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A Collection of Studies on Anesthesia Modalities, Anesthetic Drugs and Circulatory Stability in Elderly Patients

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Abstract

With the increase in the proportion of elderly population in the society, China is gradually entering an aging society. Elderly patients may require anesthesia during medical treatment, and considering the relatively high surgical risk of elderly patients, comprehensive consideration must be given to the selection of anesthesia and the use of anesthetic drugs. Induction of general anesthesia is a process in which patients undergo reversible drug inhibition from a physiological state to a surgically operable anesthesia state within a short period of time, but tracheal intubation and anesthesia inhibition can trigger cardiovascular reactions, especially in elderly patients with poor circulatory function, which can lead to hemodynamic fluctuations and affect the stability of circulatory function. As elderly patients age, their organ function decreases, and their reserve function deficiency under anesthetic stress can increase the risk of adverse cardiovascular events. The hemodynamic fluctuations of patients during the induction period of general anesthesia are large, and it is important to reduce the hemodynamic fluctuations and maintain the stability of circulatory function to improve the safety of surgery. At present, the commonly used methods for induction of general anesthesia include manual intravenous push, target-controlled infusion and constant-rate infusion by infusion pump, and the commonly used drugs for induction of general anesthesia include intravenous sedative anesthetics, intravenous analgesics, muscle relaxants and inhaled anesthetics. Based on this paper, we analyze the effects of general anesthesia, epidural anesthesia, lumbar anesthesia, and epidural anesthesia in the application of surgery in elderly patients and general anesthesia induction in the circulatory stability of elderly patients for a review, in order to more accurately and better guide further clinical anesthesia research.

Keywords: elderly patients, anesthesia modality, anesthetic drugs, circulatory stability, research progress

1. Introduction

Anesthesia is mainly used to temporarily suppress the central or peripheral nervous system, allowing patients to undergo surgical

treatment in a painless state, thus providing for the safe and smooth implementation of surgery. Regarding the choice of anesthesia and anesthetic drugs, it is necessary to take into account the actual situation of the patient and assess the anesthetic risks, especially in the clinical treatment of elderly patients. The elderly are affected by physiological aging, and the nervous system, cardiovascular system, respiratory system and other system tissues are in functional decline, and the body's tolerance to anesthesia is weakened, which increases the risk of anesthesia to a certain extent. In the surgical treatment of elderly patients, anesthesia methods and anesthetic drugs should be carefully selected. In the author's opinion, when elderly patients receive anesthesia and surgery, they should take into account their own conditions and surgical methods, choose the appropriate anesthesia, evaluate the effects of anesthetic drugs on circulatory system function and postoperative cognitive function, seek more ideal anesthetic effects, and reduce the occurrence of stress reactions and related complications. The principles of general anesthesia, nerve block anesthesia, intralesional anesthesia, and local anesthesia are discussed to clarify the principles of anesthesia selection, and the pharmacological properties and applicability of anesthetic drugs such as sevoflurane, propofol, midazolam, sufentanil, and atropine are analyzed. The author reviewed and collected research reports and literature related to anesthetic modalities and anesthetic drugs for elderly patients to develop safe and effective anesthetic protocols for surgical treatment. China is gradually entering into an aging population society, the proportion of elderly people has increased, and the population of elderly patients undergoing surgical treatment is also on the rise.

Geriatric patients are in the process of organ damage and functional decline, so it is important to consider the possible changes in the tissues and organs of elderly patients when undergoing surgical treatment, so that the choice of anesthesia for elderly patients can be well understood and the risk of anesthesia for elderly patients can be reduced while obtaining the best anesthetic effect. Therefore, when it comes to surgical anesthesia for elderly patients, careful consideration must be given to the choice of anesthesia and anesthetic drugs to minimize the harm caused by anesthesia to elderly patients. This study investigates and discusses the anesthesia and anesthetic drugs for elderly patients.

