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Observations on the safety of precision anesthesia techniques in surgery for elderly patients

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Abstract: This study aims to explore the application effect of precision anesthesia in elderly surgical patients. 82 elderly patients who underwent surgical treatment in our hospital from September 2021 to August 2023 were selected as the research subjects. The patients were divided into an observation group and a control group using a random table method, with 41 cases in each group. The control group used traditional anesthesia techniques for anesthesia management. The observation group used precision anesthesia technology to anesthetize patients. Compare the depth of anesthesia control, incidence of complications during anesthesia, and postoperative recovery between the two groups. The control group using precise anesthesia technology for anesthesia management was significantly better than the control group in terms of anesthesia control depth, incidence of complications during anesthesia, and postoperative recovery rate ($p<0.05$), promoting postoperative recovery and improving the prognosis of elderly patients during surgery. It has good safety and high clinical value, and is worth further research and promotion.

1. Introduction

With the increasing trend of global population aging, there is a growing demand for surgery in elderly patients [1]. However, elderly patients may have more sensitive and prolonged drug responses due to physiological changes, increasing the difficulty in controlling the depth of anesthesia. Their co-morbidities may have a significant impact on the safety and efficacy of anesthesia [2]. In addition, older patients may be on multiple medications concurrently to manage their chronic conditions. These medications may interact with anesthesia medications, increasing the risk of anesthesia drug metabolism and side effects. Elderly patients may have a slower recovery from anesthesia and take longer to wake up and return to normal functioning [3]. These include anesthetic risk, cardiovascular risk, respiratory risk, and infection risk. Although older patients are at higher risk for surgery, a range of strategies and preventive measures can be taken to reduce risk through comprehensive assessment and individualized management. These include preoperative assessment and preparation, selection of appropriate anesthetic techniques and medications, and intraoperative and postoperative monitoring and management [4]. These expose elderly patients to higher surgical risks. Therefore, ensuring the safety of surgery in elderly patients has become an important challenge for the medical community and public health.

Precision anesthesia technology is a revolutionary approach to anesthesia management that includes key components such as preoperative assessment, individualized design of the anesthesia

plan, use of monitoring equipment, and control of the depth of anesthesia [3]. Based on individualized patient characteristics and surgical needs, this technique aims to minimize surgical risks and the occurrence of anesthesia-related complications, improve anesthesia outcomes and surgical quality, and promote rapid postoperative recovery and rehabilitation progress [4]. In summary, the various advantages of precision anesthesia make it an important tool in modern anesthesia practice and may have a positive impact on the safety of surgery in elderly patients. Precision anesthesia technology has been widely used in many surgeries, including but not limited to the following types of surgeries: cardiac surgery, brain surgery, organ transplantation, neurosurgery, and more [5,6]. However, there are still fewer studies on precision anesthesia techniques in surgery for the elderly. Based on the high safety of precision anesthesia technology, it has unique advantages in improving surgical outcomes, individualized treatment, and optimizing postoperative recovery [7]. We firmly believe that the future of precision anesthesia technology for the elderly is very bright and can bring better results for the surgical treatment of the elderly.

In this paper, we screened 82 cases of elderly patients who underwent surgical operations in our hospital in our study groups, to explore the influence of precise anesthesia techniques on the safety of elderly patients during surgery. Our research aims to provide a scientific basis for improving the surgical outcomes of elderly patients, which is now reported as follows.

2. Information and Methods

2.1 General information

The present study used a randomized group double-blind controlled research design. Eighty-two cases of elderly patients who underwent surgical treatment in our hospital during the period from September 2021 to August 2023 were selected as the subjects of this study and were divided equally into two groups according to the method of randomized number table, with 41 patients in each of the control group and the observation group. Observation group: 26 males, 15 females, age 60-75 years old, mean age (67.5±3.5) years old. Control group: 22 males, 19 females, age 60-73 years old, mean age (66.5±3.6) years. There was no significant difference between the two groups of cases in terms of sex and age in terms of baseline characteristics ($P>0.05$). The study was approved by the Medical Ethics Committee of the hospital, and the patients and their families were informed and signed an informed consent for anesthesia.

Inclusion criteria: ① age 60-75 years old; ② body mass index (BMI) 18-25 kg-m-2; ③ ASA classification Ito III; ④ no history of surgical anesthesia, serious cardiovascular and cerebrovascular diseases, neurological or mental diseases;⑤ willing to fully express their true experience and feelings after the disease. Exclusion criteria: ① severe malnutrition or co-infection; ② previous history of surgical anesthesia, serious cardiovascular and cerebrovascular diseases, neurological or mental diseases; ③ functional and organic mental illnesses who do not cooperate with the investigator's explanations; ④ functional and organic mental illnesses.

