



Evaluation of changes in anesthetic methods for cesarean delivery: an analysis for 5 years using the big data of the Korean Health Insurance Review and Assessment Service

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Background: As an anesthesia induced during cesarean section, spinal anesthesia is preferred over general and epidural anesthesia. This study aimed to review the trend of anesthetic methods for cesarean section based on data obtained from the Korean Health Insurance Review and Assessment Service from 2013 to 2018.

Methods: The anesthetic methods were analyzed in 753,285 parturients who underwent a cesarean section in Korea from 2013 to 2018. We determined the association between each anesthetic method and hospital type and maternal and fetal factors. We also evaluated whether the anesthetic method was associated with the parturients' length of hospital stay.

Results: General anesthesia, spinal anesthesia, and epidural anesthesia were induced in 28.8%, 47.7%, and 23.6% of parturients from 2013 to 2018, respectively. Trend analyses showed that spinal anesthesia increased from 40.0% in 2013 to 53.7% in 2018. The opposite trend applied to general anesthesia, decreasing from 37.1% in 2013 to 22.2% in 2018. The factors that were significantly associated with the anesthetic method were parturient's parity, emergency condition, gestational age, and fetal weight. The type of hospital, parturient's age, and multiple birth were also associated with the anesthetic methods. There was a strong association between general anesthesia and hospital stay longer than 7 days.

Conclusions: Spinal anesthesia is currently the main anesthetic method used for cesarean delivery, and the rate of spinal anesthesia is gradually increasing in Korea.

Keywords: Anesthesia, epidural; Anesthesia, general; Anesthesia, spinal; Cesarean section.

INTRODUCTION

In South Korea, the rate of delivery through cesarean section reached 42.3% in 2018 [1]. The most suitable anesthesia must be induced when cesarean section is per-

formed as it may affect the potential complications for parturients and the fetus and the postoperative satisfaction. General anesthesia induced during cesarean section may result in difficulties in managing parturients' airway, and intravenous or inhalation anesthetics may affect the fetus.

Moreover, considering that general anesthesia increases wound infection and results in deep vein thrombosis and anesthesia-related complications, this type of anesthesia is generally avoided [2].

Although the anesthetic method should be selected according to the condition and requirement of each parturient, recently, induction of regional anesthesia when performing cesarean sections has been recommended considering the above mentioned reasons, unless any particular contraindications are evident. Therefore, the majority of cesarean sections are currently being performed under regional anesthesia. The use of general anesthesia has decreased significantly; it has been reported that only 3–4% of elective cesarean sections and 14–19% of emergency cesarean sections in the United States were performed under general anesthesia in 2011 [3]. In Germany, regional anesthesia is used most predominantly, with spinal anesthesia accounting for 90.8% of cases [4]. Spinal anesthesia can provide faster reaction time compared to epidural anesthesia, and it conveniently predicts the dermatomal level of sensory block [5].

The rate of inducing regional anesthesia has recently increased in South Korea, but there are no accurate statistics on the status of regional anesthesia used for cesarean sections. This study aimed to examine the current status and changes in the recent trends of anesthesia used in cesarean sections in South Korea through the data claimed from the Korea Health Insurance Review and Assessment Service (HIRA) from July 2013 to June 2018. This study also investigated the factors associated with the choice of anesthesia by analyzing other diagnostic codes included during the hospitalization of parturients who delivered via cesarean section and the information of the hospital that performed the operations.

MATERIALS AND METHODS

Data sources and subjects

This study was approved by the Institutional Review Board (no. 2019-10-009) and was analyzed using the parturients' data claimed from the HIRA. The HIRA of Korea is a national health insurance agency that contains all the information on cesarean sections performed in Korea, as it covers every citizen, including Koreans, and a portion of foreigners who resided in Korea for extended periods. Cesarean section is one of the seven disease groups charged by the Diagnosis Related Group (DRG) since July 2013. All

institutions have been claiming the DRG. The HIRA includes the International Classification of Diseases, 10th edition, Clinical Modification-based diagnostic code and the Korean Diagnosis Related Group 3.5 (KDRG 3.5)-based DRG code. Moreover, the definition of a cesarean section patient was based on the hospitalization charged by the KDRG code O016-O017. We searched for and reviewed the parturients with the code corresponding to the cesarean section from the HIRA data from July 2013 to June 2018.

