

# Comparison of General Anesthesia and Regional Anesthesia for Caesarean Section

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## Abstract

**Objective:** To compare the maternal and neonatal outcomes when two different types of anesthesia, either general or regional, are administered for cesarean section. **Design:** It is a comparative study. **Setting:** The research was conducted in the Dicle University Gynecology and Obstetrics Clinic, in Sehit Surgical Hospital, and in Cumhuriyet Ana Family Health Center in Diyarbakir, from June 1999 to December 2000. **Subjects:** Two hundred and twenty-eight patients who underwent cesarean section. **Interventions:** General anesthesia had been applied to 113 (49.5%) patients and regional anesthesia to 115 (50.5%) patients. **Main outcome measures:** The age, the season during which the operation was performed, the time of delivery, the residency, the education, the occupation, the parity, the type of the cesarean section, the complications, the type of anesthesia, the duration of the surgical operation, the Apgar score at the first and the fifth minute, the pH of the umbilical artery, and the adverse effects of the anesthetic agents have been researched and compared. Data are evaluated with a significance level of 0.05. (Ahmet, 2023)

The education, occupation, and the residency areas of the two groups were significantly different. In 132 (57.9%) patients, cesarean section was an elective one, and the incidence of use of regional anesthesia in this group was significantly higher than that in the emergency cases. Spinal anesthesia was applied to 101 (45.8%) patients, whereas the other majority received an epidural anesthetic procedure. As for the level at which the agents were injected, there was no significant difference between the spinal and the epidural anesthesia agents that were used. No premature births were particularly detected. During the postoperative 24 hours, 10.5% of the newborns' first Apgar scores were calculated to be lower than 8, but in the fifth minute these rates decreased to 1.3%. The anthropometric data of the patients' height and weight did not display any significantly higher ratios. No statistical differences were detected regarding the pH values of the umbilical arterial blood gases. However, the duration of the anesthetic procedure was significantly longer in the regional group. (Zhang et al.2021)

## 1. Introduction

Caesarean section is a common surgical method used to deliver a baby. Regional and general anesthesia are both routinely used for caesarean section. Neuraxial anesthesia, including epidural anesthesia and spinal anesthesia, is a standard practice for caesarean deliveries because of its lower incidence of intraoperative maternal nausea and vomiting, a shorter time to ambulation and breastfeeding, a more stable maternal-fetal hormonal response to surgical stress, and a lower incidence of intraoperative fetal acidemia. At similar costs, only spinal anesthesia is associated with fewer long-term maternal headache complications than

general anesthesia. Spinal anesthesia has a rapid onset of action and provides an effective block, unlike epidural anesthesia, which may become ineffective after one fails. Because the pregnancy stage is sudden-onset and has various conditions of parturient, general anesthesia is unavoidable in some cases. (Watson et al.2022)

There is no consensus on general and neuraxial anesthesia use in parturients requiring caesarean section. General anesthesia is associated with the removal of the partner from the operating room during the procedure, an increased risk of complications for mother and baby, lower maternal satisfaction with the birthing process, an increased risk of delayed newborn breastfeeding, and lower Apgar scores. The choice of general anesthesia or spinal anesthesia for caesarean section should be based on the benefits and disadvantages, risks, adverse effects, and costs of the methods. Some positive and negative aspects must be compared and balanced.