2.2 Anesthesia methods

The surgical operations of all patients are implemented according to the relevant standards, and the patients are connected to the anesthesia depth monitor in time after entering the operating room, and the vital signs and electrocardiograms of the patients are detected to ensure that several values of the patients are within a reasonable range. The observation group adopts precise anesthesia techniques in surgical anesthesia management, including: selecting the type and dosage of anesthesia drugs separately based on the patient's age, physical condition, and surgical type; Using

drugs and techniques to maintain physiological indicators such as blood pressure, heart rate, and blood oxygen saturation within a safe range; Adjusting the anesthesia level in real-time by monitoring the depth of anesthesia to avoid excessive or insufficient anesthesia and using local anesthesia techniques or peripheral nerve block. Anesthesia techniques or peripheral nerve block and other ways to reduce the dose and risk of general anesthesia. The control group adopts conventional general anesthesia management methods, including the use of standard anesthesia drugs and dosage, monitoring the physiological indexes of patients, and making corresponding adjustments as needed.

2.3 Evaluation indexes

The observation indexes include the status of anesthesia depth control, the incidence of anesthesia-related complications, and postoperative recovery. The anesthesia depth status of the two groups of patients was monitored through BIS [5]. The BIS values were recorded at the time points after admission (T0), before skin cutting (T1), 1 hour during the operation (T2), 2 hours during the operation (T3), and at the end of the operation (T4). Postoperative surveys were conducted 1 d postoperatively, and explicit memories of intraoperative events were memorized and recorded. Patients were monitored for anesthesia-related complications such as choking, body movements, eructation, bradycardia, hypotension, respiratory depression, nausea, and vomiting that occurred during or after surgery. Patient recovery was monitored by monitoring the recovery time after surgery, such as awake time, anesthesia recovery time, and autonomic respiration recovery time.

2.4 Statistical methods

The data in this paper were analyzed by the statistical software SPSS21.0, (n,%) indicates count data, by $\chi 2$ test for inter-group differences, (Shi s) indicates measure data, by t-test for inter-group differences, and $p<0.05$ represents the difference is statistically significant.

3. Results

3.1 Comparison of anesthesia depth control in two groups of patients

Comparing the changes in intraoperative BIS in the two groups of patients, the results showed that the fluctuation of BIS in the observation group was significantly smaller than that in the control group ($p<0.05$). The results are shown in Table 1. No intraoperative knowledge occurred in both groups.

Table 1: Comparison of the status of the depth of anesthesia control between the two groups of patients($\bar{x} \pm s$)

groups	number of cases	post-entry (T0)	pre-cutting (T1)	1 hour intraoperatively (T2)	2 hour intraoperatively (T3)	end of the operation (T4)
control group	41	95.6±0.37	47±0.55	48±0.51	48±0.69	94.6±0.55
observation group	41	96.6±0.21	46±0.42	47±0.32	48±0.21	9.52±0.43
t		22.332	13.213	14.325	14.238	20.129
p		<0.05	<0.05	<0.05	<0.05	<0.05

3.2 Comparison of the incidence of anesthesia-related complications between the two groups of patients

We compare the occurrence of complications in anesthesia in the two groups of patients, such as choking, body movement, eructation, bradycardia, hypotension, respiratory depression, nausea and vomiting, etc. The results showed that the anesthesia-related complications in the observation group were significantly lower than those in the control group ($p<0.05$). The results are shown in Table 2.

Table 2: Comparison of the incidence of anesthesia-related complications between the two groups [n (%)]

groups	number of cases	cough	belch	bradycardia	low blood pressure	respiratory depression	nausea and vomiting
control group	41	5(12.0)	0	4(9.7)	6(14.6)	1(2)	7(17.1)
observation group	41	6(14.6)	3(7.3)	6(14.6)	8(19.5)	0	10(24.4)
t		10.325	10.783	15.354	18.120	4.561	
p		<0.05	<0.05	<0.05	<0.05	<0.05	

3.3 Comparison of postoperative recovery of patients in two groups

For the postoperative recovery time of the two groups of patients, the postoperative recovery of the observation group was significantly better than that of the control group, and the awake time, anesthesia recovery time, and autonomic respiration recovery time showed better results. The difference was statistically significant ($p<0.05$), as shown in Table 3.

