

# Original Article: A Systematic Short Review in Evaluate the Complications and Outcomes of Acute Severe of Pediatric Anesthesia



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## ABSTRACT

The aim of present review and meta-analysis was to evaluate the complications and outcomes of acute severe of pediatric anesthesia. Based on the challenge and importance of identifying complications, determining acute and severe complications in pediatric anesthesia and helping comprehensive planning, clinical guidelines and educational curricula, For data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Moreover, effect size with 95% confidence interval (CI), random effect model and REML method were calculated. The Meta analysis have been evaluated with the statistical software Stata/MP v.16. A total of 724 potentially relevant titles and abstracts were found during the electronic search. Finally, nine studies required for this systematic review. Prevalence of perioperative respiratory adverse event in pediatric anesthesia was 10% (ES, 0.10 95% CI 0.01, 0.19) among nine studies and heterogeneity found (I<sup>2</sup>=0%; P =0.96). The most common acute complications in children under anesthesia are related to airway and respiratory management.

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## Introduction

In children, mortality due to Anesthesia is significant, and its acute complications can change the lives of children in the future and have lifelong consequences for the child [1-5]. Identifying and evaluating side effects related to anesthesia, especially in children, can help prevent complications. It can also be effective in educational programs, reporting instructions and protocols, and helping parents. Studies have shown that children have higher critical incidents than adults, which can also affect the type and frequency [6-9]. One of the most commonly reported complications is respiratory, followed by cardiovascular. Reducing and limiting the complications of anesthesia in children is of great importance and is an endless challenge in this regard [10-14]. Existing anesthesia guidelines meet this challenge, but side effects, especially perioperative respiratory, haemodynamic, are common. Studies show that most complications are negligible, while some can lead to child mortality. Studies show that 15% of children under anesthesia have respiratory side effects [15-19]. The research was descriptive and the study population required hospitalized patients in need of blood and blood products in different wards of Namazi Hospital. This study included all patients requiring blood transfusions (emergency and non-emergency) [20-22]. Before blood transfusion, a questionnaire for each patient was completed by one of the above groups [23-26]. Questionnaire including patient name, age, sex, blood group, file number, ward, underlying disease, type of surgery, hemoglobin level and platelet count before treatment, type of injectable product (dense red blood cells, freshly frozen plasma, Platelet and Cryo) volume of injected product, history of blood transfusion, history of transplantation, history of complication of past blood transfusion, history of allergy, blood warming, heating device, number of injection needle heads and pressure injection [27-30]. Patients who during the injection or in the first 24 h after injection have symptoms such as needle pain, discomfort, chest pain, nausea, vomiting, shortness of breath, fever, hives, back pain, anuria, flushed face,

generalized bleeding and in patients They had anesthesia, capillary bleeding, hypotension, and hematuria [31-35]. They were immediately re-sampled with EDTA blood and clotted and sent to the laboratory with blood bags and appendages. Depending on the type of complication, necessary tests were performed on samples before and after transfusion of patients (such as re-examination of ABO and Rh blood groups, crossmatch, blood culture, hot staining, peripheral blood smear, plasma dye for hemolysis, Coombs's test and check the patient's details in the relevant notes in the patient's file and offices and their compliance with the blood bag label and patient ID card) [36-39]. At the same time, depending on the type of specific complication, additional questionnaires (specific to each of the acute blood complications) were completed, which indicated the clinical signs and tests requested [40-45].

A child's first visit to the dentist and the experience he or she gains have a significant impact on his or her future and health [46-49]. A good experience with the dentist, when Cook does not yet have acute dental problems, can build a good relationship between the child and the dentist and pave the way for the child to work together in the future [50-52]. Children who are referred to the dentist when they have a toothache and a problem usually have a fear of dental practice due to the unpleasant experience they have, and when they are treated and even examined, they cry out in fear and their hands and feet [53-55]. They shake themselves. This behavior of children in the dental office is not unusual [56-59]. Why are children afraid of dentistry? In answer to this question, it should be said that many factors such as information transmitted from parents and friends, bitter and painful previous experience of dental treatments, young age of the child and lack of rational approach to the problem during dental treatment, the child does not cooperate with Dentists have an impact on this pervasive fear [60-65]. Words like "needle" and "drill" that scare the child should not be used when preparing the child for a visit to the dentist. Substituting words like pinch, sleeping water, and gnashing of teeth is more acceptable to children and reduces their fear. What to do with