2. Anesthesia Selection Basis and Risk Analysis of Anesthesia in Elderly Patients

The selection of anesthesia is based on the following criteria: 1) the patient's general condition and the state of coexisting diseases, the degree of impairment of important organ functions; 2) the type of surgery and requirements; 3) the equipment and conditions of anesthesia; 4) the degree of control of the anesthesiologist over the anesthesia methods and drugs; 5) the advantages and disadvantages of the anesthesia methods and drugs; 6) the patient's wishes. In principle, try to choose the anesthesia method that is simple to operate, less physiological interference, and more controllable. In the elderly, many systems and tissues throughout the body are in functional decline, which affects the normal metabolism and circulation of the body. When elderly patients receive anesthetic drugs, the pharmacokinetic characteristics and efficacy of anesthetic drugs differ significantly from those of young people, mainly in the form of slowed metabolism of anesthetic drugs and prolonged drug half-life, which is associated with reduced binding of anesthetic drugs to plasma proteins and reduced liver and kidney function (Lin Xuehua, 2022). It has been found (Huang Hongjue, Pan Bingbing & Hong Wanying, 2021; Zhang Qiu-Li & Cui Yuan-Yuan, 2019) that the elderly have a reduced capacity for self-regulation of the nervous system and aging of the body's circulatory system, and during surgical anesthesia, the plasma concentration of anesthetic drugs is high, and the drug sensitivity, tolerance and compensatory capacity of various organs and tissues of the body are reduced and easily damaged. At the same time, under the action of anesthetic drugs, the body's circulation and blood supply to various organs are affected, which may lead to related complications. This shows that there are certain safety risks in the process of surgery and anesthesia for elderly patients. During surgical anesthesia, postoperative pain, tracheal tube stimulation, and urinary catheter stimulation in elderly patients may lead to awakening agitation and stress reactions, which may aggravate the functional impairment of the organism. Proper selection of anesthesia and anesthetic drugs can reduce the risk of arousal agitation and stress

reactions (Liu Lina, 2021).

3. Circulatory Characteristics of Elderly Patients

Due to the significant decline in cardiac reserve, myocardial contraction and compensatory function in elderly patients, the output per beat and cardiac output were significantly reduced, resulting in their increased inhibitory response to drugs and significant hemodynamic fluctuations in patients during the induction period of general anesthesia. After analysis, there is a certain degree of decline in the neurological and humoral regulation of the cardiovascular system in elderly patients, with increased parasympathetic excitability and reduced catecholamine responsiveness and sympathetic excitability, resulting in a sluggish stress response of the cardiovascular system, and hypotension, sudden rise or fall of blood pressure, and shock can occur during general anesthesia due to the influence of drugs and intraoperative blood loss and other factors. At the same time, it has been pointed out that elderly patients have poor vascular elasticity and compliance, insufficient blood volume, reduced venous pressure self-regulation, increased sensitivity to fasting, fluid loss, blood loss, etc., and reduced circulatory stability of the body, which can easily produce large hemodynamic fluctuations (Liu Lina, 2021).

4. Study on the Application of Different Anesthesia Modalities in the Treatment of Geriatric Surgery

4.1 General Anesthesia

General anesthesia is a widely used form of anesthesia in surgical treatment. When elderly patients receive general anesthesia, the drug is administered by inhalation through the respiratory tract and intravenous injection and acts on the central nervous system. During general anesthesia, the patient completely loses consciousness and sensation, and the drug concentration can be adjusted according to the actual needs of surgical treatment, thus controlling the depth of anesthesia, and the patient under general anesthesia can maintain a stable respiratory and circulatory state. However, during the operation of tracheal intubation and extubation, it is easy to stimulate the respiratory and circulatory systems of patients, thus inducing stress reactions and affecting the effect of anesthesia, and also increasing the risk of surgical treatment. At the same time, elderly patients are often combined with cardiovascular and cerebrovascular diseases, which also increase the risk of general anesthesia to a certain extent (Chen QH, 2019).

4.2 Epidural Anesthesia

Epidural anesthesia in the surgical treatment of elderly patients is administered through the epidural space (sacral fissure, low T12 to L5, medium T6 to T12 or high C5 to T6), and the drug acts on the spinal nerve roots, producing a blocking effect and the innervated area of the nerve loses sensation. Compared with general anesthesia, epidural anesthesia has a milder effect on the respiratory and circulatory systems, can reduce the occurrence of related complications, and uses a lower dose of anesthetic drugs. In a clinical study by Chen Qinghua (Xu Yan, 2019), 76 elderly orthopedic patients received general anesthesia (38 patients) and epidural anesthesia (38 patients), in which patients who received epidural anesthesia had higher Simple Mental State Evaluation Scale scores at 6h, 12h, and 24h postoperatively than those who received general anesthesia, while the incidence of cognitive impairment was relatively lower, thus indicating that the effect of epidural anesthesia on the cognitive. This suggests that epidural anesthesia is a safer form of anesthesia because it has less impact on the cognitive function of surgical patients. In the surgical treatment of elderly patients, the advantages of both types of anesthesia can be used, and general anesthesia combined with epidural anesthesia can effectively improve the anesthetic effect and reduce the risk of anesthesia. In a clinical study by Yan Xu (Li G Q, Cai M S, Xiao Z B & Zhang Z F, 2019), 58 general thoracic surgery patients received general anesthesia combined with epidural anesthesia (29 patients in the combined group) and general anesthesia (29 patients in the independent group), and the MMSE scores of patients in the combined group were higher than those in the independent group at 1 d, 3 d, and 7 d postoperatively, thus highlighting the value of the general anesthesia combined with epidural anesthesia method in surgical anesthesia. During the administration of epidural anesthesia, puncture should be performed based on the paracentesis method, and effective control of the concentration and injection rate of anesthetic drugs needs to be strengthened, with the implementation of split and small dose administration, slow injection of drugs, and regulation of the drug interval to