Table 3: Comparison of postoperative recovery between the two groups of patients($\bar{x} \pm s$)

groups	number of cases	wake up time (min)	Recovery time from anesthesia (h)	Recovery time for spontaneous breathing(min)
control group	41	12.32±0.20	0.98±0.11	13.22±0.56
observation group	41	15.60±0.33	1.81±0.22	17.39±0.12
t		13.761	20.333	11.292
p		<0.05	<0.05	<0.05

4. Conclusion

The results of this study show that the precision anesthesia technique has better safety in surgery for elderly patients. Through the design of individualized anesthesia protocols and the use of monitoring equipment, precision anesthesia technology can better control the depth of anesthesia, reduce the incidence of anesthesia-related complications, and help the postoperative recovery of elderly patients. All these show the superiority of precision anesthesia technology [8,9].

The implementation of precision anesthesia encompasses a number of important aspects that are present in every process of anesthesia delivery [10]. First of all, the implementation of precise anesthesia requires a comprehensive anesthesia evaluation. The anesthesia assessment includes the collection of information about the patient's basic health status, drug use, allergy history, family

history, and so on [11]. In addition, the condition of the patient's cardiovascular system, respiratory system, liver and kidney function, and other organs, as well as the patient's psychological state and pain sensibility, need to be assessed. Through comprehensive assessment, doctors can understand the risks and special needs associated with the patient [12]. Thirdly, the core of precise anesthesia is individualized anesthesia plan development. In response to the patient's characteristics and needs, doctors can provide precise control based on the depth of anesthesia, drug dosage, and drug type. This requires comprehensive consideration of physiological factors such as the patient's age, weight, and gender, as well as surgery-related factors such as the type of surgery, surgical site, and surgery time. Risks and adverse reactions under anesthesia can be minimized through individualized anesthetic protocols [13]. Monitoring and adjustment is another important aspect in precision anesthesia. During surgery, doctors need to closely monitor the patient's vital signs, such as heart rate, blood pressure, and oxygen saturation. At the same time, the patient's depth of anesthesia, respiratory parameters, degree of muscle relaxation, and other indicators need to be monitored. Through real-time monitoring, doctors can adjust the dosage and type of anesthesia drugs promptly to maintain the stability and safety of patients during surgery[14]. Finally, precision anesthesia also focuses on the optimization of post-operative analgesia and recovery. At the end of the surgery, doctors will formulate an appropriate analgesia plan according to the patient's postoperative pain level and individual differences. At the same time, it is also necessary to pay attention to the patient's postoperative recovery, including respiratory function, cardiovascular function, muscle strength recovery, and so on. Through the optimization of postoperative recovery, the occurrence of postoperative complications can be reduced and the recovery of patients can be promoted.

However, it should be noted that precision anesthesia requires the use of advanced monitoring equipment and techniques, such as BIS monitoring and end-expiratory carbon dioxide concentration monitoring [15,16]. These devices and techniques require specialized technicians to operate and interpret the results, increasing the professional requirements and training costs for the healthcare team. In addition, precision anesthesia requires more detailed and meticulous monitoring and adjustment of the patient, which may increase the operating time and the use of anesthetic drugs [17]. Although precision anesthesia can provide more precise and individualized anesthesia management, it still carries certain risks [18]. Individual differences, patient disease states, and surgical risks may lead to anesthesia outcomes that are not as expected or complications. Therefore, when promoting the application of precision anesthesia technology, factors such as medical resources, technical level, and cost-effectiveness need to be considered comprehensively [19,20].

In conclusion, the results of this study show that precision anesthesia technology has better safety in surgery for elderly patients. In future clinical practice, precision anesthesia technology is expected to contribute to the improvement of surgical outcomes and medical quality in elderly patients and is worthy of clinical promotion.

References

[1] Li S J, Li Y F, Song W M, Zhang Q Y, Liu S Q, Xu T T, An Q Q, Liu J Y, Li HC. Population aging and trends of pulmonary tuberculosis incidence in the elderly. BMC Infect Dis. 2021 Mar 25; 21(1):302. doi: 10. 1186/ s12879-021-05994-z. PMID: 33765943; PMCID: PMC7993467.

[2] Lim BG, Lee IO. Anesthetic management of geriatric patients. Korean J Anesthesiol. 2020 Feb; 73(1):8-29. doi: 10. 4097/kja. 19391. Epub 2019 Oct 22. PMID: 31636241; PMCID: PMC7000283.