### **1.1. Background and Rationale**

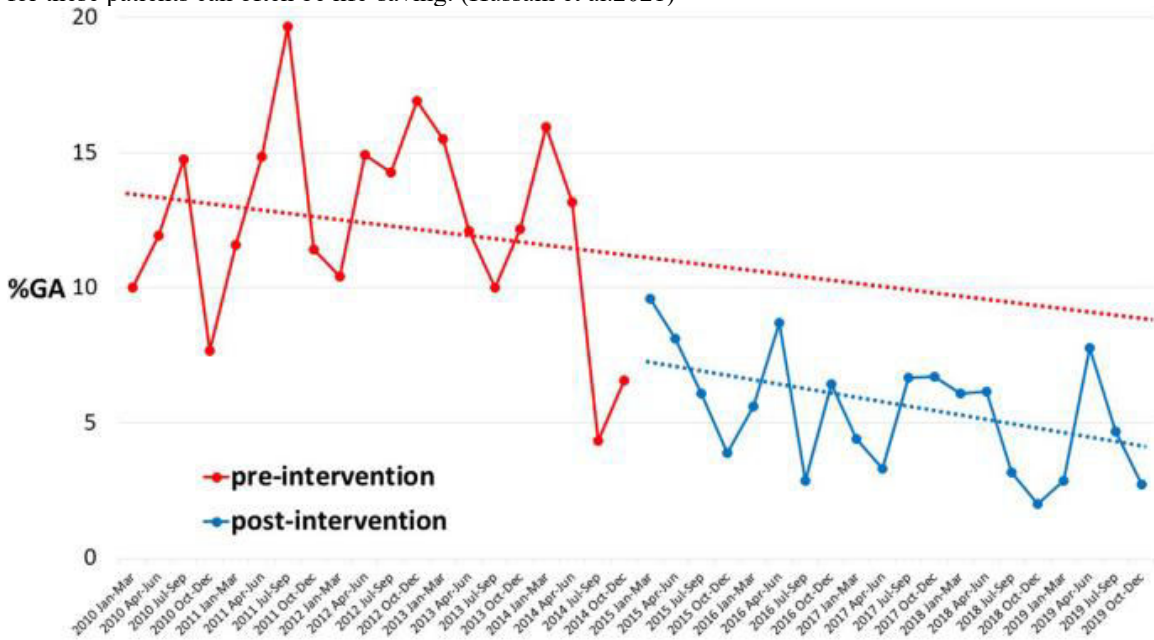
Pregnancy and labor are physiological events that are highly significant for women, not a disease. However, cesarean sections are often required. As a result of increases in the rates of preterm labor, multiple pregnancies, maternal age, hourly labor induction, and elective cesarean delivery, the rate of cesarean sections is increasing. The highest indications for cesarean sections refer to the term in which it is performed for fetal distress. The choice of general or regional anesthesia changes depending on maternal and gestational complications. Early maternal bonding, breastfeeding, depression, satisfaction levels, neonatal adverse effects, and neonatal outcomes are other significant factors. In our study, we aimed to compare the general and regional anesthesia techniques regarding these parameters and will contribute to the literature by presenting our study results. In previous studies, it has been shown that dealing with the intensive emotional aspects of pregnancy and preparing for delivery should not be overlooked. The type of anesthesia affects many psychological parameters, especially the bonding period, post-cesarean fear, and emergency cesarean, which is known as a more stressful event than a usual vaginal delivery. The increase in stress levels may also affect the emotional state of the mother in the postpartum period; the increased adrenaline values are associated with higher systolic, diastolic, and mean arterial blood pressures, which are predisposing factors for the increased neonatal adverse effects during general anesthesia. Anesthesia can be performed depending on the choice of the mother and the clinician's experience based on a detailed examination of the risks and benefits of both drugs. (Metogo et al.2021)

### **2. General Anesthesia**

General anesthesia options such as rapid sequence induction, modified rapid sequence induction, and awake intubation techniques could be considered as the induction methods. The main concern in rapid sequence induction is the rapid sequence of events due to desaturation and oxygen desaturation, which is

aimed at intubation by early administration of a large quantity of O<sub>2</sub>, cricoid pressure, avoiding mask ventilation, and using rapid-onset muscle relaxants. The point of distinction for the modified sequence is to allow the patient to breathe spontaneously by using LMA and to ensure the occurrence of a sufficient apnea phase with the last respiratory movement before intubating. As the prior laryngoscopy experiences and the possible operation plans will disrupt the sedation, working under total brain aesthetics is appropriate. While rapid-onset muscle relaxants aim to provide the necessary conditions, surgical readiness is maintained by ensuring their effect through intravenous medications.

Cesarean section is one of the most frequently performed surgical procedures during pregnancy and childbirth. The increase in cesarean section rates has an impact on all countries and health systems globally. The average cesarean rate worldwide is about 15%. The rate can go up to 40% in some countries. It is recommended that it is necessary to consider "around 15%" at the point where the benefits of cesarean section are balanced against the high rate of cesarean section in the populations, without realizing an improvement in maternal and child health outcomes. In cesarean deliveries, the preferred anesthesia method is important for the mother and child. Also, these patients generally apply to the anesthesiology clinic without receiving any preoperative anesthesia briefing. It comes to a realization in the same place where anesthesia is applied before surgery. In addition, since the condition of the patient is not elective, the factors related to both the disease and the pregnancy inhibit subdilation in terms of anesthetic options. The preferred anesthesia for cesarean section is regional anesthesia, and if and when it cannot be applied, general anesthesia is preferred. Since the general anesthesia option is an urgent procedure for cesarean sections, it is preferred in patients who are generally in a more critical clinical condition. Since the patient may not have received preprepared general anesthesia, including pregnant women, the anesthesia techniques present additional challenges for pregnant women. The general anesthesia techniques performed for these patients can often be life-saving. (Hussain et al.2021)



**2.1. Definition and Mechanism of Action**

Lidocaine, procaine, tetracaine, bupivacaine, etidocaine, and mepivacaine belong to the amide or the ester group of local anesthetics. Basically, these drugs prevent the generation and conduction of impulses in sensory nerve fibers by interfering with the small fibers. They are used to achieve local and regional anesthesia by blocking numerous different sensitive receptors and channels on sensory neurons. Local anesthetics work at different concentrations depending on the site of action. If they block the sodium channels on the motor axon, they cause paralysis and compromise voluntary muscle function. Local anesthetics bind different numbers after different binding times to transmit channels. The mechanism by which nerve conduction blockade occurs immediately after binding of the nerve cannot yet be clarified. Since the drug not only suppresses the transmission of impulses in the nociceptors, it also suppresses the axial contribution. In this case, anesthesia is provided.