effectively control the blocking plane, thus obtaining the ideal anesthetic effect and reducing the risk of anesthesia (Chen XK, Zheng Huan J & Chen Shaoxia, 2019). It is worth noting that the physiological conditions of the patient should be taken into account during the implementation of epidural anesthesia. Due to the narrow epidural space and spinal canal space in the elderly, accompanied by calcification and fibrous changes, the difficulty of operations such as epidural puncture and tube placement will be elevated (Feng WG, Jiang W & Song GJ, 2019).

4.3 Lumbar Anesthesia

Lumbar anesthesia is used in surgery, where anesthetic drugs are injected through the lumbar interspace and the anesthetic drugs are injected into the subarachnoid space, acting on the nerve root tissue, which in turn produces the anesthetic effect. Lumbar anesthesia is indicated for the treatment of lower abdominal, lower extremity, and anal perineal surgery. During anesthesia, a small dose of the drug is used, but the effect can be rapid. During the administration of lumbar anesthesia, it is necessary to monitor blood pressure and heart rate, and to be alert to the occurrence of hypotension and bradycardia. During anesthesia, affected by cerebrospinal fluid leakage, patients may experience a decrease in intracranial pressure, which can easily produce painful symptoms. During the implementation of lumbar anesthesia, the puncture operation should be performed in a standardized and cautious manner paying attention to the protection of the spinal cord and spinal nerve roots. At the same time, the control of the anesthetic level should be strengthened to avoid too high anesthetic level.

4.4 Combined Lumbar and Rigid Anesthesia

Combined lumbar and epidural anesthesia can be used as an alternative to anesthesia for elderly surgical patients, taking advantage of both anesthesia modalities to improve anesthetic effectiveness and safety. Feng Wenguang et al. reported in their study (Guo H Y, Zhou L X, Wu Q Y, et al, 2018) that combined lumbar and epidural anesthesia has the advantages of both lumbar anesthesia and epidural anesthesia, which can effectively control the anesthetic plane while rapidly initiating and adequately blocking the lumbosacral nerve block, and can meet the anesthetic needs for prolonged surgery. At the same time, during anesthesia, the vasodilatation range of elderly surgical patients is effectively controlled, which helps maintain the stability of blood pressure and heart rate and avoid related complications. Compared with lumbar anesthesia or epidural anesthesia, combined lumbar and epidural anesthesia has better anesthetic effect and safety.

5. Drug Selection in Anesthesia for Geriatric Surgical Patients

5.1 Preoperative Medication

Regarding the preoperative medication for elderly surgical patients, the physiological characteristics of elderly patients should be taken into account, and the dose of medication should be strictly controlled and should be appropriately reduced on the basis of the dose standard for adults to ensure the safety of medication. In a clinical study by Guo Haiyan et al (Feng WG, Jiang W & Song GJ. 2019), 60 elderly patients under general anesthesia were treated with long tonic (30 patients in the observation group) and atropine (30 patients in the control group) as preoperative medications, and the same methods were used for induction and intraoperative maintenance of anesthesia. The blood pressure and oxygen saturation of the patients in both groups did not change significantly after 15 min and 30 min of administration, indicating that the effects of long Eltonin and atropine on the blood pressure and oxygen saturation of the patients were relatively mild. In the control group, the patients showed accelerated heart rate, while the heart rate of the patients in the observation group always remained within a stable range. At the same time, the incidence of complications was relatively lower in the observation group, thus highlighting the advantageous role of long tonic in the preoperative administration of general anesthesia. In the process of general anesthesia for surgical patients, it is recommended to use long Eltonin in the preoperative medication phase to reduce the impact of adverse effects on general anesthesia and surgical treatment.