a frightened child? Non-cooperation of the child reduces the quality and standard of medical services provided. In addition to reducing the accuracy and quality of work, physical intimidation and restraint can also produce pleasant psychological results in the child [66-69]. In many pediatric dental treatment centers, the dentist, with the help of his assistants and even the parents, has to keep the child immobile for a while so that a limited treatment can be performed in the shortest possible time [70-74]. An alternative solution to this problem is to provide medical treatment to this group of children under general anesthesia. This was first done by an American pediatric dentist in the early 1900s and is still not acceptable to many parents [75-79]. The younger the child is under anesthesia, or if the child has an underlying disease, the more difficult the anesthesia is and, naturally, the more complications it will have. Medications such as halothane, commonly used in adult anesthesia, are not recommended for pediatric anesthesia [80-84]. For this reason, it is necessary for parents to pay special attention to choosing medical centers and not to neglect pre-surgery anesthesia consultation. Benefits of anesthetizing the baby with anesthesia, the child loses consciousness and does not remember what happened during the operation. There is also complete pain for him and he will not move. This condition allows the therapist to proceed with complete calm and careful consideration of the necessary treatment [85-89]. Dental treatments under anesthesia compared to medical surgeries due to limited extent, low risk of postoperative bleeding, the possibility of controlling postoperative pain by prescribing oral analgesics and no need for intravenous drugs in the postoperative period, differences. Therefore, the child can be hospitalized on the morning of the operation, and in one session, all the desired medical procedures can be performed as outpatient surgery, and the child can be discharged on the same day after a period of postoperative control [90-95]. About 50 years ago, the risks of anesthesia were very high, but today, due to the need to refer patients to equipped centers equipped with general anesthesia and the development of monitoring systems in the operating room, the risks and complications of anesthesia for patients are very

low [96-99]. When the surgeon is operating, the anesthesiologist simultaneously monitors the patient's symptoms, including blood pressure and breathing, and keeps the condition under complete control. A common misconception among the general public is that anesthesia reduces the intelligence of children in adulthood, but this has not yet been scientifically proven [100-103]. Of course, there are still concerns about the side effects of repeated anesthesia. Some parents ask about the risk of death. Statistics show that the mortality rate due to anesthesia is 1 in 10,000 cases, which is also due to underlying diseases and the type of surgery [104-109].

The results of several studies show that exposure to general anesthesia before the age of 4 increases the risk of cognitive problems and ADHD. Another study found that children who underwent two general anesthetics were 50 % more likely to have learning difficulties than other children [110-113]. To answer the question of how these drugs affect children's brains, British experts are conducting joint research [115]. Although surgery is inevitable for children in threatening cases, one of the goals of this joint study is to help parents in Especially the decision to delay surgery [13]. According to the results of one study, which has caused a great deal of concern, anesthesia before the age of 2 significantly increases the risk of developing ADHD [19]. On the other hand, general anesthesia before the age of 4 increases the probability of reading, writing and solving math problems by up to 50%. In this regard, the number of times of anesthesia and its time are also important, as it has been determined that surgery less than 2 h does not pose any risk [13]. But surgeries lasting more than 3 hours increase the likelihood of learning disabilities [15].

"The complications and consequences of anesthesia vary depending on the type and physical condition of the individual." Some of these complications show up quickly and by the end of the surgery time, and some complications occur in the long run. Anesthesia has the same potential risks for all people that are not related to their underlying diseases, and before the operation, the patient is informed by the legal

framework whether he or she will accept the risk of anesthesia or not. Dangerous

complications from anesthesia occur in less than one percent of people. Cross-sectional allergic reactions to the anesthetic and discharge into the lungs are possible side effects of anesthesia. Of course, in some people who have underlying diseases such as chronic hypertension, underlying heart disease, advanced heart failure, lung failure, brain damage, etc., anesthesia can have its own consequences.

