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Complications of spinal and general anesthesia for total knee arthroplasty

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Abstract

Introduction. General anesthesia (GA) and spinal anesthesia (SA) are the main techniques applied during total knee arthroplasty (TKA). SA belongs to neuraxial anesthesia (NA) category. Numerous studies have explored benefits of NA in diminishing the complications, among which are pulmonary embolism (PE), urinary tract infection (UTI), and deep vein thrombosis (DVT).
Aim. To compare rate of complications of SA and GA in TKA.
Materials and methods. This is a retrospective cohort studie conducted on 190 patients who attended Alwasity teaching hospital in Baghdad and underwent TKA. The age ranged from 41 to 75 years and 69% of patients were females. The patients were enrolled into SA group (80 patients) and GA group (110 patients). We reviewed patients' records and interviewed patients and medically examined them to obtain data on age, sex, body mass index (BMI), comorbidities including diabetes mellitus (DM), hypertension (HT) and other comorbidities.
Results: Higher age and BMI were found in SA group. Complications' incidence in SA group vs. GA group was PE 0.03 vs. 0.09, DVT 0.04 vs. 0.10, Pneumonia 0.04 vs. 0.08, UTI 0.06 vs. 0.23, and ARF 0.03 vs. 0.33, they didn't differ significantly.
Conclusion: SA is a good option for anesthesia in TKA because it wasn't associated with higher complications rate compared to GA.

Keywords: total knee arthroplasty, general anesthesia, spinal anesthesia, neuraxial anesthesia, pulomonary embolism

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Осложнения спинальной и общей анестезии при тотальном эндопротезировании коленного сустава

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Резюме

Введение. Общая анестезия (ОА) и спинальная анестезия (СА) являются основными методами, применяемыми при тотальном эндопротезировании коленного сустава (ТЭПКС). СА относится к категории нейроаксиальной анестезии (НА). В ходе многочисленных исследований были выявлены преимущества НА, выражающиеся в снижении частоты осложнений, среди которых тромбоэмболия легочной артерии (ЛЭ), инфекция мочевыводящих путей (ИМП) и тромбоз глубоких вен (ТГВ).
Цель. Сравнить частоту осложнений спинальной анестезии и общей анестезии при ТЭПКС.
Материалы и методы. В ретроспективное групповое исследование было включено 190 пациентов, которые наблюдались в больнице аль-Уозити Тичинг (Багдад) и перенесли ТЭПКС. Возраст пациентов колебался от 41 до 75 лет, 69% пациентов составляли женщины. Пациенты были распределены между группами СА (80 пациентов) и ОА (110 пациентов). Нами изучены истории болезней пациентов, проведен их опрос и медицинское обследование, в результате чего были получены данные о возрасте, поле, индексе массы тела (ИМТ), сочетанных заболеваниях, включая сахарный диабет (СД), артериальная гипертензия (АГ) и др.
Результаты: В группе СА были выявлены пациенты более старшего возраста и с более высоким ИМТ. Частота осложнений в группе СА по сравнению с группой ОА составила ТЭЛА – 0,03 vs 0,09, ТГВ – 0,04 vs 0,10, пневмония – 0,04 vs 0,08, ИМП – 0,06 vs 0,23, а также ОПН – 0,03 vs 0,33, достоверных различий между ними не выявлено.
Заключение. При ТЭПКС СА является оптимальным вариантом анестезии, так как она не связана с более высокой частотой осложнений по сравнению с ОА.

Ключевые слова: тотальное эндопротезирование коленного сустава, общая анестезия, спинальная анестезия, нейроаксиальная анестезия, ТЭЛА

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INTRODUCTION

Globally, huge number of patients undergo total knee arthroplasties (TKA) which is a common orthopedic procedure and a prominent modality in the treatment of chronic painful conditions in the knee. Nowadays, TKA is a successful procedure with positive impact on patient [1, 2].

Changes in population size and composition and improvement of surgical techniques for TKA over time caused evolvement of the anesthetic techniques applied for this surgery, hence, an improvement in the complications' occurrence. However, the ideal anesthetic technique for TKA remains complex and controversial issue where the debate regarding the choice and its impact on patient's outcomes has continued for many years [2–5].

