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Comparison of General Anesthesia and Spinal Anesthesia on Hemodynamic Stability in Patients Undergoing Hernia Repair

Adnan Abdul Adheem Kadhim, Haider Ahmed Jalab Salem Al-Khikani✉, Qasim Muhammad Hamza, Yass Khudair Habib, Muhammad Mohsen Hussein, Hassan Taqi Muhammad

Al-Taff University College, Karbala, Iraq

✉ hider.ahmed.j@gmail.com

Abstract

Introduction. The issue of choosing the optimal anesthesia that is least dangerous to the patient's life is still the main concern of the workers in the anesthesia and intensive care department, including techniques, medications, plans, and instructions followed in order to choose the best anesthesia. It can also be said that spinal anesthesia is the best and most standard anesthesia for those who repair hernia.

The aim of the study — learn about obtaining and verifying hemodynamic stability in patients undergoing hernia repair under anesthesia.

Materials and methods. An accurate and recent study of patients attending Al-Hussein Medical City and Al-Hasan Hospital in the city of Karbala. We included 100 patients who underwent a herniotomy, were divided into two groups on the types of general and spinal anesthesia. Fifty patients received general anesthesia and 50 patients received spinal anesthesia. Data related to the patient's age, weight, change in blood pressure and pulse rate were analyzed. The study analyzed patients aged 20–90, dividing them into two groups: general anesthesia (GA) and spinal anesthesia (SA), for careful follow-up before, during, and after operations.

Results. We show that it is also more stable in SA which is about 56 % in comparison to GA which is about 40 % but increased blood pressure is more in GA which was 32 % and 24 % in SA, but decreased blood pressure is also more in GA which was 28 % and in SA was 20 %. In this study, as shown, there is more stability in heart rate, which is 56 % in SA but in GA it is 32 % and the increase in heart rate was 34 % in SA but was 60 % in GA. The decreased heart rate was 10 % in SA and about 8 % in GA and the effect of SA is more stable.

Conclusions. We found spinal anesthesia was more than general anesthesia in stability of blood pressure and heart rate and minimum or normal.

Keywords: general anesthesia, spinal anesthesia, hemodynamic stability, hernia repair

Conflicts of interest. The authors declare no apparent or potential conflicts of interest.

Conformity with the principles of ethics. The authors received official permission to conduct the study in all the hospitals mentioned in the work. Patients have agreed to participate in the study.

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Сравнение влияния общей и спинальной анестезии на гемодинамическую стабильность у пациентов, перенесших герниопластику

Аднан Абдул Адим Кадим, Хайдер Ахмед Джалаб Салем Аль-Хикани✉, Касим Мухаммед Хамза, Ясс Кудейр Хабиб, Мухаммед Мосен Хуссейн, Хасан Таки Мухаммед

Университетский колледж Аль-Тафф, Кербела, Ирак

✉ hider.ahmed.j@gmail.com

Аннотация

Введение. Выбор наименее опасной для жизни пациента анестезиологической тактики, включая методику, препараты, планы и инструкции, по-прежнему остается главным аспектом в работе анестезиологов-реаниматологов. Вопрос использования общей или спинальной анестезии является важным при лечении грыжи.

Цель исследования — сравнить влияние общей и спинальной анестезии (ОА и СА) на гемодинамическую стабильность у пациентов, перенесших герниопластику.

Материалы и методы. В наблюдательное исследование (до, во время и после операции) включено 100 пациентов 20–90 лет, посещавших медицинский городок Аль-Хусейн и больницу Аль-Хасан в Кербеле (Ирак) и перенесших герниопластику. Пациенты разделены на две группы: 50 — ОА; 50 — СА. Анализировались следующие данные: возраст, вес, изменения артериального давления и частоты пульса.