### *Selection Criteria*

Nausea and vomiting are the most common consequences of anesthesia. These side effects are caused by anesthesia, but at present, due to the use of the best anesthetics in the country, vomiting and nausea caused by anesthesia are greatly reduced. Some people think that anesthesia causes memory impairment and this concern is much more serious, especially for children and infants, but no scientific textbook mentions memory impairment or permanent brain damage as complications of anesthesia. The situation is slightly different for adults, and temporary forgetfulness may occur in adults after anesthesia. Spinal and local anesthesia also have their own consequences. Headache followed by low back pain is one of the most important complications of spinal anesthesia and in some rare cases it can cause other problems. Regarding how long a person can be anesthetized, it can be said that the patient's history should be considered for this purpose, whether the person is tolerant of receiving anesthesia or previous drugs, problems with the liver, kidneys or breathing. "They created it or not."

### *Inclusion criteria*

1. Randomized controlled trials studies, controlled clinical trials, prospective and retrospective cohort studies.
2. Acute severe complications of anesthesia
3. Age < 16 years of age.
4. English language

### *Exclusion criteria*

1. In vitro studies, reviews, animal studies and clinical studies
2. Incomplete or inconsistent data for the purpose of the present study.
3. Studies that referred to conscious sedation rather than general or regional anesthesia.
4. Excluded data on cardiac arrest

Surgery is painful and this pain must be eliminated in some way. Anesthesia has greatly contributed to the advancement of medical science by reducing the patient's pain during surgery and has enabled us to perform surgeries more easily [19]. However, anesthesia may be associated with problems for the patient [13]. These side effects may persist for hours or days after anesthesia and disappear in the vast majority of patients with medical care. Dr. Khosrow Farhadi, anesthesiologist and faculty member of Kermanshah University of Medical Sciences, stated in this regard: "Complications and consequences of anesthesia vary depending on the type and physical condition of individuals. What are the serious side effects of anesthesia? Some of these complications show up quickly and by the end of the surgery time, and some complications occur in the long run [18]. Anesthesia has the same set of potential risks for all people that are not related to their underlying diseases, and before the operation, the patient is informed by the legal framework whether or not he or she will accept the risk of anesthesia. Dangerous complications from anesthesia occur in less than one percent of people [51]. Cross-sectional allergic reactions to the anesthetic and discharge into the lungs are possible side effects of anesthesia. However, in some people who have underlying conditions such as chronic hypertension, underlying heart disease, advanced heart failure, lung failure, brain damage, etc., anesthesia can also have its own consequences. Some people think that anesthesia causes memory impairment. Memory impairment or permanent brain damage have not been mentioned in any scientific textbook as a complication of anesthesia [15]. Anesthesia is

a targeted procedure performed by an anesthesiologist Nausea and vomiting are the most common consequences of anesthesia [156-159]. These side effects are caused by anesthesia, but at present, due to the use of the best anesthetics in the country, vomiting and nausea caused by anesthesia are greatly reduced. Some people think that anesthesia causes memory impairment and this concern is much more serious, especially for children and infants, but no scientific book mentions memory impairment or permanent brain damage as complications of anesthesia. Headache followed by low back pain is one of the most important complications of spinal anesthesia and in some rare cases it can cause other problems [16]. Regarding how long a person can be anesthetized, it can be said that the patient's history should be considered for this purpose, whether the person is tolerant of receiving anesthesia or previous drugs, problems with the liver, kidneys or breathing [16]. "They created it or not." Studies that did not meet the inclusion criteria were excluded from the study. In the second step, the full text of 9 studies was reviewed. Finally, three studies were selected (Figure 1) [13].

#### *Problems with Anesthesia and Local Anesthesia*

Nausea and vomiting: This problem exists in both anesthesia and anesthesia. Sore throat: In cases where the patient is under general anesthesia and is due to a tube that is inserted into the patient's trachea during anesthesia. This pain may last for hours to days. Feeling dizzy: Caused by low blood pressure or medications used. Shivering: due to anesthesia drugs or due to the patient staying cold during surgery. It is treated by warming the patient with an electric towel. Headache: Medications taken during surgery, lowering blood pressure, anxiety and

other causes can cause headaches. Severe headaches are more common after anesthesia. Itching: It is caused due to the use of large amounts of narcotic analgesics or due to allergies to drugs. Low back pain: usually caused by lying on the operating table for a long time. Confusion and memory impairment: more common in the elderly after general anesthesia. Lung infection: more common in smokers. Not seen in anesthesia. Urinary disorders: In men it is more in the inability to urinate and in women it is urinary incontinence. It usually heals within a few hours after surgery. Seen in numbness. - Muscle pain: due to the use of some drugs during general anesthesia. Complications that are less common - Shortness of breath and slow breathing: caused by excessive use of drugs to reduce postoperative pain. Injuries to teeth, lips and tongue: These injuries are usually mild and are in the form of small hemorrhages and are due to the pressure of the respiratory tract that is used for the patient during general anesthesia. - Not being fully anesthetized and being aware of the surroundings during general anesthesia: This condition occurs in some cases and although the patient is not in pain, but during anesthesia is not completely asleep and is aware of what happens in the operating room.

