



Elective Cesarean Section under General Anesthesia Experience in more than 5,000 Patients at Melinda Women Hospital Bandung-Indonesia

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Abstract

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BACKGROUND: Despite the safe nature of the procedure, cesarean section (CS) is still associated with higher maternal mortality and morbidity rates. CS can be performed under spinal, epidural, combined spinal and epidural, or general anesthesia. The choice of anesthesia for CS is still a matter of debate due to its side effects on mothers and neonates. Success in the selection of anesthesia in CS is seen in maternal and neonatal outcomes, where the Apgar score is used for assessing neonates in the first and fifth minutes.

AIM: This study aimed to determine the effect of general anesthesia in cesarean section as measured by Apgar score.

SUBJECT AND METHODS: This was a cross-sectional analytical retrospective study on a total sample of 7,131 patients who underwent elective cesarean section under general anesthesia during 18 years (July 2004–June 2022) at Melinda Women Hospital Bandung Indonesia. In this study, data from medical records were used to analyze neonatal and maternal outcomes.

RESULTS: Of the 7,131 CS under general anesthesia cases, no maternal death or difficult ventilation was found; however, the incidence of postoperative nausea and vomiting (PONV) (15), difficult intubation (6), hypotension (5), and need for blood transfusion (5), and postoperative analgesia (all cases) were observed in the mothers. In neonates, neonatal death caused by IUFD and severe congenital disease (3), and a mean neonatal Apgar score of 9 and 10 at 1 and 5 min were identified.

CONCLUSION: No low Apgar score is found as the effect of general anesthesia in cesarean section.

Introduction

Although the procedure has become very safe, Cesarean section (CS) is still associated with higher maternal mortality and morbidity rates. The risk of maternal death with CS is four times higher than the risk associated with all types of vaginal delivery. Furthermore, a greater risk of neonatal respiratory distress is also observed in CS when compared to vaginal delivery, regardless of the gestational age. Regional and general anesthesia is commonly used for the Cesarean section with their respective advantages and disadvantages.

Cesarean section is used to deliver babies in an estimated 15% of all births globally, where 40% of them are performed in developing countries. In an analysis performed by the National Sentinel Cesarean Section Audit on data from 99% of total births in England and Wales during 2001, 32,222 of 150,139 deliveries were done through a cesarean section [1]. Compared to vaginal delivery, the maternal mortality rate associated with the CS procedure is ten times higher, where some of the deaths are linked to anesthesia. The common

causes of anesthesia-related deaths during the cesarean section are intubation failure, gastric content aspiration, and incorrect intubation into the esophagus [2].

Using the national statistics of the United States between 1985 and 1990, Hawkins *et al.* reported in 1997 that the mortality rate of cesarean section under general anesthesia was 16.7 times higher than that of regional anesthesia. Recently, the same group evaluated data from 1997 to 2002, and demonstrated that the risk of general anesthesia has decreased 1.7-fold, and differences in anesthetic method selected are shown to no longer influence the mortality rate [3].

Pregnant women undergo remarkable changes during pregnancy, labor, and the immediate postpartum period, i.e., changes in body weight, blood volume, cardiovascular, respiratory, renal, gastrointestinal, central and peripheral nervous, musculoskeletal, dermatological, mammary, ocular system, all of which will directly affect the anesthetic technique selected. Another factor that will also influence the selection of the anesthetic technique is uteroplacental blood flow which depends on uterine arterial pressure, uterine venous pressure, and uterine vascular resistance [1], [4].

It is still not well established yet which anesthetic technique is better for CS, and an ongoing debate on whether to use general anesthesia or regional anesthesia still ensues. A report by ASA Task Force on Obstetric Anesthesia on decisions to use a particular anesthetic technique stated that the choice of anesthetic technique should be individualized based on several factors such as the anesthetic, obstetric/or fetal risk factors (e.g., elective versus emergency), and the preference of the patient and the anesthesiologist. The technique that can be used in CS are general, spinal, epidural, or combined spinal-epidural anesthesia [5].

A Cochrane Database Systematic Reviews in 2006 suggested that regional anesthesia (RA) and general anesthesia (GA) are commonly used for cesarean section (CS) and both have their own advantages and disadvantages. Sixteen studies on a total of 1,586 women are included in this review. The conclusion made is that there is no evidence to show that RA is superior to GA in terms of major maternal or neonatal outcomes [6].