Adequate local anesthesia must be achieved during a surgical operation. Other drugs should be administered in appropriate amounts and should be administered when necessary. The local anesthesia technique involves interrupting the nerve fibers at a suspected site within a range of 9-salt. The anesthesia sites belonging to the facial nerve in the muscles are illustrated. However, clarifying the method would be more appropriate in a human nerve trunk. Since the branches of the facial nerve are located in the muscles, they were not completely saved and therefore the standard classifications were changed to the structure we obtained. (Engle et al.2024)

## **2.2. Indications and Contraindications**

General anesthesia applying following conditions: the violation of hemostasis; critical development of cardiac function in the background of acute or chronic heart diseases. Regional anesthesia applying following indications: the fear, psychosis, and other affective disorders in pregnant; significant abnormalities of the early stages of labor threatening the life of the fetus or other complications in the mother. The presence of severe preeclampsia in pregnant becomes the indication for cesarean section. In such cases, to achieve surgical management of anesthesia may not be applied and cure pregnant with the ongoing development of preeclampsia is possible on the background of that principle. Preterm placenta. In such cases, are considering gestational age, the tactic of its determination, the state of the cervix, presenting part and the fetus. These women are divided into three groups: the first group consists of women in whom there is a possibility of lower segment cesarean section at the specific indications; women from the second group, when there are no contraindications are doing abdominal delivery; in the third group are the pregnant, in which there are signs of imminent onset of labor, which can not be executed outpatient treatment. (An et al., 2024)

## **2.3. Techniques and Drugs Used**

There is still no "Standard, Super Technique" for Caesarean section. The technique of anesthesia needs to be chosen depending on the condition of the patient, the surgical procedure, and the choice of the patient. Both regional and general anesthesia techniques have advantages and disadvantages. Anesthesia techniques for the Caesarean section should be selected on a patient basis. Although single-shot spinal anesthesia is the most popular choice, the application is increasing in some countries. The most preferable technique in our country has been spinal anesthesia alone or combined with epidural anesthesia.

Techniques Local anesthetics in obstetrics and gynecology: Widely used regional anesthesia in surgical procedures and obstetric interventions are local anesthetics. In addition to surgical procedures in obstetrics and gynecology, administration is performed for pain during labor, cervical dilation, endoscopies, biopsies, and various outpatient interventions. The aim in obstetrics is mother and fetus safety, and in gynecology, it is uterine performance prediction. Therefore, often short or extended duration are sought.

## **2.4. Advantages and Disadvantages**

Regional anesthesia is generally used for cesarean delivery, and while superior to general anesthesia for minimizing neonatal depression and ensuring maternal-infant early bonding, it increases the risk of adverse postoperative outcomes such as vasodilation and hypotension, itching, prolonged bladder evacuation, and generalized shivering. The current wisdom is that the reduction in risk associated with regional anesthesia for cesarean delivery overrides the comparable safety and efficacy of general anesthesia and may be balanced with the benefit of bonding and a short length of hospital stay. Although general anesthesia can be applied to any parturient, except in very special conditions, the risks undertaken by the fetus are higher in general anesthesia compared to regional anesthesia. Analysis of the maternal-neonatal morbidity spectrum indicates an advantage of regional anesthesia in terms of the postpartum period. It is undisputed that it reduces the neonatal period in the birth unit, and that the fetus emerges more vigorous and alert due to its absence in the embryonal period. However, the use of sedation and optimal timing of general anesthesia provision that ensures a rapid and problem-free emergence of the fetus can balance the differences and allow the use of general anesthesia. (Bollag et al.2021)

## **3. Regional Anesthesia**

Regional anesthesia is a very effective method of pain relief, and it has been successfully applied to many different surgical procedures. Spinal anesthesia, the regional anesthesia technique most frequently used in cesarean sections, allows the fetus to get enough oxygen and does not let the mother experience pain during the operation. Because of its numerous advantages, spinal anesthesia constitutes the first choice for anesthesia in many maternity clinics. Furthermore, cesarean section under spinal anesthesia is noted to be less painful during and after the operation when compared with general anesthesia. As long as it is performed under low pressure, spinal anesthesia allows the extinction of pain and bearing down during vaginal delivery, and it stops the movement of the affected mother, which allows the surgeon to perform

the operation safely and swiftly. The biggest advantage of regional anesthesia techniques over general anesthesia in cesarean sections is their effect on fetal and maternal mortality and morbidity.

The patient operated on under regional anesthesia needs to be slightly monitored during the operation; however, surgical requirements and the surgeon are also factors that need to attend to the maternal and fetal well-being. Due to the dense innervation of the abdomen, which also plays a major role in pain during the postoperative period, the motor loss after spinal anesthesia can be considered quite important. Especially in addition to recommendations about service and the baby in the first 24 hours after the operation, the closeness maintained between the mother and the baby, the ease of breastfeeding, and the early discharge of the patient enable the patient to return to normal life quickly, to keep motherhood alive, and enable the baby to grow up without feeling desolate within the family. Also, the side effects and complications in the mother and the baby during regression from spinal anesthesia can be noted to be rather limited. Due to these facts, the general congresses of anesthesiology recommend the use of spinal anesthesia in scheduled and emergency operations as long as there are no contraindications. (Mendonça et al.2021)

### **3.1. Types: Spinal, Epidural, and Combined Spinal-Epidural**

Spinal anesthesia was first described for ambulatory orthopedic and urological procedures. Although spinal anesthesia has been used for over the past century worldwide, it has seen a significant level of development in the last few decades. It results in a shorter stay in the hospital after a C-section with fewer postoperative complications and a quick recovery to normal physical activity. Because of its rapid onset of action and patient satisfaction, the technique of choice for neuroaxial anesthesia during C-section has also become spinal anesthesia. Spinal anesthesia, as opposed to general anesthesia, allows patients to watch the birth of their child, participate in initial maternal care, and attach to the newborn during the newborn's first golden hour.