Результаты. Выявлено, что при СА гемодинамическая стабильность составляет около 56 %, при ОА — около 40 %; повышенное и пониженное артериального давления чаще встречается при ОА (32 % и 28 %), чем при СА (24 % и 20 %). Более стабильная частота сердечных сокращений наблюдается при СА (56 %), нежели при ОА (32 %): увеличение этого показателя при ОА и СА наблюдалось в 60 % и 34 % случаев соответственно; снижение — при СА и ОА встречалось в 10 % и около 8 % случаев. При этом определено, что эффект при СА более стабилен.

Выводы. СА превосходила ОА по стабильности артериального давления и частоты сердечных сокращений, а также минимальному или нормальному уровню.

Ключевые слова: общая анестезия, спинальная анестезия, гемодинамическая стабильность, герниопластика

Конфликт интересов. Авторы заявляют об отсутствии явного или потенциального конфликта интересов.

Соответствие принципам этики. Авторы получили официальное разрешение на проведение исследования во всех упомянутых в работе больницах. От пациентов получено согласие на участие в исследовании.

Для цитирования: Сравнение влияния общей и спинальной анестезии на гемодинамическую стабильность у пациентов, перенесших герниопластику / А. А. А. Кадим, Х. А. Д. С. Аль-Хикани, К. М. Хамза [и др.] // Уральский медицинский журнал. 2024. Т. 23, № 3. С. 71–78. [На англ.]. DOI: <https://doi.org/10.52420/umj.23.3.71>. EDN: <https://elibrary.ru/USRQCT>.

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Introduction

Hernia treatment plans come with a number of difficulties, including postoperative analgesic medication and anesthesia for the process. Open inguinal hernia repair involves the use of both spinal and general anesthetic procedures [1]. Although there is little information on the long-term

effects of persistent hypertension in children, it is known that children with hypertension have end-organ damage and are at risk of hypertension into adulthood [2]. Hypertension is a major risk factor for stroke, coronary artery disease, and kidney damage in adults. Monitoring for the American Society of Anesthesiologists standard involves keeping an eye on the patient's temperature, circulation, breathing, and oxygenation. It is necessary to use a second pulse oximeter to measure pre- and post-ductal oxygen saturation in addition to routine monitoring. The onset of a gradient between the pre- and post-ductal oxygen saturations may signal pulmonary hypertension exacerbation [3]. Propofol lowers systemic vascular resistance, myocardial contractility, and preload to lower arterial blood pressure. Extremes in age, heart dysfunction, and higher dosages all increase the severity of these consequences. Injection pain and infrequent thrombophlebitis About 58 % of injectable users of propofol report experiencing pain (4). While most patients' blood pressure should return to normal several months prior to surgery, modest to severe diastolic or systolic hypertension does not raise the risk of anesthesia. Acute management of mild to moderate elevations shouldn't be done in the days leading up to surgery. Increased operating risk is associated with higher blood pressure increases, which need to be carefully managed prior to surgery [5]. Many hernia repair techniques, including Shouldice, Darning, Modified Bassini, Lichtenstein mesh repair, and the more recent laparoscopic repair, have been published since Bassini published his original description of inguinal hernia repair in 1887. Laparoscopic and Lichtenstein mesh repair are becoming more and more popular in recent times because they are linked to a quick return to normal activities and low recurrence rates [6]. The two main factors contributing to maternal morbidity and death from general anesthesia are pulmonary aspiration of stomach contents and unsuccessful endotracheal intubation. Patients with additional risk factors that make them more susceptible to aspiration should also receive intravenous ranitidine 50 mg or metoclopramide 10 mg, or both, 1 to 2 hours prior to the induction of general anesthesia. These risk factors include morbid obesity, symptoms of gastroesophageal reflux, a potentially difficult airway, or emergency surgical delivery without an elective fasting period. All patients should receive antacid prophylaxis against aspiration pneumonia with sodium citrate 30 mL, 30 to 45 minutes prior to induction. Omeprazole 40 mg used orally as a premedication [7]. Propofol primary cardiovascular action is a reduction in arterial blood pressure brought on by a decrease in cardiac contractility, preload, and systemic vascular resistance (the inhibition of sympathetic vasoconstrictor activity). Following induction, hypotension is typically reversed by the stimulation that comes with intubation and laryngoscopy. Propofol-induced hypotension is linked to several factors, such as large dosages, fast injections, and advanced age. The typical arterial baroreflexes response to hypotension is significantly impaired by propofol [8]. Comparing sevoflurane with isoflurane was shown to be inappropriate for single vital-capacity breath inhalational induction in 67 adults when it came to either sevoflurane or isoflurane mixed with 67 % nitrous oxide [9]. In 68 unplanned children ages 1–3 undergoing adenoidectomy, the hemodynamic responses to halothane induction and maintenance of anesthesia were compared with those of sevoflurane [10]. Not all surgeries are given the same three options for anesthetic as the open groin hernia treatment. The ideal anesthetic technique must satisfy a number of requirements. It must be straightforward, low postoperative morbidity, and as safe as feasible. It needs to be affordable, ensure a speedy recovery without adverse effects following surgery, and provide the patient with a painless procedure [11].