A study on the effect spinal (SA) and general anesthesia (GA) on Apgar score in neonates delivered through an elective C-section concluded that no significant difference is seen between the effect of GA and SA on the neonatal Apgar score at 5 min after birth [7]. In contrast, a prospective cohort study in Gandhi Memorial Hospital Adis Ababa has concluded that SA is associated with a high incidence of post-operative nausea and vomiting (PONV) and hypotension, but the 1st min Apgar score and first-time analgesic requests are better in SA. General anesthesia is associated with high estimated blood loss, shorter time to first analgesic, and lower first-minute Apgar score [8].

A previous study was also performed on the maternal and neonatal outcomes after spinal versus general anesthesia for cesarean delivery. It is demonstrated that SA is a better form of anesthesia in CS than GA since it is associated with shorter hospital stay, greater maternal satisfaction, and better Apgar score [9]. Another study on the comparison of Apgar scores in neonates delivered through cesarean section under spinal versus general anesthesia has also concluded that the Apgar scores at 1 and 5 min after delivery of ≥ 7 are 96.66% and 100% in the SA group, respectively, while the scores for the GA group are 73.33% and 93.33%, respectively. Thus, the Apgar scores are better in neonates who are delivered through CS under spinal anesthesia [10], while another publication compared the effect of general and spinal anesthesia on the Apgar score of the neonates in patients undergoing elective cesarean section and concluded that neonates of women have a higher Apgar score when they are delivered through CS under SA [11].

With the ongoing debate on whether SA or GA is the better technique for CS, this study sought to contribute knowledge by collecting data from all patients who underwent CS from 2004 to 2021 at the Melinda

Mother and Child Hospital Bandung, Indonesia, and analyzing the differences in the neonatal Apgar Score of infants born through CS under general anesthesia.

Subjects and Methods

This cross-sectional study applied the retrospective descriptive method to determine the effect of general anesthesia on neonatal Apgar scores. Subjects were all cases of elective cesarean section performed under general anesthesia at Melinda Women and Child Hospital Bandung, Indonesia, during a 18-year period from July 2004 to June 2021. Data used for the analysis were secondary data from patients' medical records. The inclusion criteria in this study were singleton pregnancy, healthy mother, and healthy fetus, while the exclusion criteria were twin pregnancy. The sample size of this study was 7,131 people, and ethical approval for this research was obtained from the hospital under the ethical clearance number 001/SKEP/KM/RSIAM/XI/2022. Permission to collect data from medical reports was also given by the hospital.

In Melinda Women and Child hospital, the anesthesiology procedure for cesarean section starts with the anesthesiologist's visit one day before the surgery to examine and explain the anesthetic technique to be used to the woman. For patients undergoing general anesthesia, the technique applies follows this procedure: after installing blood pressure, ECG, and SpO₂ monitor, induction of anesthesia is performed with propofol 2 mg/kg body weight. Atracurium of 0.5 mg/kg body weight is also provided, and ventilation using O₂/air with the target of normoventilation as monitored using capnograph monitor) is performed. Sevoflurane or isoflurane is provided and analgesia with 1.5 ug/kg fentanyl is given after delivery of the baby. For postoperative nausea and vomiting (PONV) prevention, 10 mg of dexamethasone is provided before intubation and 8 mg of ondansetron is given after birth. Fifteen minutes before the end of anesthesia, 50 mg of ketoprofen is provided to the patient. The criteria applied for assessing the difficulty level in intubation and ventilation are as defined ASA, and hypotension is defined as a blood pressure of <20% from base line. The measured parameters assessed in this study were maternal death, maternal blood transfusion, difficult intubation, difficult ventilation, hypotension, need for postoperative analgesia, and incidence of PONV.

Results

The results of this study are presented in total cases per year for 18 years, maternal outcomes in

Table 1: Neonatal outcomes

Parameters	
Neonatal death	3 (IUFD and severe congenital disease)
Apgar score ≤ 4 one and 5 min	0
Apgar score ≤ 6 one and 5 min	0
Mean neonatal Apgar score at 1 and 5 min.	9, 10

IUFD: Intrauterine fetal death

Table 1, and neonatal outcomes in Table 2. The total data of patients are shown in Table 3.