Epidural anesthesia is the most common obstetric neuraxial technique. Non-laboring patients in the literature on C-section performed under epidural anesthesia are limited and lack randomization. A study found no significant differences in the recovery intensity between spinal and epidural anesthesia. Another study used 27 ml of 0.5% bupivacaine and sufentanil to perform C-section in 136 patients. They found that the incidence of hypotension, duration of analgesia, pain level, ITTs, and breastfeeding were equivalent in all groups, indicating no significant statistical difference. A comparison of the quality of anesthesia, the dynamics of vital parameters, the plasma epinephrine levels, and the quality of the block in patients undergoing C-section under epidural anesthesia and spinal anesthesia concluded that spinal anesthesia provided faster start time, higher sensory and motor blockade, and less sympathetic response. (Plaat et al.2022)

### **3.2. Advantages and Disadvantages**

**Advantages of General Anesthesia** General anesthesia provides rapid, complete analgesia, muscle relaxation, and therefore an optimal surgical field. It inhibits the elevation of intracranial or intraocular pressure induced by a difficult airway for intubation, coughing, or straining caused by intractable vomiting in the case of severe preeclampsia. It is therefore a reliable anesthetic method and is indispensable in cases with cerebral aneurysms or for patients who are totally unwilling to receive regional anesthesia. In addition, it does not require special elaborate or time-consuming examinations. **Disadvantages of General Anesthesia** Maternal hypotension occurs because of the sympathetic blockade induced by major arterial and venous vasodilation that occurs with general anesthesia and is associated with subsequent nausea and vomiting. When the excitatory rapid induction method is employed to prepare the airway to intubate the patient as rapidly as possible, the fetus is exposed to preoxygenation for induction, tracheal intubation, and positive pressure ventilation within a few minutes. The anesthesia does not act on the fetus since volatile anesthetics are not transferred into the fetus via the placenta. However, the fetus may be affected by factors such as a decrease in gas partial pressure and maternal hypotension that directly affect placental blood flow. (Elsayed et al.2020)

## **4. Comparative Studies**

The issue is whether general anesthesia should be used routinely for cesarean section since awareness under general anesthesia may harm both the infant and the mother. Conversely, major or even deadly complications of regional anesthesia may occur. This systematic review attempted to identify all randomized controlled trials, but this difficult question has been addressed in only three studies. The findings of two smaller trials have been synthesized, and the contribution of the largest trial has been explored in a sensitivity analysis. Complications of regional anesthesia were the primary outcomes, and neonatal condition, adverse maternal symptoms, and the procedure for cesarean section were the secondary outcomes. (Neuman et al.2021)

Compared with general anesthesia, regional anesthesia seems to be associated with a reduced risk for postoperative maternal infectious morbidity and a reduced need for blood transfusion. With increasing complications of surgery in obstetrics, including the use of drugs for induction, it seems to be important to keep some advantages of the mode of anesthesia. However, information was limited by differences between the trials, and large-scale epidemiologic studies are needed. If we need to deal without more evidence, regional anesthesia seems to be associated with less maternal infectious morbidity and less need for blood transfusion than the general mode of anesthesia. However, the results indicate that regional anesthesia increases the incidence of hypotension, which should not be very surprising. Although a low level of hypotension is tolerable for women, this complication may harm the unborn baby.

#### **4.1. Methodology and Study Design**

There is a large body of evidence supporting the safety of both general and regional anesthesia for cesarean section. The main aim of our study was to compare maternal and neonatal outcomes following cesarean section in two groups of pregnant women, one receiving general and the other receiving regional anesthesia. The secondary aim was to compare the main physiological parameters of the newborns in these two groups. This was a prospective observational study conducted at a medical university. Pregnant women after 24 weeks of gestation scheduled for an elective or an emergency cesarean section were included in the study and were divided into two groups based on their anesthesia type.