The aim of the study. The failure to achieve circulatory stability for patients suffering from hernia repair under general and spinal anesthesia is what prompted us to provide clear solutions to avoid this problem and prevent all complications that reduce morbidity and mortality.

Materials and methods

In this study, we take 100 patients make herniectomy operation which divided into two groups of 50 subjects each (50 general anesthesia and 50 spinal anesthesia), A data analysis was done regarding the age of patient, weight, change in blood pressers and pulse rate. In this study the patients were selected from 20-years-old to 90-years-old, then divided into two groups. After obtaining all approvals, we went to the hospitals where samples were collected and worked. We took official approvals within the health institutions and hospitals from 1 October 2023 to 31 March 2024. The patients was divided two groups the general anesthesia group GA and the second group spinal anesthesia group SA. We also took the age and weight determined by the anesthesia staff, which can be calculated and calculated to formulate the ideal weight for which the medications are estimated. After that, we listed the things that can be monitored well in the operating room and divided them into three periods before and during the operation. The operation, after the operation, and the nature of the patient, as the information that we collected was blood pressure and the variables that accompany it, such as high or low pressure, the heart rate as well, and the accompanying highs and lows, and MAP, which is that the patient went into one of the shocks from lack of fluids or cardiac shocks, etc. Similar to that, as well as the ECG, and here we very carefully monitor the work of the heart throughout the operation and the performance of its function, and whether there are tests before the operation or electronic monitoring on the Montring device during the operation or a routine examination after the operation. Inhaled anesthetics the Minimum alveolar concentration inhaled anesthetic amount that in 50 % of individuals stops movement in response to a standardized stimulus (such as surgical area). Because it replicates brain partial pressure, enables potency comparisons among drugs, and offers a benchmark for experimental assessments. Spinal anesthesia provides an alternative to general anesthesia. Although a spinal anesthetic prevents pain during surgery by numbing the lower body, those who have received one might remain conscious during the procedure. Most surgeries performed below the waist can be performed under a spinal anesthetic. An anesthetist administers a spinal anesthetic. Propofol has the greatest effect on systemic blood pressure when compared to other induction medicines; this is due to substantial vasodilation in both arterial and venous circulations, which leads to decreases in preload and afterload. This effect on systemic blood pressure is particularly significant with age, in individuals with low intravascular fluid capacity, and after a fast injection. Because the hypotensive effects are amplified by the suppression of the usual baroreflexes response, vasodilation causes only a little rise in heart rate.

Results

In this study as show in Table 1 in Distribution of patients to the change in Blood Pressure. A blood pressure we show the is also more stable in SA which about 56 % in compare to GA which is about 40 % but increase blood pressure is more in GA which was (32 %) and (24 %) in SA, but decrease blood pressure is also more in GA which was (28 %) and in SA was (20 %).

