasında peroperatif morbidite ve mortalite açısından anlamlı bir fark olmadığını gözlemledik. Bu konuda daha kapsamlı meta analizlere ve çalışmalara ihtiyaç olduğu kanısındayız.

Anahtar Kelimeler: Total diz protezi, Total diz artroplastisi, Rejyonel anestezi, Genel anestezi

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1. Introduction

The effects of the anesthesia method on the perioperative results have been a subject of curiosity. There are many studies on the results of regional or general anesthesia applications during and after surgery (1). Regional anesthesia and general anesthesia methods can be applied in total knee arthroplasty operations (2). An increasing number of total knee prosthesis surgeries are performed every year, as a result the number of studies on this subject is increasing. Especially the anesthesia method to be used for surgery and the complications of the anesthesia method have been a matter of curiosity. (3).

Total knee arthroplasty is one of the most frequently performed operations worldwide (2, 4). The purpose of total knee arthroplasty surgery application is providing movement, relieving pain and correcting deformity. Total knee arthroplasty can be performed under regional or general anesthesia. Based on the medical condition of the patient, one of these two methods is chosen. The superiority of regional or general anesthesia over cognitive functions, cardiovascular status, and mortality rates has not been fully demonstrated (5).

It has been suggested that neuraxial anesthesia increases the survival in patients with hip fractures, regardless of the type of anesthesia and other factors (6). Although there are studies suggesting that neuraxial anesthesia in orthopedic interventions increases the risk of thromboembolism (7), studies suggesting that it reduces the risk of thromboembolism, decreases intraoperative blood loss, and shortens the duration of stay in the operating room (8). The number of patients included in randomized controlled trials is generally low. In order to obtain realistic results, retrospective cohort studies and examinations involving a large number of patients are ongoing.

Postoperative close follow-up is important for the first 24 hours. One out of every 30 patients who undergo total knee arthroplasty needs intensive care in the postoperative period (9-11). Adequate hydration and analgesia should be provided. Effective pain management is very important because postoperative pain has a direct impact on the quality of life (4). Postoperative analgesia can be provided through an intraoperatively placed epidural catheter, patient-controlled intravenous anesthesia or orally. Knee exercises are performed in the early postoperative period under the control of a physiotherapist (10). Usually they are discharged in 5-14 days. After orthopedic surgeries, performed with neuraxial anesthesia, the length of stay in the hospital is very short and the hospital mortality is very low (12). Thromboembolism prophylaxis is continued at home.

Ankara Numune Training and Research Hospital is a multidisciplinary hospital with a history of more than 130 years, with advanced systems, experienced surgeons in surgical branches, 1150 beds and approximately 50,000 surgeries per year. Examining the results of applied anesthesia methods retrospectively in this hospital can contribute to evidence-based medicine as well as self-assessment of the anesthesia branch and determining future goals.

In Turkey, there are few studies conducted on the retrospective evaluation of the perioperative and postoperative effects of anesthesia methods applied in patients undergoing total knee arthroplasty surgery. In this study, our aim is to test the hypothesis that regional anesthesia techniques applied in patients undergoing total knee replacement surgery provide better results than general anesthesia.

2. Material ve Method

Ankara Numune Training and Research Hospital Scientific Research Evaluation Commission approved this study (ID Number: 2013-533, Date: 27.02.2013). Medical archives and anesthesia records of 247 patients who underwent knee arthroplasty surgery between January 01, 2012 and December 31, 2012 were retrospectively analyzed.

Patients who will have knee arthroplasty surgery were evaluated in the anesthesia policlinic one day before the surgery. The patients were informed about the procedure

and their informed consent was obtained. Regional anesthesia was recommended primarily to suitable patients. General anesthesia was administered to patients who were unsuitable or did not accept regional anesthesia. In the preoperative period of the patients; demographic data (name, surname, age, smoking), ASA physical condition scores, accompanying systemic diseases, preoperative hemoglobin values were recorder. In the intraoperative period; the type of applied anesthesia, the type of applied surgery, the duration of the operation, the fluids and respective amounts, the amount of blood and blood products, blood pressures, heart rates, the presence of perioperative complications (hypotension, bleeding, embolism, arrest), the resulting morbidity and mortality were recorded. In the postoperative period, postoperative hemoglobin value, presence of postoperative intensive care need, duration of intensive care stay, duration of discharge from the hospital, postoperative morbidity and mortality reasons were recorded.

Statistical analysis of the data was performed in the SPSS 16.0 statistics package program. Descriptive statistics of continuous variables were given as mean ± standard deviation, while categorical variables were expressed as number (n) and percentage (%). Pearson's chi-square test and Fisher's exact chi-square test were used in the analysis of categorical data. The level of significance was determined as $\alpha = 0.05$.