Medical utilization and resource of big data

There were a total of 795,369 cesarean sections performed from July 2013 to June 2018, but 2,409 cases without detailed medical examination summaries and 39,675 cases without anesthetic method records were excluded (Fig. 1). The diagnosis and treatment codes of the parturients were assessed to identify the anesthetic methods, the need for emergency cesarean sections, parity, and the presence of multiple fetuses. The anesthetic method was divided into general anesthesia (L1211, L1221), spinal anesthesia (L1213, L1223), and epidural anesthesia (L1214, L1224). It was defined by searching for the anesthetic procedure code. Whether or not the emergency operation was defined as the case of the appearance of the O821 code in the diagnostic code of each hospitalization, the routine operation was defined as the case of the appearance of the O820 code. The multiple fetuses was defined as the case of the appearance of R4519 and R4520 in the code. The single fetus was defined as the case of appearance of R4517, R4518, and R4514. Gestational age was divided into a specific classification code (JT005, MT006), indicating the number of gestational weeks. It was divided into 22 weeks or less, 23–34 weeks, 35–36 weeks, and more than 37 weeks. Fetal weight was separated in the case of a specific classification code (MS004), indicating the newborn weight, and was categorized to less than 1,500 g, 1,500–2,499 g, and 2,500 g or more. The hospitalization period was divided using the number of hospitalization days of the specification. Each subsection was categorized into groups, and data were presented by number of parturients in each group. All parturients remained anonymous.

Additionally, the size and location of the hospitals where the cesarean sections were performed were also classified. The sizes of the hospitals were classified according to the Korean Medical Care Act. Hospitals with more than 30 beds were classified as hospitals, hospitals with less than

30 beds as clinics, hospitals with more than 100 beds and more than seven medical departments as general hospitals, and hospitals with more than 20 medical departments as tertiary care hospitals. Regional classifications were based on areas of submitted claims and included the following divisions: Seoul capital area, Gyeongsang, Jeolla, Chungcheong, Gangwon, and Jeju.

Statistical analysis

Statistical Analysis System (SAS) version 9.4 (SAS Institute, Inc., USA) was used for the statistics of the data preprocessing, and Statistical Package for the Social Sciences (SPSS) version 12.0 (SPSS Inc., USA) was used for the statistical analyses of the processed results. Each subsection was categorized, and all patients' baseline characteristics are expressed as numbers with percentages. The odds ratios were calculated using the Pearson's chi-squared test to analyze the independence of variables (region, hospital sizes, parturients' age, parity, gestational age, fetal weight, emergency condition, hospital period). Linear-by-linear association was used to determine the fluctuating trends of anesthetic methods (type of anesthesia and regional trend, hospital size, fetal weight). P values less than 0.05 were considered statistically significant.

RESULTS

Among the 753,285 cesarean sections included in this study, there were 359,106 spinal anesthesia cases (47.7%) and 177,494 epidural anesthesia cases (23.6%) that demonstrated regional anesthesia to account for a high proportion, and 216,685 cesarean sections (28.8%) were performed under general anesthesia (Fig. 1). Regarding hospi-

tal sizes, 46.1% of the total cesarean sections were performed predominantly in hospitals, followed by clinics (35.7%), general hospitals (10.1%), and tertiary care hospitals (8.2%). The most common groups that received cesarean sections was 30–34 years (47.0%), primiparas (56.9%), single fetuses (95.9%), and elective cesarean sections (55.9%). The most common gestational age of the fetus was more than 37 weeks (91.3%), and the most common weight was greater than 2,500 g (95.6%). Most parturients had a hospital stay of 4–6 days (55.8%) or 7–9 days (43.1%). The region with the highest number of cesarean sections was the Seoul capital area (49.6%) (Table 1).