General anesthesia (GA) and spinal anesthesia (SA) are the main techniques applied during TKA. Previously, GA was the best option, but nowadays SA became the trend [6–8].

Neuraxial anesthesia (NA) is performed by injecting local anesthetic in or around the central nervous system. SA is a variant of NA that implies injecting a local anesthetic is injected directly in the intrathecal space [8].

Numerous studies have explored the potential benefits of NA versus GA in diminishing the rate of complications in TKA. These complications include critical care unit admission, ventilator use, surgical site infection, pulmonary embolism (PE), pneumonia, urinary tract infection (UTI), deep vein thrombosis (DVT), and acute renal failure (ARF) [1, 4].

In arthroplasty field, SA is accompanied by less complications postoperatively [6, 9].

The current study aims to compare the complications rates of SA and GA in TKA.

MATERIALS AND METHODS

This is a retrospective cohort studie conducted from January 2021 to December 2022 on 190 Iraqi patients who attended Alwasity teaching hospital in Baghdad and underwent TKA. Their age ranged from 41 to 75 years. The patients were enrolled into SA group (80 patients) and GA group (110 patients) based on the decision of the anesthesiologist and the surgeon taking into account the patient's own decision after fully explaining the advantages and disadvantages of each technique.

We reviewed patients' records and used direct interview and medical examination of patients to obtain data on age, sex, body mass index, comorbidities including diabetes mellitus (DM), hypertension (HT), cardiac disease, cerebrovascular disease, pulmonary disease, renal disease, and we followed up patients for 30 days to detect complications including PE, pneumonia, UTI, DVT, and ARF.

For SA we used bupivacaine 0.5%. For GA we used fentanyl then we gave propofol which is in a dose of 2–2.5 mg/kg. Also, we gave midazolam the anxiolytic drug as a sedation in a dose of 0.01 mg/kg, and we gave a muscle relaxant which is rocuronium in a dose of 0.6 mg/kg. We also have atracurium in a dose of 0.5 mg/kg. Regarding inhalational anaesthesia we gave isoflurane or sevoflurane. For prophylaxis of DVT and PE, we used Graduated compression stockings, intermittent pneumatic compression, and enoxaparin 4000 I.U. given postoperatively subcutaneously once daily and continued for 3 weeks. For diagnosis of DVT we relied on clinical diagnosis and doppler ultrasound, while for diagnosis of PE we relied on clinical diagnosis and computerized angiography of the chest.

Data were entered into computer and analysed by Microsoft excel software 2019 version 2305. Continuous variables were expressed as mean and standard deviation (M ± SD), while categorical variables were expressed as proportiones. Student's *t* test was used to compare the continuous variables, whereas, Chi- square test was used to compare the categorical variables. In all statistical tests, p value (*P*) of ⩽ 0.05 was considered significant.

RESULTS

One hundred ninety patients, of which, 59 were males and 131 were females. Their age ranged from 41 to 75 years, with M ± SD of 50.8 ± 7.5 y. Regarding the differences between SA and GA groups in age, sex, and BMI, *Table 1* shows that age and BMI were significantly different from each other (*P* ⩽ 0.05), whereas gender distribution wasn't significantly different.

Regarding the differences between SA and GA groups in the rate of comorbidities (HT, DM, cardiac disease, pulmonary disease, cerebrovascular disease, and renal

Table 1. Age, sex, and BMI of patients by anesthesia group
Таблица 1. Пол, возраст, индекс массы тела (ИМТ) пациентов по группам анестезии

Variables		SA	GA	P
Age (M ± SD)		51.8 ± 6.5	49.8 ± 5.8	0.0269
Gender %	M	0.33	0.30	0.7138
	F	0.68	0.70	
BMI (M ± SD)		28.88 ± 6.5	27.0 ± 6.3	0.0465

Table 2. Distribution of comorbidities among patients by anesthesia group
Таблица 2. Распределение сочетанных заболеваний среди пациентов по группам анестезии