3. Results

There were 247 patients; 82.2% were women and 17.8% were men. The average age was 67.3 ± 8.3 and 60.3% of them was smoking. 3.6% was categorized in ASA-I, 64.8% in ASA-II, 31.6% in ASA-III risk groups. General anesthesia was applied to 37.2% of the patients and regional anesthesia method was applied to 62.8%. 93.1% had a total surgery and 6.9% had a revision surgery type. 61.9% of these patients needed blood transfusion. 2.0% of the patients required postoperative intensive care. The average length of stay in the intensive care unit was 2.2 ± 1.1 days. The mean of preoperative hemoglobin values were 13.0 ± 1.4. The mean of postoperative hemoglobin values were 9.3 ± 4.5. The mean operation time was 79.2 ± 13.3 minutes. Mean discharge time was 10.8 ± 3.6 days. There was no mortality (Table-1).

Table 1. Characteristics of Participants

		n	%
Gender	Female	203	82.2
	Male	44	17.8
		n	**Ort. ± SS**
Age		247	67.3 ± 8.3
		n	**%**
Smoking	No	98	39.7
	Yes	149	60.3
ASA	I	9	3.6
	II	160	64.8
	III	78	31.6
Anesthesia Method	Group I (General)	92	37.2
	Group II (Regional)	155	62.8
Type of Surgery	Total	230	93.1
	Revision	17	6.9
Blood Donation Status	No	94	38.1
	Yes	153	61.9
		n	**Mean ± SD**
Amount of Given Blood		153	1.9 ± 1.0
Amount of Liquid Given		247	1,761.1 ± 551.8
		n	**%**
Postoperative IC Need	No	242	98.0
	Yes	5	2.0
		n	**Mean ± SD**
IC Stay Duration (day)		5	2.2 ± 1.1

HB Value Preoperative		247	13.0 ± 1.4
HB Value Postoperative		247	9.3 ± 4.5
Operation Duration (minutes)		247	79.2 ± 13.3
Discharge Time (day)		247	10.8 ± 3.6
		n	**%**
Mortality	No	247	100.0
	Yes	--	--

ASA: American Society of Anesthesiologists, HB: Hemoglobin, IC: Intensive care

Co-morbid diseases; hypertension in 72.9%, diabetes mellitus in 26.7%, chronic obstructive pulmonary disease in 32.0%, coronary artery disease in 16.6%, atrial fibrillation in 2.0%, chronic kidney failure in 4.0%, chronic heart failure in 4.5%, cerebrovascular accident in 1.6%, Parkinson in 0.4%, rheumatoid arthritis in 2.4% and obesity in 2.4% were also observed in the patients participating in the study. In terms of gender accompanying diseases, it was found that there is no statistically significant difference between the groups studied (p> 0.05).

In terms of gender, age, smoking status, ASA level, surgery type, perioperative hypotension, perioperative mean arterial blood pressure, perioperative bleeding, embolism, cardiac arrest, blood donation status, postoperative intensive care need, intensive care stay times, operation and discharge times, it was found that there is no statistically significant difference between the groups studied (p> 0.05).

While there was no statistically significant difference in terms of blood donation status between the groups studied (p> 0.05), there was a statistically significant difference between groups in terms of the amount of blood given (p <0.05). It was observed that the amount of blood given to Group I patients was higher than the amount of blood given to Group II patients (Table-2).

Table 2. Comparison of Blood Donation Status, Amount of Blood Given and Amount of Liquid Given Between Groups

		Group I (General) (n=92)		Group II (Regional) (n=155)		x^2	P
		n	**%**	**n**	**%**		
Blood Donation Status	No	34	37.0	60	38.7	0,019	0,890
	Yes	58	63.0	95	61.3		
		Mean+SD (n=58)		**Mean+SD (n=95)**		**t**	**P**
Amount of Blood Given		2.1 ± 1.2		1.7 ± 0.8		2.519	**0.013**
		Group I (General) (n=92) Mean+SD		**Group II (Regional) (n=155) Mean+SD**		**t**	**P**
Amount of Liquid Given		1,657.6 ± 569.0		1,822.6 ± 533.7		-2.291	**0.023**

When a comparison was made between the groups in terms of the amount of fluid administered, a statistically significant difference was found (p <0.05). It was observed that the amount of fluid given to Group II patients was higher than the amount of fluid given to Group I patients (Table-2).

While there was no statistically significant difference in terms of postoperative Hemoglobin (Hb) values between the groups studied (p> 0.05), the difference in terms of preoperative Hb values was statistically significant (p <0.05). Preoperative HB values of Group II patients were found to be higher than Group I patients. In group comparisons; a statistically significant difference was found between preoperative HB values and postoperative HB values in both groups (p <0.05). It was observed that postoperative HB values were lower than preoperative HB values in both groups (Table-3).

Table 3. Comparison of Preoperative and Postoperative Hb Values Between Groups and Within Groups

	Group I (General) (n=92)	Group II (Regional) (n=155)	t	P*
Hb Preoperative	12.8 ± 1.5	13.1 ± 1.3	-2.103	**0.037**
Hb Postoperative	8.9 ± 1.3	9.6 ± 5.6	-1.080	0.281
t	26.981	7.856		
P**	**0,000**	**0,000**		

Hb: Hemoglobin
** Comparison between groups.*
*** Intragroup comparison.*

While there was no statistically significant difference in terms of heart rate (HR) from the 10th minute to the 75th minute between the groups studied (p> 0.05), it was found that there was a statistically significant difference between the groups at the 5th minute (p <0.05). It was found that the HR values of Group I patients were higher than those of Group II patients (Table-4).