Table 1

Distribution of patients according to the change in Blood Pressure, *n* (%)

Group	Increase in HR	Remain	Decrease in HR
GA, <i>n</i> = 50	30 (60)	16 (32)	4 (8)
SA, <i>n</i> = 50	17 (34)	28 (56)	5 (10)
Total, <i>n</i> = 100	47 (47)	44 (44)	9 (9)

In this study as show in Table 2 Distribution of patients to the change in Heart rate, is more stability in heart rate which is 56 % in SA but in GA is 32 % and increase heart rate was 34 % in SA

but was 60 % in GA, and the percentage of decrease heart rate was 10 % in SA and about 8 % in GA and the effect of SA is more stable.

Table 2

Distribution of patients according to the change in Heart rate

Group	Increase in Blood Pressure	Remain	Decrease in Blood Pressure
GA, $n = 50$	16 (32)	20 (40)	14 (28)
SA, $n = 50$	12 (24)	28 (56)	10 (20)
Total, $n = 100$	28 (28)	48 (48)	24 (24)

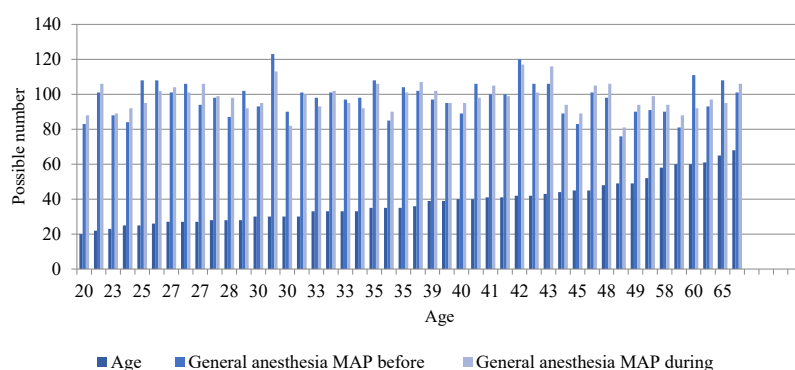


Fig. 1. The relationship between age GA and Mean Arterial Pressure GA

We show the is also more stable in SA which is about 56 % in comparison to GA which is about 40 %. Without treatment, but increase blood pressure is more in GA which was (32 %) and (24 %) in SA, but decrease blood pressure is also more in GA which was (28 %) and in SA was (20 %).

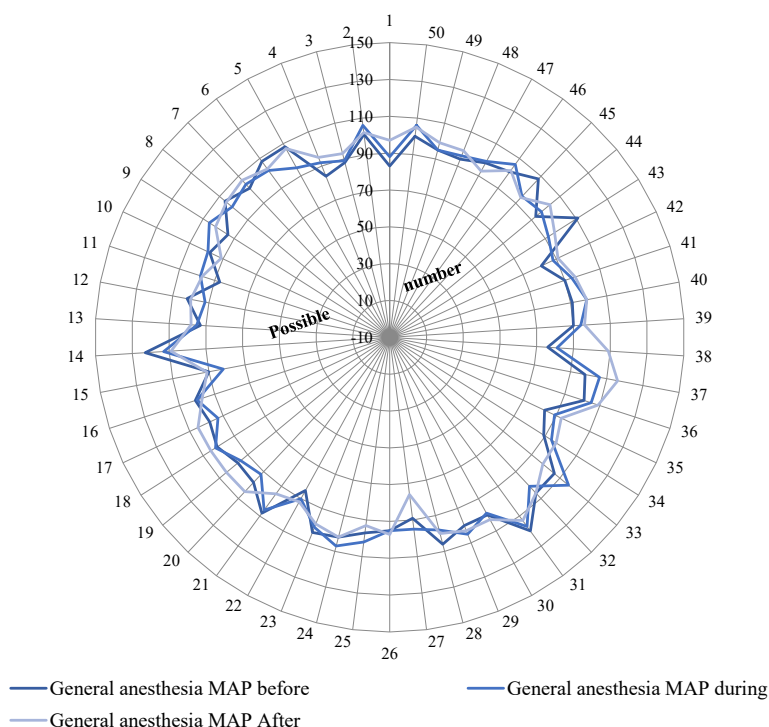


Fig. 2. The Relationship Mean Arterial Pressure GA

Blood pressure is also more stable in SA which about 56 % in compare to GA which is about 40 % but increase blood pressure is more in GA which was (32 %), but decrease blood pressure is also more in GA which was (28 %).