In group GA, only general anesthetics were applied, either by means of facemask or with intubation. In group RA, obstetric patients were anesthetized by spinal or epidural anesthesia. This study provides evidence of comparative outcomes of both general and regional anesthesia for cesarean section - an important part of the decision-making process for pregnant women and an opportunity to inform the anesthetic approach to the pregnant patient. Also, it can be useful for informing the informed consent processes of obstetric units. The study is not randomized; an important limit of this work is that if there are options for regional anesthesia, it is not ethical to administer general anesthesia. In line with the internal standards and safety rules, the decision about anesthesia is at the discretion of the patient and anesthetist together. (Al-Husban et al.2021)

#### **4.2. Key Findings**

Summary: For caesarean section under general anesthesia, a lumbar epidural technique using lower segment delivery was discussed in preference to the subarachnoid administration of low concentration and dose of bupivacaine. Low-dose opiates were an alternative to ordinary amounts of bupivacaine for patients with lumbar epidural block. Combined spinal and epidural block provided some advantages in both dimensions with low-dose opiates for caesarean section. The avoidance of post-spinal headache is another benefit when the epidural space is identified before the subarachnoid block is done with any cycle of spinal needle. In conclusion, there are many ways to tackle this issue, but an anesthetic technique based on low-dose opiates, low concentration and dose of bupivacaine, and lumbar epidural placement for the administration of the above drugs is suggested at this time for caesarean section under regional anesthesia. (Rajan et al.2022)

Studies comparing regional and general anesthesia for caesarean section in patients at high risk of infection showed some advantages with regional anesthesia, with more marked effects related to the general condition of the general anesthetic patient group. Opioid doses varied considerably between studies; however, a continuous infusion of bupivacaine with low-dose opiates was chosen in a multimodal pain regimen for patients undergoing two previous caesarean section procedures and scheduled to undergo ESS. Such low-dose epidural opiates for multimodal pain management were associated with fewer adverse effects and reduced rehabilitation; thus, it may be the multimodal pain regimen and not the type of anesthesia used in patients planned for caesarean section that contributes to the shorter time to bowel movements in the perioperative period.

#### **5. Maternal Outcomes**

For the main maternal outcomes: maternal death, major intraoperative and postoperative complications, ICU admission, maternal risk was more or similar in the GA group compared with the RA group. For the minor intraoperative and postoperative complications, the risk was similar in both GA and RA groups. The quality of evidence was moderate for maternal death, ICU admission, and minor intraoperative and postoperative complications, moderate for major postoperative complications, and low for major intraoperative complications. There is insufficient high-quality evidence to conclude that regional anesthesia is superior or safer to general anesthesia for cesarean section in ensuring better maternal outcomes. What is known on the subject: Most patients for cesarean section will prefer regional anesthesia to general anesthesia without a surgical reason. This review is important to ascertain whether regional

anesthesia is indeed superior to general anesthesia in ensuring maternal safety and the unlikelihood of major complications such as maternal death, major hemorrhage, or seizure from the underlying disease. (Guillot et al.2022)

**5.1. Surgical Conditions and Complications**

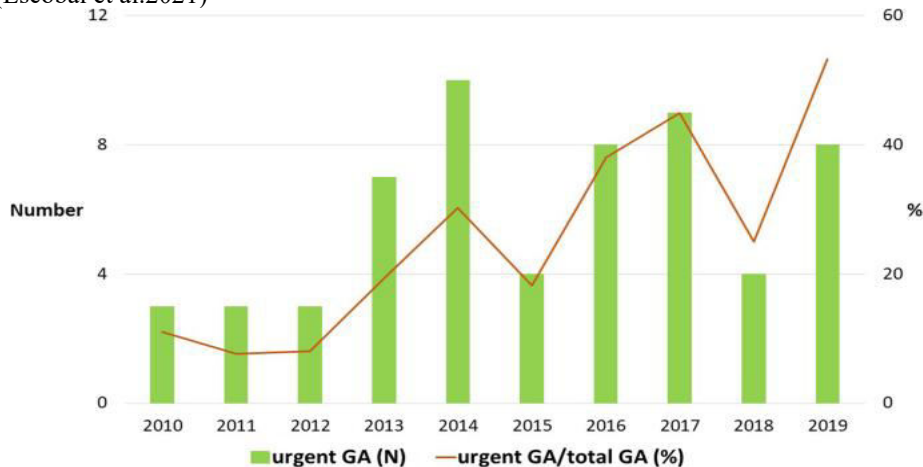
**Surgical Conditions.** The onset of anesthesia was defined as the time that the anesthesiologists considered the patient to be ready for surgery, which was recorded in the patient’s chart. The duration of surgery was determined using information from the operating room electronic record. The urgency of surgery was categorized as "urgent" only when it was decided less than an hour after the diagnosis and as "emergency" if the anesthesiologist mobilized as the patients were being transported to the OR and the diagnosis was not anticipated. In cases where immediate diagnosis was known and the team was already organized at the time the parturients arrived in the OR, an emergency C-section was considered.