5.2 Induction of Anesthesia

During the induction phase of anesthesia, sufentanil and fentanyl are commonly used anesthetic drugs. In a clinical study by Luo Ping (Luo P., 2019), 110 elderly patients undergoing general anesthesia were administered sufentanil (55 patients in the observation group) and fentanyl (55 patients in the control group) in

combination with anesthetic drugs such as propofol, midazolam, and cis-atracurium. During the induction of anesthesia, the changes of systolic blood pressure, diastolic blood pressure, heart rate and mean arterial pressure in the observation group before induction, during intubation and 1 min, 5 min and 10 min after intubation were not significant, while the changes of SBP, DBP, HR and MAP in the control group before induction, during intubation and after intubation were more significant, thus indicating that the application of sufentanil has a more significant effect on the hemodynamics of elderly patients undergoing general anesthesia. The hemodynamic effects of sufentanil on elderly patients undergoing general anesthesia were mild, and the safety of sufentanil was better than that of fentanyl. Among the drugs used for anesthesia induction, sufentanil is an opioid receptor agonist with good lipid solubility, which can inhibit the secretion of adrenaline, and at the same time can reduce the level of catecholamines and endorphins, block nerve conduction and achieve good anesthetic effect, which is a good choice for anesthesia induction.

5.3 Anesthesia Maintenance

In Chen's clinical study (Chen JH, 2019), 100 patients undergoing general anesthesia were maintained in anesthesia by applying inhaled sevoflurane (50 patients in the experimental group) and target-controlled infusion of propofol (50 patients in the control group), and the experimental group had higher MMSE scores than the control group at 6 h and 12 h of anesthesia, and shorter disorientation recovery time, eye opening time, and respiratory recovery time than the control group. Compared with propofol, the application of sevoflurane in the maintenance of anesthesia could better alleviate postoperative cognitive function and accelerate the postoperative recovery of patients. As an inhaled anesthetic drug, sevoflurane has good anesthetic and blocking effects, and at the same time, it is less irritating to the cardiovascular and respiratory tracts, avoiding the occurrence of causing adverse reactions and thus ensuring the safety of anesthetic medication (Wang MELI, Wu WSS & Wang YH, 2019; Guo W-Y, 2019; Li HX, Xiao J, Liu ZJ, et al, 2019).

6. Progress in Maintaining Circulatory Stability During Induction of General Anesthesia in Elderly Patients

Cardiac function monitoring such as transesophageal ultrasound and FloTrac/Vigileo monitoring system has a positive effect in guiding accurate fluid replacement prior to induction, clarifying volume load, improving hypotension due to induction of general anesthesia, and having a positive effect in maintaining stable cardiac output. It has been reported that the administration of α1-adrenoceptor agonists before induction of general anesthesia has a positive effect on reducing the risk of hypotension in elderly patients by ensuring adequate blood volume (Long H, 2019). It has also been suggested that the administration of cardiac vasoconstrictive drugs such as dopamine and ephedrine at the beginning of induction can help reduce the risk of hypotension in patients (Q.R. Xu, H.L. Bo, Y. Li, et al, 2021; Zhao Caiyi, Liu Xin, Li Zhao, et al, 2021). In addition, calcium blockers and β-blockers can improve the heart rate and blood pressure rise due to intubation; Prompt deepening of anesthesia prior to intubation helps to reduce the response to tracheal intubation.

7. Discussion and Outlook

In conclusion, anesthesia is an important part of surgical treatment and needs to be strictly grasped and controlled to reduce anesthetic risks. In the surgical treatment of elderly patients, the risk of anesthesia is relatively high, and the choice of anesthesia and anesthetic drugs is very critical. General anesthesia, epidural anesthesia, lumbar anesthesia and epidural anesthesia are commonly used in the surgical treatment of the elderly, with significant differences in the mechanism of action and scope of application, as well as their respective advantages and disadvantages. The application of general anesthesia combined with epidural anesthesia and combined lumbar and epidural anesthesia can improve the anesthetic effect and safety to a certain extent. At the same time, according to the needs of preoperative medication, anesthesia induction and anesthesia maintenance, combined with the pharmacological characteristics of sevoflurane, propofol, midazolam, sufentanil and other anesthetic drugs, scientific selection, as well as good monitoring during anesthesia, can provide a guarantee for safe and smooth surgical treatment of elderly patients.

Due to the special physiological characteristics of elderly patients, preoperative evaluation

should be carried out adequately during general anesthesia to clarify the patient's cardiac reserve function and compensatory capacity, reasonably select anesthetic induction drugs with rapid onset of action and low impact on circulatory function, and make adequate preoperative preparations; induction drugs should be given slowly, in small increments, and with extended intervals. Maintain the stability of the patient's circulatory function.