Changes in the anesthetic methods by time and region

The rate of general anesthesia was observed to be steadily decreasing with time ($P < 0.001$) (Fig. 2). The decreased portion was replaced by spinal anesthesia, and 53.7% of all cesarean sections, which were more than half, were performed under spinal anesthesia in 2018 ($P < 0.001$). Additionally, the use of epidural anesthesia slightly increased, from 22.9% in 2013 to 24.1% in 2018 ($P < 0.001$). Such national trends can be further broken down and examined in detail by region and year (Table 2). In particular, the regions with low rates of general anesthesia use were Chungcheong and Seoul capital areas, and the regions with high rates of general anesthesia use were Jeju and Gyeongsang. In Jeju, the use of epidural anesthesia increased steadily, reaching 41.4% in 2018, and epidural anesthesia use also increased in Gyeongsang. The use of epidural anesthesia decreased in Seoul capital areas, but it did not appear to affect the national trend. Such regional characteristics were continuously observed, but the rate of general an-

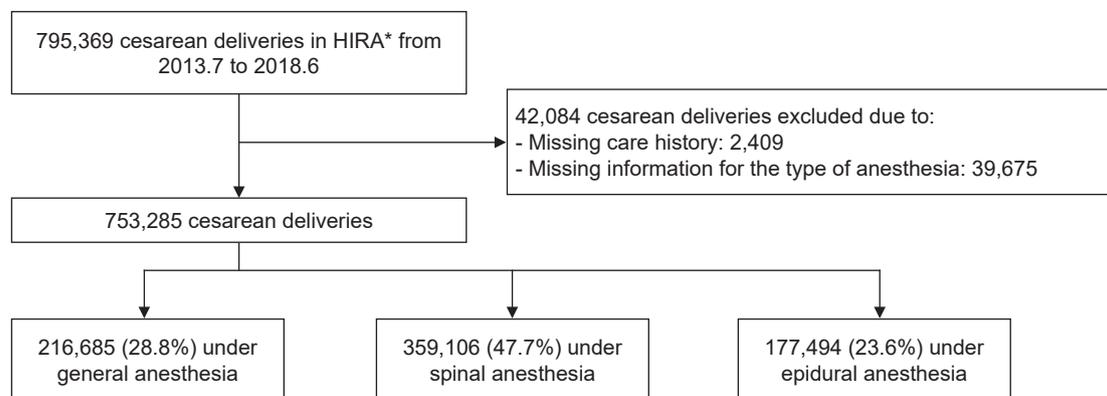


Fig. 1. Flow diagram of parturients who underwent a cesarean section. *Korean Health Insurance Review and Assessment Service.

Table 1. Basic Characteristic of Study Population

Characteristic	Value (n = 5)	
Year	2013.7~	70,562 (9.4)
	2014	151,556 (20.1)
	2015	159,276 (21.1)
	2016	155,075 (20.6)
	2017	145,356 (19.3)
	~2018.6	71,460 (9.5)
Region	Seoul capital area	373,756 (49.6)
	Gyeongsang	207,369 (27.5)
	Jeolla	61,339 (8.1)
	Chungcheoung	84,030 (11.2)
	Gangwon	17,400 (2.3)
	Jeju	9,391 (1.2)
Hospital size	Tertiary care hospital	61,692 (8.2)
	General hospital	75,950 (10.1)
	Hospital	346,892 (46.1)
	Clinic	268,751 (35.7)
Age (yr)	< 20	2,000 (0.3)
	20 – 29	171,658 (22.8)
	30 – 34	353,729 (47.0)
	35 – 39	192,577 (25.6)
	> 40	33,321 (4.4)
Parity	Primipara	419,604 (56.9)
	Multipara	318,393 (43.1)
Multiple gestation	Singleton	707,550 (95.9)
	Multiple gestation	30,447 (4.1)
Emergency state	Emergency	228,817 (44.1)
	Elective	290,191 (55.9)
Gestational age (wk)	≤ 22	1,599 (0.2)
	23–33	21,171 (3.0)
	34–36	39,212 (5.5)
	≥ 37	650,624 (91.3)
Fetal weight (g)	< 1,500	8,891 (1.2)
	1,500–2,499	45,734 (6.2)
	≥ 2,500	687,995 (95.6)
Hospital stay (d)	≤ 3	2,005 (0.3)
	4–6	420,269 (55.8)
	7–9	324,493 (43.1)
	≥ 10	6,518 (0.9)