**Mothers’ Fever > 37.5 °C.** Postoperative axillary temperature was recorded in the patient’s chart. Rises in body temperature > 37.5 °C occurring during the first 72 hours following surgery were analyzed. In addition to evaluating maternal temperature, length of hospitalization, and antibiotic administration for both mother and the newborn were also recorded. To ensure an adequate evaluation of the other predictive variables, we only considered maternal hyperthermia after the 12-hour clinical onset of analgesia. Data regarding infection conditions was added. For analytical purposes, maternal fever was sorted as maternity fever. Postpartum pelvic infection is one of the most common diseases related to C-section. (Golandaj et al.2024)

**5.2. Maternal Satisfaction**

Maternal satisfaction with the process and outcome of her delivery is one of the key indicators for the evaluation of services. The factors that influence maternal satisfaction during a caesarean section are not completely clear. The methods of general anesthesia and regional anesthesia, as well as additional non-pharmacological methods, have been evaluated with controversial statistical data. Despite numerous conflicting studies, regional anesthesia is still the "gold standard" for elective and emergency caesarean sections and is recommended by leading guidelines. Maternal satisfaction with the chosen method of anesthesia is only one of the criteria for evaluating methods, but it plays an important role in the process and outcome of the delivery. It should be stated that the psychological state of a woman at the time of a caesarean section is multi-faceted and concerns her experiences and fears. (Choi, 2022)

It causes prerequisites of pain, fear of the process, fear for the baby, insomnia, worries about psychosocial adaptation, separation from the newborn, the fetal margin, and concern about the surgical interference itself. It is not always possible to prevent adverse maternal and fetal effects completely, but qualified obstetric care, readiness of the multidisciplinary team, and the choice of optimal method of anesthesia and management strategy together can reduce psychological trauma to the expectant mother. Attention should be paid to the assessment of maternal satisfaction as one of the components of postpartum follow-up. Currently, the choice of methods of anesthesia for a caesarean section takes into account not only the well-studied classic clear obstetric criteria – the safety of the method selected for the pregnant woman and the fetus, but also the opinion of the pregnant woman, anesthetic risk, the availability of high-tech regional methods of anesthesia, and the possibility of using modern anti-stress and additional non-pharmacological methods. (Escobal et al.2021)



## **6. Fetal and Neonatal Outcomes**

Regional anesthesia affects the fetus in several ways, including maternal hypotension and reduced uterine blood flow. This might influence the likelihood of delivery for fetal distress, fetal well-being, and the Apgar scores being less than 7 after 5 minutes. This part describes the fetal and neonatal outcomes.

### **Chosen Modalities of Anesthesia**

Nowadays, most Caesarean sections are performed under either spinal or epidural anesthesia or combined spinal-epidural anesthesia. Other modalities of regional anesthesia are less used but also prevail over general anesthesia in elective cases. This might already influence the results.

### **Study Populations and Definitions**

The studies involved pregnant women who were scheduled for elective Caesarean section for singleton pregnancies in cephalic presentation, and healthy full-term elective Caesarean section singletons were our study populations.

### **General Fetal and Neonatal Outcomes**

Most authors do address fetal and neonatal outcomes, simply because this is the real purpose of a human Caesarean section. What is striking is that there are only a few studies that describe neonatal well-being in the first minutes of life. This is difficult to understand in the context of comparing the outcomes of general anesthesia and regional anesthesia, together with an implicit understanding that in cases of non-legal anesthesia (and in most situations), the first assistance after birth will be given to the baby. (Sharp et al.2021)

### **6.1. Impact on Neonatal Apgar Scores**

Under general anesthesia, a single high-pitched scream and a flushed, brisk, tangible response is the best a newborn does at one minute. However, the results related to neonatal Apgar scores at 1, 5, or 10 minutes have been contradictory, with most studies showing no significant difference. Three trials found no statistical difference, and one trial reported the Apgar score to be significantly lower in the regional anesthesia group. It has been demonstrated that a number of factors are significant in influencing the Apgar score, such as inter-observer variability, maternal height, maternal age, sex of the newborn, and maternal medical condition. In one trial, the Apgar scores of the general anesthesia group were significantly poorer than in the regional anesthesia group, and this was considered to be the effect of the types of anesthetic used. Pulmonary ventilatory stimulation provided by early fetal exposure to adrenaline and adenosine may be less efficient with rapid desaturation due to the poor tolerance of acidosis *in vivo*. (Аббуд et al.2024)

Exploration of these differences is limited by the power of the current study size, confusion in defining the exact phase of resuscitation at which the Apgar score should be recorded, lack of a standard definition of fetal acidosis at birth, and also limited due to the continued presence of a significant number of antenatal deaths. In addition, it has been argued previously that neonatal morbidity has been proposed to be a better measure of neonatal well-being rather than 1 and 5 minute Apgar scores.

### **6.2. Neonatal Respiratory Distress**

Other factors such as neonatal respiratory distress are assessed from the neonatal point of view. This distress is an important cause of admission in neonatal intensive care. It requires polyvalent therapy often associated with complications that will be the cause of morbidity and mortality. Its frequency varies from 1 to 10% of the newborns, and from 3 to 5%. A rate of 16% has been found. This difference in rate could be justified by the inclusion criteria of each study, i.e., only newborns from mothers who received general anesthesia. A rate of 38% was found for newborns from parturients who underwent general anesthesia, compared to 7.1% for newborns from parturients who underwent subarachnoid anesthesia for the same indication. The difference between these two groups is significant, as is the difference with the control group. This difference in rate suggests that neonatal respiratory distress is more linked to the type of anesthesia received by the mother than to the duration of labor. (Debrabandere et al.2021)