Discussion

Courtney J. Balentine et al. Inguinal hernia repair is the most common general surgery procedure in the United States 15–20 % of these procedures are performed under general anesthesia, whereas the remaining 80 % are performed under local anesthesia. Based on a study titled Using Local Anesthesia for Inguinal Hernia Repair Reduces Complications in Older Patients, we hypothesized that the advantages of local anesthesia over general anesthesia for inguinal hernia repair would increase with age [15]. Bay-Nielsen and H. Kehlet Anesthesia and post-operative morbidity after elective groin hernia repair is a nationwide study that was conducted. Randomized studies indicate that after groin hernia repair, regional anesthesia has the highest morbidity and local infiltration anesthesia has the lowest morbidity. The mortality rate within 30 days of the elective groin hernia repair procedure was 0.12 %, and patients who died within a week of the procedure were disproportionately more likely to have received regional anesthesia [16]. Anthony Rodgers et al. study entitled Reduction of postoperative mortality and morbidity with epidural or spinal anesthesia results from overview of randomized trials, Neuraxial blocking lowers major problems such as postoperative mortality. Further investigation is necessary to ascertain the extent of some of these benefits, as well as whether they are exclusively attributable to the avoidance of general anesthesia, all-cause mortality, DVT, pulmonary embolism, myocardial infarction, transfusion needs, pneumonia, other infections, respiratory depression, and renal failure [17]. David L. Reich et al. study entitled Predictors of Hypotension After Induction of General Anesthesia found that severe hypotension after induction of anesthesia is quite typical, and it's more common in the 5–10 minute late post induction interval than it is in other times. In conclusion, it is prudent to consider alternatives to using propofol to induce anesthesia in patients older than 50 years of age with ASA physical status \geq III, 9 % of patients experienced clinically significant hypotension in the period 0–10 minutes after anesthetic induction in common clinical practice [18]. Al-Khikani et al. Owners of this research study a comparison between general and spinal anesthesia in the effect on hemodynamic stability in patients Undergoing hernia repair, Due to research showing that spinal anesthesia is more stable than general anesthetic, potential issues may arise but the cardiovascular system is unaffected, and the advantage must be increased by accurate and exact work rather than reliance. It's critical to track and fix blood circulation deviations from its intended course.

Conclusions

We found a very noticeable increase in heart rate in general anesthesia, while spinal anesthesia was more stable, Mean arterial pressure (MAP). We found a very noticeable increase in arterial pressure in general anesthesia, while spinal anesthesia was more stable, Blood pressure (PB). We found a very noticeable increase in pressure in general anesthesia, while spinal anesthesia was more stable. Achieving hemodynamic stability is crucial for balancing the supply and demand of oxygen in the heart. To achieve an identical objective, many agents and methods may be employed, Includes fentanyl plus isoflurane, sevoflurane, or propofol, Through a variety of mechanisms, volatile anesthetics exert cardio-protective effects [12]. The science and training are in line with the American Heart Association Guidelines Update for CPR and Emergency Cardiovascular Care, The American Heart Association's BLS course is recommended for healthcare professionals and other

staff members who need to learn how to perform CPR and other basic cardiovascular life support procedures in a variety of scenarios [13]. A significant portion of individuals receiving general anesthesia are susceptible to the common occurrence of intraoperative hypotension (IH). Significant postoperative sequelae, including as renal failure, cardiac damage, and even higher mortality, are associated with the incidence of IH [14].