Values are expressed as number of parturients (%). When calculating the percentage of each category, the missing data were excluded from the evaluation. Data are obtained from the Korean Health Insurance Review and Assessment Service, 2013–2018.

esthesia is decreasing in all regions (Table 2).

Hospital sizes

We found that the anesthetic methods for cesarean sections were associated with differences in hospital size ($P < 0.001$). The rate of general anesthesia was highest in tertiary hospi-

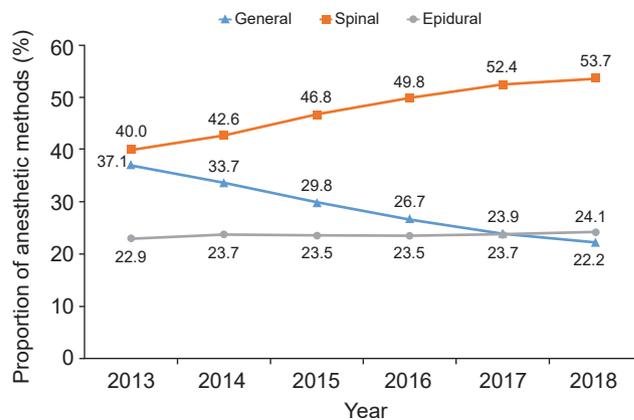


Fig. 2. Trends in anesthetic methods of cesarean sections in the Korean Health Insurance Review and Assessment Service, 2013–2018. Values are expressed as percentages for each year. It shows a pattern of decrease in general anesthesia and an increase in spinal and epidural anesthesia over time ($P < 0.001$). Linear-by-linear association test was used for trend analysis.

tals, and the percentage of general anesthesia decreased with smaller hospital sizes ($P < 0.001$). Epidural anesthesia was most frequently induced at the hospital level (Table 3).

Maternal factors

The parturient's age ($P < 0.001$) and parity ($P < 0.001$) were also associated with the choice of anesthetic methods. Cesarean section was most common in the 30–34 year-old age group, and majority of the anesthesia induced in this age group was regional anesthesia (Tables 1, 3). In particular, spinal anesthesia accounted for the highest percentage (47.6%). For parturients aged less than 20 years, the use of general anesthesia was 40.4%, accounting for the most commonly used method among the three anesthetic methods. Multiparas received more spinal anesthesia compared to primiparas (44.1% vs. 52.2%, $P < 0.001$) (Table 3).

Fetal factors

In the multiple fetuses, the use of epidural anesthesia decreased, and the use of general anesthesia and spinal anesthesia increased (Table 3). There were significant differences in the choices for the types of anesthesia according to fetal gestational age ($P < 0.001$). Regarding the selected anesthetic methods, general anesthesia was mostly preferred in 22–33 weeks (54.9%), and epidural anesthesia was the least preferred (4.4%) (Table 3). If the gestational age was higher or lower than 22–33 weeks, a biphasic pattern of decrease in the rate of general anesthesia and an in-

Table 2. Temporal Changes in Anesthetic Methods for Cesarean Sections in Each Region of Korea