#### *Characteristics*

Nine studies (three randomized controlled trial study and seven Cohort studies) have been included in present article. The Number of patients a total was 10244 with rang of age between 0-16) (Table1) [16].

#### *Bias assessment*

According to GRADE guidelines, all studies had low to moderate risk of bias.



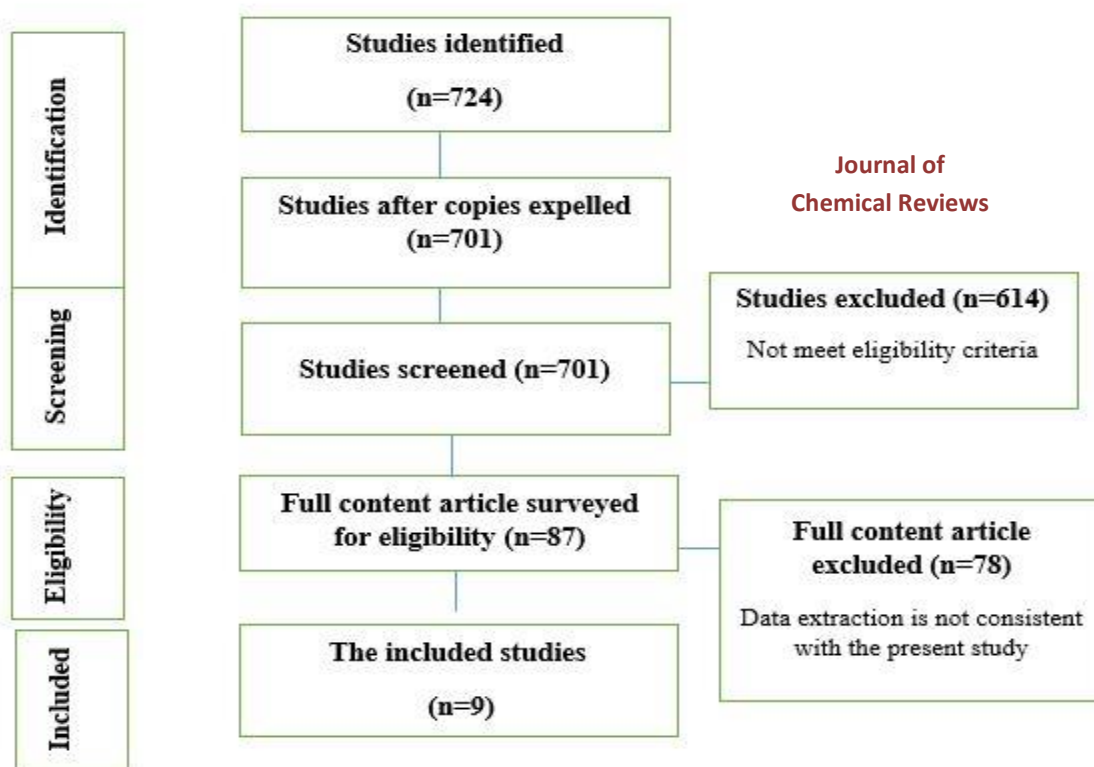


Figure 1. Study Attrition

Table 1. Studies selected for systematic review and meta-analysis

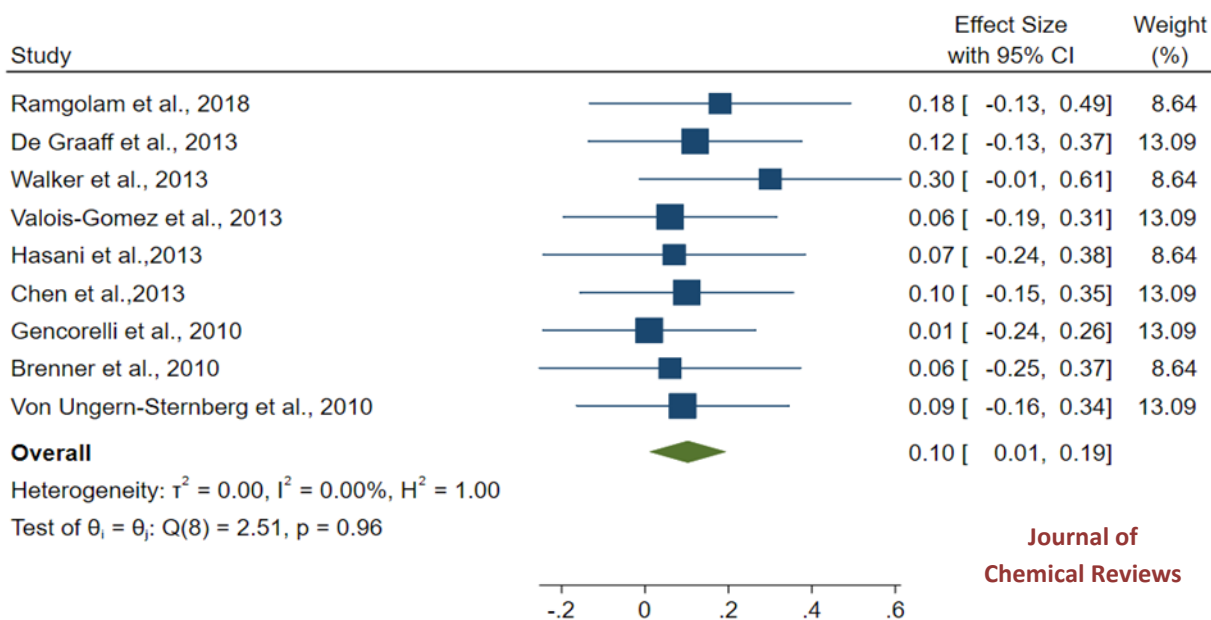
Study. Years	Study Design	Number of Patients	Mean/Rang of Age (years)
Ramgolam et al., 2018 (8)	RCT	300	0-8
De Graaff et al., 2013(9)	Cohort studies	575	0-16
Walker et al., 2013 (10)	Cohort studies	24	0-8
Valois-Gomez et al., 2013 (11)	Cohort studies	484	0-8
Hasani et al.,2013 (12)	RCT	88	3-6
Chen et al.,2013 (13)	RCT	150	1-3
Gencorelli et al., 2010 (3)	Cohort studies	1070	3–12
Brenner et al., 2010 (14)	Cohort studies	512	6-16
Von Ungern-Sternberg et al., 2010 (15)	Cohort studies	7041	0-16

### Perioperative Respiratory Adverse Event

Prevalence of perioperative respiratory adverse event in pediatric anesthesia was 10%

(ES, 0.10 95% CI 0.01, 0.19) among nine studies and heterogeneity found ( $I^2=0\%$ ;  $P =0.96$ ). Heterogeneity between studies was very low

and similar results have been reported in all studies (Figure 2).



Random-effects REML model

**Figure 2.** Forest plot showed perioperative respiratory adverse event

In the present study, nine studies that met the inclusion criteria were selected. The results of the present study show that respiratory events are the most common complication and occur in 10% of the population of children 0 to 16 years under anesthesia. The results of other studies show that cardiovascular events are common after respiratory complication, which was not investigated in the present study due to heterogeneity between studies [18]. Also, studies demonstrated that the increase in the proportion of cardiovascular events may be due to respiratory events [19].

In one study, circulatory complications were reported to be more prevalent than respiratory problems. This study reported complications only at the level of the organ systems involved, without going into further detail about the events. Kakavouli et al., 2009 have reported the most side effects in the respiratory system [86].

Diagnosis of respiratory complications is easier and faster than cardiovascular events and can often be the cause of cardiovascular events, so diagnosing respiratory complications is very important. Most existing studies have examined

respiratory problems, so the present study examined the prevalence of this complication and summarized the results [11].