## **7. Anesthetic Considerations**

General anesthesia is the method of choice for performing caesarean sections in patients with acute or eclamptic hypertension because the administration of regional anesthesia can prolong the procedure. Regional anesthesia should be reserved for patients with stable gestational hypertension in the absence of a platelet count below 100,000/mm<sup>3</sup> because, although its administration does not increase the risk of headache compared to healthy patients, it can cause hypotension, pelvic pain, and intrathecal hematoma during puncture. On the other hand, it is contraindicated even in cases of chronic hypertension due to the risk of severe exacerbation. Preoperative assessment of gestational hypertension should be no different from assessing any other parturient, except that preeclampsia should be ruled out. Ideally, patients with severe defined gestational hypertension should be managed in a critical care area. Blood pressures should

be checked at least every 15 to 30 minutes, and intravenous access should be secured. Infusion of small amounts of mLRS and/or colloids with an isotonic intravenous solution to achieve hemodynamic balance is indicated. Blood gases, serum electrolytes, and a cardiograph should be performed. Hematocrit and platelet count should be requested. (Antończyk & Ochota, 2022)

### **7.1. Preoperative Assessment**

Preoperative assessment includes obtaining a complete obstetric and anesthesia history. The patient will be assessed for symptoms or signs of preeclampsia such as high blood pressure, proteinuria, lower extremity edema, headache, upper abdominal pain, visual defects, and central nervous system disturbance. Hypertension should be confirmed in at least two measurements 4 hours apart. Proteinuria should be confirmed by either 24-hour urine collection, the presence of urinary protein with a urinary dipstick, or urinalysis revealing a protein to creatinine ratio of 0.3 or greater. In severely preeclamptic women with severe symptoms, especially with HELLP syndrome and eclampsia, cesarean section is necessary to stabilize the condition and prevent further deterioration. (Bao et al.2022)

Patients are assessed for anemia, thrombocytopenia, neutropenia, and coagulopathy depending on symptoms, signs, and blood investigations. Urine and blood investigations are requested to establish a diagnosis and assess for ongoing maternal and fetal well-being. Preoperative coagulation profile should only be performed in preeclamptic patients if the symptoms of bleeding are present or if the platelet count was checked by the time of booking and found to be low. The request should be marked 'for cesarean section due to preeclampsia.' Patients diagnosed with preeclampsia should be investigated for possible multisystem involvement such as oliguria that might mandate invasive central and arterial monitoring.

### **7.2. Intraoperative Management**

During regional anaesthesia, patients are awake and do not have endotracheal tube. When the mother is shown the neonate, the surgeon carries out its procedure and disconnects the umbilical cord from the placenta. As an advantage of regional anaesthesia, there is no need for neuromuscular blocking drugs or their reversal agents. However, in some cases, the surgeon may need a general anesthetic to carry out the surgery. Although this situation is very rare, it has a lot of importance during surgical planning. Although there is no evidence of an interaction between regional anesthetics and the signal transduction mechanisms of the cells, it is known that the decision receives many transmitters in the mammalian central nervous system. However, other unknown subliminal response mechanisms may also play a role. The mediators of these responses are interwoven into the common cell membrane of the cell through negative and positive feedback channels and receptors. Recent studies have shown that volatile anesthetic agents directly inhibit the inositol triphosphate receptors of both the endoplasmic reticulum and the cytosapping actions from the outside of the plasma membrane of central neurons and the cells that release to the uterus during pregnancy.

## **8. Postoperative Care**

A written handover from the anesthesia team to the next shift is essential, as well as a postoperative visit to the patient by a member of the anesthesia team, in order to assess her pain adequately and treat any pain or complications according to the standards of the unit. A plan for the patient and neonate, including who will have the care of the neonate, should be made at the start of the case in order to reduce anxiety for all parties and prevent confusion at delivery. Each patient should have her own individual postoperative regimen, including pertinent orders for the nursery and neonate, and the patient and family should be made aware and understand the recommendations. The initial period following anesthesia for an operative delivery is important and involves monitoring both mother and neonate. The mother should recover from the effects of surgery and anesthesia prior to undertaking feeding and handling the newborn. She should be monitored closely by skilled and efficient staff, and help should be available at all times. The staff must be aware of the optimal way to treat the potential adverse effects of the anesthetic or operative anesthesia. The neonate should be given due attention in order to establish physiological stability, and thermoregulation should be swiftly restored. The neonate should be handled in such a way as to promote both maternal and paternal bonding, without increasing the neonate's stress. The period of time from a cesarean section to full recovery decreases maternal anxiety and agitation postpartum, and this in turn reduces the potential for negative impacts on both mother and neonate. (Li et al.2023)

### **8.1. Pain Management Strategies**

Enhanced recovery after cesarean section represents an evolving field. The use of multimodal analgesics, including paracetamol and nonsteroidal anti-inflammatory drugs, can also have significant benefits while reducing opioid requirements. The use of spinal rather than general anesthesia for elective cesarean section also provides significant potential for improved recovery through avoidance of the risks of airway trauma

and oversedation, as well as earlier maternal-baby bonding and reduced neonatal respiratory depression. Cellular and hormonal stress reduction from surgical injury, recognized with reduced analgesic requirements, also plays a role and is an added therapeutic consideration for the woman's immediate emotional recovery and long-term post-traumatic stress.