References

1. Callesen T. Inguinal hernia repair: Anaesthesia, pain and convalescence. *Danish Medical Bulletin*. 2003;50(3):203–218. PMID: <https://pubmed.gov/13677240>.
2. Chaturvedi S, Lipszyc DH, Licht C, Craig JC, Parekh R. Pharmacological interventions for hypertension in children. *Cochrane Database of Systematic Reviews*. 2014;(2):CD008117. DOI: <https://doi.org/10.1002/14651858.CD008117.pub2>.
3. Aglio LS, Urman RD (eds.). *Anesthesiology: Clinical case reviews*. Cham: Springer; 2017. XV, 493 p. DOI: <https://doi.org/10.1007/978-3-319-50141-3>.
4. Forkin KT, Nemergut EC. Miller's Anesthesia, 8th Edition. *Anesthesiology*. 2016;124(4):977–978. DOI: <https://doi.org/10.1097/ALN.0000000000001020>.
5. Wolfsthal SD. Is blood pressure control necessary before surgery? *Medical Clinics of North America*. 1993;77(2):349–363. DOI: [https://doi.org/10.1016/s0025-7125\(16\)30256-5](https://doi.org/10.1016/s0025-7125(16)30256-5).
6. Mabula JB, Chalya PL. Surgical management of inguinal hernias at Bugando Medical Centre in northwestern Tanzania: Our experiences in a resource-limited setting. *BMC Research Notes*. 2012;5:585. DOI: <https://doi.org/10.1186/1756-0500-5-585>.
7. Aitkenhead AR, Moppett I, Thompson J (eds.). *Smith and Aitkenhead's textbook of anaesthesia*. 6th ed. Churchill Livingstone; 2013. 928 p.
8. Mackey DC, Wasnick JD, Butterworth JF. *Morgan and Mikhail's clinical anesthesiology*. 6th ed. McGraw-Hill Education; 2018. 1408 p.
9. Ti LK, Pua HL, Lee TL. Single vital capacity inhalational anaesthetic induction in adults — isoflurane vs sevoflurane. *Canadian Journal of Anaesthesia*. 1998;45(10):949–953. DOI: <https://doi.org/10.1007/BF03012302>.
10. Aronson JK (ed.). *Meyler's side effects of drugs used in anesthesia*. Amsterdam: Elsevier Science; 2009. 320 p.
11. LeBlanc KA, Kingsnorth A, Sanders DL. *Management of abdominal hernias*. Cham: Springer; 2018. XXV, 541 p. DOI: <https://doi.org/10.1007/978-3-319-63251-3>.
12. Kaplan JA, Augoustides JGT, Manecke GR, Maus T, Reich DL (eds.). *Kaplan's cardiac anesthesia: In cardiac and noncardiac surgery*. 7th ed. Philadelphia: Elsevier; 2017. 1280 p.
13. Pardo M (ed.). *Miller's basics of anesthesia*. Elsevier Health Sciences; 2022. 944 p.
14. Benes J, Simanova A, Tovarnicka T, Sevcikova S, Klecka J, Zatloukal J, et al. Continuous non-invasive monitoring improves blood pressure stability in upright position: Randomized controlled trial. *Journal of Clinical Monitoring and Computing*. 2015;29(1):11–17. DOI: <https://doi.org/10.1007/s10877-014-9586-2>.
15. Balentine CJ, Meier J, Berger M, Reisch J, Cullum M, Lee SC, et al. Using local anesthesia for inguinal hernia repair reduces complications in older patients. *Journal of Surgical Research: Clinical and Laboratory Investigation*. 2021;258:64–72. DOI: <https://doi.org/10.1016/j.jss.2020.08.054>.
16. Bay-Nielsen M, Kehlet H. Anaesthesia and post-operative morbidity after elective groin hernia repair: A nation-wide study. *Acta Anaesthesiologica Scandinavica*. 2008;52(2):169–174. DOI: <https://doi.org/10.1111/j.1399-6576.2007.01514.x>.
17. Rodgers A, Walker N, Schug S, McKee A, Kehlet H, van Zundert A, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: Results from overview of randomised trials. *BMJ*. 2000;321(7275):1493. DOI: <https://doi.org/10.1136/bmj.321.7275.1493>.
18. Reich DL, Hossain S, Krol M, Baez B, Patel P, Bernstein A, et al. Predictors of hypotension after induction of general anesthesia. *Anesthesia & Analgesia*. 2005;101(3):622–628. DOI: <https://doi.org/10.1213/01.ANE.0000175214.38450.91>.