Comorbidity	SA	GA	P	95% C.I.
HT	0.44	0.43	0.99	[-0.1328, 0.1528]
DM	0.19	0.20	0.98	[-0.1239, 0.1039]
Cardiac disease	0.14	0.07	0.88	[-0.0197, 0.1597]
Pulmonary disease	0.05	0.02	0.91	[-0.0245, 0.0845]
Cerebrovascular disease	0.06	0.04	0.95	[-0.0436, 0.0836]
Renal disease	0.04	0.01	0.89	[-0.0168, 0.0768]

Table 3. Complications rates among patients by anesthesia group
Таблица 3. Частота осложнений среди пациентов по группам анестезии

Complications	SA	GA	P	95% C.I.
PE	0.03	0.09	0.87	[-0.1252, 0.0052]
DVT	0.04	0.10	0.88	[-0.1306, 0.0106]
Pneumonia	0.04	0.08	0.91	[-0.1064, 0.0264]
UTI	0.06	0.23	0.77	[-0.2643, -0.0757]
ARF	0.03	0.33	0.65	[-0.3955, -0.2045]

disease), *Table 2* shows that SA group tended to have higher comorbidities rate than GA group except for DM, however, no significant difference was found in any comorbidity rate.

The differences between SA and GA groups regarding the rate of complications (PE, DVT, pneumonia, UTI, and ARF), *Table 3* shows that SA group tended to have lower complications rate than GA group, however, there was no significant difference in any complication rate.

DISCUSSION

The current study is one of few studies conducted in Iraq that explore the choice of anesthesia techniques used in TKA and their related complications, however, our study included comparisons of comorbidities and complications rates between SA and GA groups which isn't done in other Iraqi studies [10, 11].

Our study revealed that the patients who underwent SA for TKA tended to be older and having more body mass index than those who underwent GA, which is in consistency with the results of some other studies [12–14] and this tendency might reflect the presence of comorbidities which affected the choice of anesthesia. Our study also showed that more females than males underwent TKA, although there was no significant difference, however, this female predominance is consistent with the results of some other studies [12, 13] and it could be attributed to the fact that females are more affected by osteoarthritis which might eventually demand TKA [15, 16].

No significant difference was shown in our study in the distribution of comorbidities between SA and GA groups which could be attributed to the small sample size which is a limitation in our study. The small sample size fails to detect small differences between the different groups. The similar distribution of comorbidities between SA and GA groups might also reflect that comorbidities such as HT, DM, and other comorbidities are prevalent nowadays in Iraqi population across many age groups and many patients with other diseases.

Our study showed that the absolute rates of all complications that occurred in SA group were lower than those in GA group, however, no significant difference was shown between the two groups which is supporting the results found in other studies [12, 14, 17]. However, taking into consideration that the absolute value of complications accompanying TKR is not a big one, the comparison of anesthesia modalities would require large numbers of patients for evaluating the anticipated complications and this may not be a feasible approach [18]. In addition to that, the lack of significant difference in the rate of complications between the two groups could be attributed to the good standard of healthcare services offered to all patients preoperatively and postoperatively regardless the choice of anesthesia.

While our study showed no significant difference in the complications rate between SA and GA groups, many other studies showed that SA is superior to and more beneficial than GA, for example, some studies found a relationship between NA and a lowering incidence of DVT, pneumonia, PE, respiratory depression transfusion requirement, and the patients receiving SA had

a lower chance of acute renal failure, wound infection, urinary tract infection, blood transfusions and all-cause infections, superficial wound infections, critical care admissions, and readmissions and overall complications [1, 2, 5, 13, 19–22].

It is worth mentioning that the decision of which anesthetic technique to choose is a complex issue related to the medical team (the surgeon and the anesthesiologist), the patient and external factors related to the healthcare system [4].

The mechanisms that lead to the beneficial effect of the NA are based on the physiological aspects including a diminished sympathetic stress response from surgery, lower immunomodulation, and the absence of mechanical ventilation accompanying GA, alteration of coagulation and blood flow, preservation respiratory function [4, 17].

It is also worth mentioning that NA can cause, urinary retention, hypotension and pruritus [23].

CONCLUSION

SA is a good option for TKA compared to GA, even with the absence of significant difference between them, for at least not causing more complications than GA. However, there is a need to conduct more studies regarding this topic with larger sample sizes.

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