References

Chen JH. (2019). Observation on the effect of sevoflurane inhalation general anesthesia on postoperative cognitive function in elderly surgical patients. *Corps Medicine, 36*(02), 52-53.

Chen QH. (2019). Observation of the effects of different anesthesia methods on postoperative cognitive function in elderly orthopedic patients. *Capital Food and Medicine, 26*(20), 19-19.

Chen XK, Zheng Huan J, Chen Shaoxia. (2019). Effect of general anesthesia compounded with different doses of dexmedetomidine continuous infusion on elderly patients with hip fracture. *Chinese Journal of Geriatric Multi-Organ Diseases, 18*(09), 674-677.

Feng WG, Jiang W, Song GJ. (2019). Analysis of the anesthetic effect and safety of lumbar plexus-sciatic nerve block under combined lumbar hard anesthesia and nerve stimulator positioning in elderly patients undergoing lower limb fracture surgery. *Journal of Liberation Army Medicine, 31*(09), 100-103, 107.

Guo H Y, Zhou L X, Wu Q Y, et al. (2018). Clinical comparison of long tocopherol and atropine for preoperative medication in elderly patients under general anesthesia. *China Health Standards Management, 9*(08), 123-125.

Guo W-Y. (2019). Effect of nalbuphine on anesthetic stress response and agitation during the wake period in elderly patients undergoing radical gastric cancer surgery. *Huaihai Medicine, 37*(5), 475-477.

Huang Hongjue, Pan Bingbing, Hong Wanying. (2021). Efficacy of dexmedetomidine versus midazolam in the treatment of post-anesthesia delirium in the elderly in thoracic surgery and its psychological impact. *Psychological Monthly, 16*(18), 77-78.

Li G Q, Cai M S, Xiao Z B, Zhang Z F. (2019). Effect of continuous epidural anesthesia on the incidence of incisional infection and serum TNF-α and CRP levels after laparoscopic appendectomy in elderly patients with acute appendicitis. *Chinese Journal of Gerontology, 39*(19), 4750-4753.

Li HX, Xiao J, Liu ZJ, et al. (2019). Assessment of the effects of different anesthesia modalities on early postoperative cognitive dysfunction in elderly patients. *Medical Information, 32*(18), 68-70.

Lin Xuehua. (2022). Analysis of different doses of midazolam on the improvement of cognitive dysfunction after anesthesia in the elderly. *Journal of Jiujiang College (Natural Science Edition), 37*(1), 103-105.

Liu, Lina. (2021). Comparative analysis of the anesthetic effect of low-dose bupivacaine lumbar epidural combination anesthesia and ropivacaine epidural anesthesia in the elderly. *China Modern Drug Application, 15*(4), 22-24.

Long H. (2019). Observation of the effect of applying intravenous anesthesia with remifentanil and fentanyl in elderly patients under surgical anesthesia. *Chinese Prescription Drugs, 17*(9), 103-105.

Luo P. (2019). Hemodynamic effects of sufentanil for induction of general anesthesia in elderly surgical patients. *Journal of Clinical Rational Drug Use, 12*(11), 68-69.

Q.R. Xu, H.L. Bo, Y. Li, et al. (2021). Effects of rSO 2-guided low-dose norepinephrine on POCD in elderly patients undergoing general anesthesia hip arthroplasty Impact. *Chinese Journal of Anesthesiology, 41*(6), 662-666.

Wang MELI, Wu WSS, Wang YH. (2019). Effect of dexmedetomidine combined with sevoflurane anesthesia on postoperative cognitive function, stress response and pain in elderly patients with lower limb fractures. *Clinical Misdiagnosis and Mistreatment, 32*(9), 62-65.

Xu Yan. (2019). Effects of two types of anesthesia on postoperative central nervous injury and early cognitive function in elderly patients undergoing general thoracic surgery. *Capital Food and Medicine, 26*(20), 38-38.

Zhang Qiu-Li, Cui Yuan-Yuan. (2019). Effects of

different anesthesia modalities on stress levels and hemodynamics in elderly patients undergoing radical open-heart lung cancer surgery. *Hainan Medicine, 30*(17), 2255-2258.

Zhao Caiyi, Liu Xin, Li Zhao, et al. (2021). Effect of general anesthesia guided by EEG monitoring on postoperative delirium in elderly patients with fragile brain function in the non-acute phase. *Chinese Journal of Anesthesiology, 41*(6), 651-655.