Information about the authors

Adnan Abdul Adheem Kadhim — General Surgery Specialty, Academic Professor of the Department of Anesthesia and Intensive Care Technologies, Al-Taff University College, Karbala, Iraq.

E-mail: Adnan.AI-HusseiniQ111@gmail.com

ORCID: <https://orcid.org/0009-0000-2271-3675>

Haider Ahmed Jalab Salem Al-Khikani✉ — Bachelor of Anesthesia and Intensive Care Technology, Al-Taff University College, Karbala, Iraq.

E-mail: hider.ahmed.j@gmail.com

ORCID: <https://orcid.org/0009-0008-5416-1498>

Qasim Muhammad Hamza — Bachelor of Anesthesia and Intensive Care Technology, Al-Taff University College, Karbala, Iraq.

E-mail: alabrahymyq9@gmail.com

ORCID: <https://orcid.org/0009-0007-6948-4305>

Yass Khudair Habib — Bachelor of Anesthesia and Intensive Care Technology, Al-Taff University College, Karbala, Iraq.

E-mail: yaskhdyr862@gmail.com

ORCID: <https://orcid.org/0009-0000-5622-5338>

Muhammad Mohsen Hussein — Bachelor of Anesthesia and Intensive Care Technology, Al-Taff University College, Karbala, Iraq.

E-mail: hfg8037@gmail.com

ORCID: <https://orcid.org/0009-0006-1286-8431>

Hassan Taqi Muhammad — Bachelor of Anesthesia and Intensive Care Technology, Al-Taff University College, Karbala, Iraq.

E-mail: hasangghh54321@gmail.com

ORCID: <https://orcid.org/0009-0001-5768-3805>

Информация об авторах

Аднан Абдул Адим Кадим — специалист по общей хирургии, академический профессор кафедры анестезиологии и реаниматологии, Университетский колледж Аль-Тафф, Кербела, Ирак.

E-mail: Adnan.Al-HusseiniQ111@gmail.com

ORCID: <https://orcid.org/0009-0000-2271-3675>

Хайдер Ахмед Джалаб Салем Аль-Хикани✉ — бакалавр анестезиологии и реаниматологии, Университетский колледж Аль-Тафф, Кербела, Ирак.

E-mail: hider.ahmed.j@gmail.com

ORCID: <https://orcid.org/0009-0008-5416-1498>

Касим Мухаммед Хамза — бакалавр анестезиологии и реаниматологии, Университетский колледж Аль-Тафф, Кербела, Ирак.

E-mail: alabrahymyq9@gmail.com

ORCID: <https://orcid.org/0009-0007-6948-4305>

Ясс Кудейр Хабиб — бакалавр анестезиологии и реаниматологии, Университетский колледж Аль-Тафф, Кербела, Ирак.

E-mail: yaskhdyr862@gmail.com

ORCID: <https://orcid.org/0009-0000-5622-5338>

Мухаммед Мосен Хуссейн — бакалавр анестезиологии и реаниматологии, Университетский колледж Аль-Тафф, Кербела, Ирак.

E-mail: hfg8037@gmail.com

ORCID: <https://orcid.org/0009-0006-1286-8431>

Хасан Таки Мухаммед — бакалавр анестезиологии и реаниматологии, Университетский колледж Аль-Тафф, Кербела, Ирак.

E-mail: hasangghh54321@gmail.com

ORCID: <https://orcid.org/0009-0001-5768-3805>

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