Table 4. Comparison of the Amount of Liquid Given Between Groups

	Group I (General) (n=92)	Group II (Regional) (n=155)	t	P
Liquid	1,657.6 ± 569.0	1,822.6 ± 533.7	-2.291	**0.023**

4. Discussion

Studies have been published suggesting that the application of neuraxial anesthesia in orthopedic interventions reduces the risk of thromboembolism, reduces intraoperative blood loss, and shortens the duration of stay in the operating room (8). Neuroaxial regional anesthesia techniques have advantages over general anesthesia techniques such as avoiding complications due to airway requirement and maintaining communication with the patient (4).

In this study, the anesthesia methods applied in patients undergoing total knee arthroplasty surgery were examined and we concluded that there was no significant difference between general anesthesia and regional anesthesia groups in terms of perioperative complications.

For anesthetists, it is important to determine the most appropriate anesthesia method to be applied in total knee arthroplasty surgery.

There are existing studies comparing regional and general anesthesia techniques in different patient populations in the literature. In their meta-analysis, Rodgers et al. (11) concluded that regional anesthesia reduces major postoperative complications by comparing regional and general anesthesia in terms of postoperative mortality and morbidity. They reported that deep vein thrombosis, pulmonary embolism, need for blood transfusion, pneumonia and respiratory depression are observed less under regional anesthesia, especially in the patient population who underwent orthopedic surgery (11). In this study, we concluded that there was no significant difference in complications between patients undergoing general anesthesia and regional anesthesia.

Sharrock et al. (13) reported that in a hospital performing orthopedic surgery while the hospital mortality rate was 36% from 1981 to 1985, it decreased to 0.01% between 1987 and 1991, and this decrease was observed

simultaneously with changes in anesthesia practices. They claimed that mortality decreased with hypotensive epidural anesthesia instead of general anesthesia in orthopedic procedures (13). Waren et al. (8), in their study comparing spinal anesthesia with general anesthesia, suggested that there was no difference in postoperative 30-day mortality. In this study, we concluded that there was no significant difference in morbidity and mortality between patients undergoing general anesthesia and regional anesthesia.

It has been reported that the incidence of deep vein thrombosis decreases in patients who underwent total knee arthroplasty surgery and who received continuous epidural infusions for postoperative pain relief (14, 15).

There are studies suggesting that more thromboembolism is seen in the postoperative period of patients who underwent total knee arthroplasty surgery and were operated under regional anesthesia compared to patients who were operated under general anesthesia. However, there also exists studies suggesting that less thromboembolism is seen in patients operated under regional anesthesia (7, 8).

In total knee arthroplasty surgeries, it has been reported that there is a 20% reduction in mean arterial pressure within one minute after the tourniquet is opened (16). Adequate fluid supply, rapid treatment of hypotension and bradycardia may reduce hemodynamic instability after opening the tourniquet.

It has been shown that spinal and epidural anesthesia suppresses the increase in blood pressure during tourniquet inflation more than those under general anesthesia (17). This situation is interpreted as regional anesthesia relieves tourniquet pain better than general anesthesia. It has been suggested that the relief of tourniquet pain by regional anesthesia leads to a decrease in hypercoagulability after total knee arthroplasty (18). It has been shown that the incidence of proximal thrombosis significantly decreases in the period following the surgery in cases where epidural anesthesia was applied for knee arthroplasty surgery (15).

Some studies could not show the superiority of neuraxial anesthesia over general anesthesia during knee arthroplasty surgery. For example, Anderson et al. found that there was no difference between epidural and general anesthesia in terms of long-term cognitive functions and cardiovascular complications in 262 elderly patients who underwent knee arthroplasty (19). In our study, regional anesthesia and general anesthesia were found to be similar in terms of perioperative hypotension, perioperative mean arterial blood pressure, perioperative bleeding, embolism, cardiac arrest, blood donation status, postoperative intensive care need, intensive care stay times, operation and discharge times.

It has been shown that the hypotensive epidural anesthesia technique reduces the need for perioperative blood transfusion by reducing blood loss in orthopedic procedures (20, 21). Less bleeding in the operation area shortens the operation time and indirectly, the short operation time reduces the risk of developing deep vein thrombosis (22).

The aim of hypotensive epidural anesthesia technique is to keep the mean arterial pressure between 50-60 mmHg during the operation. Sympathetic blockade caused by epidural anesthesia and the block of cardiac accelerator fibers reduce systemic vascular resistance and, if uncontrolled, may cause severe hypotension, bradycardia and a decrease in cardiac output (23). Mean arterial pressure between 50-60 mmHg can be maintained with the infusion of vasopressors such as norepinephrine or phenylephrine.

5. Conclusion

In our study, 247 patients who underwent knee arthroplasty were analyzed retrospectively. We concluded that there was no significant difference in terms of perioperative operative morbidity and mortality between regional anesthesia applications and general anesthesia applications in patients with similar age groups and concomitant diseases. We think that more comprehensive meta-analyzes and studies are needed on this subject.

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