Table 2: Total number of patients undergo cesarean section under general anesthesia in a period of 18 years (2004–2021)

Year	Number of Caesarean Sections under General Anesthesia
2004	162
2005	457
2006	152
2007	522
2008	463
2009	481
2010	473
2011	547
2012	509
2013	460
2014	441
2015	380
2016	384
2017	368
2018	373
2019	297
2020	376
2021	286
Total number of cases	7,131

The parameters recorded were maternal death, maternal blood transfusion, difficult intubation, difficult ventilation, hypotension, need for postoperative analgesia, and incidence of PONV.

Table 3: Maternal outcomes

Parameters	
Maternal death	0
Maternal blood transfusion	5
Difficult intubation	6
Difficult ventilation	0
Hypotension	5
Need for postoperative analgesia	All
Incidence PONV	15

PONV: Postoperative nausea and vomiting

Discussion

Anesthesia for cesarean section is mostly performed under spinal anesthesia, with epidural anesthesia being the next option. These are followed by spinal-epidural combination anesthesia and general anesthesia as the least common technique for CS [4], [5], [12].

Among the reasons why spinal anesthesia becomes the first option for CS are simpler technique, speed of induction, reliability, minimum fetal exposure to the drugs, an awake parturient, and minimal aspiration hazard. However, there are disadvantages, such as a high incidence of hypotension, intrapartum nausea and vomiting, and possible headache after dural function associated with this technique. The duration of action of the spinal anesthesia is also minimum, unless it is provided continuously [5], [13], [14].

Speed of induction, reliability, reproducibility, controllability, and avoidance of hypotension is considered to be the strength of general anesthesia in CS. However, this is not without any weaknesses, as there are possibilities of maternal aspiration, problems of airway management, narcotization of the newborn, and maternal awareness during light anesthesia [5], [13], [14].

Previous data have stated that the mortality rate of cesarean section general anesthesia is higher due to the frailties in airway management. Anesthesia in cesarean section is based on the principle of the A (airway), B (breathing), C (circulation), D (drugs), and E (environment) as the mnemonic of anesthesia principle. To have successful airway management, complete preparation of the tools to free the airway must be ensured, such as the provision of the direct laryngoscope, stylet mandarin, bougie, and video laryngoscope. In addition, prediction of the difficult airway should be made through the implementation of complete airway preoperative examinations such as the Mallampati test, thyromental distance, open mouth, neck circle, and body mass index (BMI) to prevent complications during the procedure [2], [15], [16], [17], [18].

Adequate UBF is ensured by calculating it using the formula of $UBF = UAP - UVP$ divided by UVR (UBF = Uterine blood flow; UAP = Uterine arterial pressure; UVP = Uterine venous pressure; UVR = Uterine vascular resistance). When these three factors are well regulated, adequate UBF can be expected. A previous observation on thousands of cases, only a few cases experienced hypotension due to massive bleeding, with placenta accreta and uterine atony as the primary causes. In cases with uterine atony, the first line of uterotonic (oxytocin) is given as the first measure to manage the condition. When it is not successful, a succession of actions is given, starting from the provision of the second line uterotonic (ergometrine), third line (misoprostol), to Lynch-B suture. When all fail, a hysterectomy is performed as the last resort [4], [5], [12], [19].

After the baby is born, the mother is routinely given oxytocin and ergometrine and has her uterine contractions assessed using a linear analog scale (LAS) with a range of 0–10, with 0 being no contractions and 10 being very strong contractions. The anesthetic inhalation used is sevoflurane or isoflurane, which has the least relaxing effect on the uterus [13], [20], [21], [22].

The Apgar scores are influenced by various factors, including the baby's condition before cesarean section and uteroplacental blood flow. As long as the uteroplacental blood flow is adequate and hypoxemia does not occur, it is assumed that the oxygen supply to the fetus is adequate with no anesthetic effect on the fetus. The effect of the anesthetics penetration through the uteroplacental barrier is very small [4], [5], [12], [21].

Conclusion

In these groups of newborns delivered through cesarean section under anesthesia, no difference is seen in the Apgar scores between those who received general anesthesia and spinal anesthesia. An in-depth understanding of the physiology and pharmacology of pregnant women is necessary to improve the skill in providing general anesthesia for cesarean section, which, when combined with good preparation, will lead to the absence of intubation failures.

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