Most studies have documented the occurrence of respiratory and hemodynamic side effects not only during induction but also during maintenance of anesthesia and emergence. There are two studies that distinguish between the occurrence of side effects during the induction period and during maintenance [15]. Which was also examined in the present study. This study showed that children with multiple risk factors for postoperative respiratory side effects experienced fewer side effects during anesthesia. Placing an airway mask minimizes the occurrence of side effects after induction with inhaled anesthetics. In the present study, there was no heterogeneity between the studies and the results of the studies were almost very similar to each other [98].

The present study had limitations, including the amount and duration of complications due to heterogeneity of studies not studied, the cause of diagnosis was different between studies, differences in the definition of child population

and age range were different, lack of information about the total population may What kind of complication was seen in the rest of the population? Mortality rate and its relationship with complications have not been investigated [19].

Children who are afraid of dentistry and do not work with a doctor, mentally and physically retarded patients, cerebral palsy and seizures, adults who are afraid of dentistry, people whose teeth are not anesthetized and patients who want all dental services They should be performed in one session, under anesthesia. Repair of carious lesions in deciduous teeth, root canal treatment, treatment and control of dental abscesses, installation of fixed and movable maintenance space to maintain the space of lost deciduous teeth, plaque making and reconstruction of lost teeth, especially teeth Anterior and fluoride therapy to prevent tooth decay, various types of maxillofacial surgery, extraction of incisors and wisdom teeth, gingival surgery and removal of cysts are among the tasks performed under anesthesia and sedation (short-term anesthesia). If your child has a toothache or infection, immediate action should be taken, with or without anesthesia, but if the pain has not yet started, perhaps with regular brushing and flossing and fluoridated mouthwash. The development of caries can be prevented. Risk of anesthesia for children with colds Anesthesia has both harms and risks, but the harms and risks must be weighed against the benefits to the child of the anesthesia. Sometimes a work session may be extended to 10 sessions. Anxiety and pain that is going to be created for the child in 10 sessions, creates a lot of problems for him and makes the work difficult for the surgeon. The disadvantage of anesthesia for a child is the transient learning disability that lasts for several months. The risk of anesthesia is when it is performed by a non-specialist in an office that does not have sufficient equipment for cardiopulmonary resuscitation. Therefore, the child should be anesthetized for treatment in licensed clinics and hospitals licensed by the Ministry of Health, by pediatric anesthesiologists, and in the operating room. Dentists never anesthetize a child for a small operation and usually do not maneuver too

much on baby teeth. For children with colds, anesthesia should be delayed for up to 6 weeks because anesthesia is 10 times more common for them than for other children. The child's heart problems and other diseases must also be considered [20].

## Conclusion

Few data have been reported on acute complications in pediatric anesthesia. The most common acute complications in children under anesthesia are related to airway and respiratory management. It is suggested that more studies need to be conducted in this field, and future studies in this field are very important to be based on a standard diagnostic reporting system with sufficient description of population details to describe the heterogeneity of data. The results of this study can be used in developing guidelines and parental guidance. The COVID-19 epidemic poses unique challenges to anesthesia. General anesthesia and airway manipulation are aerosol-producing procedures. Subsequently, the aerosol produced could potentially infect health care workers. Another aspect of the COVID-19 epidemic is the unprecedented demand for anesthetics for intensive care, which has reduced existing stocks of anesthetics for general anesthesia. The Royal College of Anesthesiologists in the UK has identified the use of local anesthesia as a solution to this problem in the Emergency Guide for Emergency Surgery such as Pelvic Fractures and in the Medication Reduction Guide. Therefore, the importance of safe and evidence-based use of local anesthesia is increasing to maintain the ability to provide anesthesia services as well as reduce the contact of health care workers to COVID-19. Apart from the COVID-19 epidemic, there are other benefits to using local anesthesia in anesthesia. This method provides excellent postoperative analgesia that allows the use of strong narcotics, and is a good alternative for patients for whom general anesthesia may be dangerous. Local anesthesia may also accelerate recovery and limit some common complications, such as nausea, vomiting, and intestinal obstruction; But the evidence for some of these consequences is less certain. About when to use local anesthesia, the most effective method of



local anesthesia, safety and effectiveness of local anesthesia, drugs and adjuvant drugs that can be injected, the amount of peripheral nerve block against nerve axis obstruction, and possible complications, among specialists Anesthesia there is disagreement.

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