Opioids are the mainstay of postoperative analgesia following surgery, including cesarean delivery. However, healthcare providers are becoming increasingly aware of the growing opioid epidemic and the potential risks for both the patient and the fetus. Enhanced recovery programs across different surgical disciplines aim to significantly reduce opioid consumption and its side effects. Avoiding general anesthesia, the main source of the adverse risk profile of cesarean delivery, could hence significantly contribute to enhanced recovery after cesarean delivery. Furthermore, the confluence of the many physiological changes relevant to the operation and the potential for significant intraoperative edema makes airway management more difficult compared to the non-pregnant patient.

### **8.2. Recovery and Discharge Criteria**

Following a successful spinal or epidural anaesthetic, two-thirds of women can usually be safely transferred to the general ward at 2 hours postoperative. Following an epidural local anesthetic low-dose opioid infusion, it is usual to wait until the infusion is stopped before discharging the patient to the ward or care area. Many women experience acute shivering following regional anaesthesia, and this may persist for an hour or so; consequently, once transferred to the ward, it is common to cover the patient with a warm blanket. Ambulation is only permitted once the patient is able to walk without difficulty (usually 6 hours following hypotension). Patients usually complain of acute pain in the surgical area approximately 72 hours following their caesarean section, and it is usual to have some form of supplemental analgesia therapy available before this acute pain arises. Many women reported a headache following their regional anaesthetic, although it is rare for a headache to persist for more than two days. With the exception of regional block surgical anaesthesia, a urinary catheter is usually in situ for up to 12 hours following the anaesthetic.(Sun et al.2020)

### **9. Ethical and Legal Considerations**

Ethical and legal aspects of care are important. It is understandable that the proportion of anesthesia techniques should vary depending on the country. Legal regulations, care standards, and accessibility to healthcare contribute to a more homogeneous pattern. From an ethical point of view, another important consideration is the issue of freedom of choice for pregnant women, especially if they are in a position to choose. Delimiting the role of those who can intervene is important. For example, in some countries, anesthesia cannot be safely administered by non-anesthesiologist doctors, and if the freedom of choice is complete, too much importance may be attached to patient autonomy, which may conflict with the principles of beneficence and non-maleficence. Care efficiencies and techniques valid from some perspectives may not be acceptable from an ethical point of view.

In conclusion, regional anesthesia for cesarean sections has advantages over general anesthesia. As a point of care, it is important to investigate cases in countries where it is used at a lower rate, and the reasons for this will probably vary from one context to another. Other sources of variance may be definitional. Information also has to be provided about the frequency of shared decision-making to understand if the lower frequency of choice of regional anesthesia may require more significant intervention. Policies supporting access to all safe surgical techniques have to be developed, and decision-makers have to offer citizens and pregnant women the choice referred to in possible conditions of non-directive counseling.

### **10. Future Directions in Research**

First, we need to fortify the research infrastructure; we need to strengthen rural health centers and recruit research nurses as data collectors to notify the investigator when a patient is eligible for inclusion in the study. A suitable computer system would be useful in collecting data. Researchers forming a team with experts in the field and quality control should plan the protocol and should have proper training and preparation before initiating the study. Financial and psychological support from responsible personnel is beneficial for hardworking field researchers. Also, patient involvement in determining relevant and feasible outcomes will help to develop a study. Providing motivation, continuous support, and proper equipment for engaged staff bears equal importance. Enthusiastic clinical attention plays a vital role. Finally, understanding the limitations of their research when dealing with pregnant women will benefit these projects. With the ideal cooperation and support of all concerned, future researchers will be able to contribute comprehensive information about these medications. (Patel et al.2023)

## 11. Conclusion

In conclusion, maternal general anesthesia for cesarean section is associated with an increased risk of several adverse outcomes, including failure of intubation requiring emergency intraoperative conversion to regional anesthesia, difficult laryngoscopy, risk of hypoxia, assisted airway maneuvers, and emergency surgical airway. The incidence of hypotension necessitating intravenous vasopressor administration is commonly associated with a maternal risk of prolonged hypotension and category II emergency delivery. Besides, with general anesthesia, a significantly higher number of boluses of ephedrine were administered, which is again associated with adverse maternal and fetal outcomes. Fetal outcomes, which are associated with secondary limitations, are lower Apgar scores, increased incidence of resuscitative interventions, and lower blood pH. To improve maternal and fetal outcomes, the individual risk of maternal aspiration syndrome and the presence of a difficult airway should be assessed to consider general anesthesia, while low-dose spinal combination opioid anesthesia and spinal-local anesthesia and open cavity at a small incision of the uterus should be the standard of care, especially in obese parturients, for cesarean delivery. Often, to avoid conversion from regional anesthesia to general anesthesia in emergencies, and in obese pregnant women as well, potassium-sparing muscle relaxants should be considered.

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