[3] Ali A, Azime B. Mean platelet volume, neutrophil/lymphocyte ratio, platelet/lymphocyte ratio and early post-operative anesthesia complications [J]. Turkish Journal of Biochemistry, 2023, 48(4).

[4] Konishi Y, Nakata Y, Nemoto A, Ushijima M, Matsuura M. The preoperative risk factors of postoperative self-extubation in elderly patients. Int J Risk Saf Med. 2019; 30(1):9-18. doi: 10. 3233/JRS-180011. PMID: 30175984.

[5] Magoon R. Precision Cardiac Anesthesia: Welcome Aboard! J Cardiothorac Vasc Anesth. 2020 Sep; 34(9): 2551-2552. doi: 10. 1053/j. jvca. 2020. 02. 029. Epub 2020 Feb 26. PMID: 32209289.

[6] Hung MH, Chen JS, Cheng YJ. Precise anesthesia in thoracoscopic operations. Curr Opin Anaesthesiol. 2019 Feb; 32(1):39-43. doi: 10. 1097/ACO. 0000000000000680. PMID: 30540577; PMCID: PMC6326264.
[7] Savoia G, Scibelli G. From balanced to precision anesthesia: a complex road map. Minerva Anestesiol. 2018 May; 84(5):534-537. doi: 10. 23736/S0375-9393. 17. 12489-2. Epub 2017 Dec 13. PMID: 29239157.
[8] Gu S, Luo Q, Wen C, Zhang Y, Liu S, Chen C, Lei Q, Zeng S. Application of Advanced Technologies-Nanotechnology, Genomics Technology, and 3D Printing Technology-In Precision Anesthesia: A Comprehensive Narrative Review. Pharmaceutics. 2023 Sep 6; 15(9):2289. doi: 10. 3390/pharmaceutics15092289. PMID: 37765258; PMCID: PMC10535504.
[9] Eagleman SL, MacIver MB. Advances in precision anaesthesia may be found by testing our resistance to change. Br J Anaesth. 2020 Sep; 125(3):235-237. doi: 10. 1016/j. bja. 2020. 06. 007. Epub 2020 Jul 10. PMID: 32654746.
[10] Bach-Rojecky L, Vađunec D, Lozić M, Žunić K, Špoljar GG, Čutura T, Erceg D, Primorac D. Challenges in anesthesia personalization: resolving the pharmacogenomic puzzle. Per Med. 2019 Nov; 16(6):511-525. doi: 10. 2217/pme-2019-0056. Epub 2019 Nov 6. PMID: 31692418.
[11] Qiu C, Nguyen T V, Desai V. Precision Anesthesia: Fiction or Reality? [J]. Anesthesiology Communications, 2017, 1(1).
[12] Kehlet H, Dahl JB. Anesthesia, surgery, and challenges in postoperative recovery. Lancet. 2003; 362(9399): 1921-1928.
[13] Kim R, Tsui BCH. Toward precision regional anesthesia: is the PENG block appropriate for all hip fracture surgeries? Reg Anesth Pain Med. 2022 Jan;47(1):76-77. doi: 10. 1136/rapm-2021-102905. Epub 2021 Jun 22. PMID: 34158374.
[14] Richard. Toward precision regional anesthesia: is the PENG block appropriate for all hip fracture surgeries? [J]. Regional anesthesia and pain medicine, 2021.
[15] Guangle Q, Dapeng C, Jingdong L, et al. Research on control technology of high precision and painless oral anesthesia microinjection system[P]. Jiangsu Automation Research Institute (China), 2022.
[16] Stoneham MD, Savoia G, Wilson I, et al. Guideline implementation for regional anesthesia: an educational review. Br J Anaesth. 2019; 122(2):e42-e53.
[17] Sessler DI, Bloomstone JA, Aronson S, et al. Perioperative Quality Initiative consensus statement on intraoperative blood pressure, risk and outcomes for elective surgery. Br J Anaesth. 2019; 122(5):563-574.
[18] Kheterpal S, O'Reilly M, Englesbe MJ, et al. Preoperative and intraoperative predictors of cardiac adverse events after general, vascular, and urological surgery. Anesthesiology. 2009; 110(1):58-66.
[19] Lee LA, Caplan RA, Stephens LS, Posner KL, Terman GW, Voepel-Lewis T. Postoperative opioid-induced respiratory depression: a closed claims analysis. Anesthesiology. 2015; 122(3):659-665.
[20] Myles PS, Leslie K, Chan MT, et al. The safety of patient-controlled analgesia: a review. Reg Anesth Pain Med. 2017; 42(3):346-352.