Region		Year					
		2013	2014	2015	2016	2017	2018
Seoul capital area	General	28.9	26.9	24.1	20.5	18.0	16.4
	Spinal	40.9	43.3	46.9	50.1	53.6	55.4
	Epidural	30.2	29.7	29.1	29.4	28.4	28.2
Gyeongsang	General	54.6	48.7	42.6	39.8	36.6	33.8
	Spinal	28.2	31.6	37.9	41.1	42.8	44.3
	Epidural	17.3	19.7	19.5	19.1	20.5	21.9
Jeolla	General	36.0	33.8	30.6	28.7	25.1	24.3
	Spinal	38.8	40.0	44.6	47.3	48.4	48.4
	Epidural	25.2	26.1	24.9	23.9	26.5	27.4
Chungcheoung	General	21.5	18.6	16.4	16.0	14.4	14.3
	Spinal	70.3	72.5	73.3	75.2	76.7	76.8
	Epidural	8.3	9.0	10.3	8.8	9.0	8.9
Gangwon	General	49.1	42.8	36.4	36.0	30.4	29.8
	Spinal	37.3	43.5	47.6	50.1	56.0	57.3
	Epidural	13.6	13.8	16.0	13.9	13.6	12.9
Jeju	General	88.0	82.2	73.1	53.2	50.2	49.2
	Spinal	11.2	13.8	17.4	16.7	14.3	9.4
	Epidural	0.8	4.0	9.5	30.1	35.5	41.4

Values are expressed as a percentage of the anesthetic methods by region and year. General anesthesia decreased in all areas ($P < 0.001$). Spinal anesthesia increased in all regions, except Jeju ($P < 0.001$). Epidural anesthesia use increased in Gyeongsang and Jeju ($P < 0.001$). Epidural anesthesia use in Seoul capital area decreased over time ($P < 0.001$). Linear-by-linear association test was used for trend analysis. Data are obtained from the Korean Health Insurance Review and Assessment Service, 2013–2018.

crease in the rate of epidural anesthesia were observed. The fetal weight was also associated with the types of anesthesia. The percentage of general anesthesia increased with smaller weight ($P < 0.001$). When the weight of the fetus was less than 1,500 g, the rate of general anesthesia was 57.4%, and even among the regional anesthetic methods, epidural anesthesia was selected the least (2.9%) (Table 3).

Emergency states

Of the total cesarean sections, the percentages of emergency and elective surgeries were 44.1% and 55.9%, respectively (Table 1). The rate of general anesthesia use increased when emergency cesarean sections were performed (odds ratio, 1.147; 95% confidence interval, 1.133–1.161; $P < 0.001$) (Table 3).

Hospitalization period

The study also confirmed the association between the anesthetic method and the length of hospital stays. Among the parturients who were hospitalized for 6 days or less, the rate of spinal anesthesia was high (51.0%). General anesthesia was associated with hospital stay longer than 7 days

(Table 3).

DISCUSSION

It is well known that inducing spinal anesthesia for cesarean sections is advantageous. Although there have been skeptical opinions about spinal anesthesia in the past, including reports of low cord pH in fetuses born from spinal anesthesia [6–8], several studies have been conducted on the treatment of post-spinal anesthesia hypotension ever since, and the complications of spinal anesthesia have gradually decreased [9]. Additionally, a previous study has identified the positive effect of administering intrathecal opioids for postoperative pain [10,11], with high satisfaction as parturients were able to ambulate faster after the operation when spinal anesthesia, rather than general anesthesia, was administered [12]. Spinal anesthesia is also more economically beneficial compared to epidural anesthesia [13]. The interval from the operating room to the skin incision was short in general anesthesia [14]. However, continuing reports stating that general anesthesia has more complications compared to regional anesthesia exist [2], and the complications related to general anesthesia have not decrease over time [9]. General anesthesia has longer

Table 3. Factors associated with Anesthetic Methods for Cesarean Section

Variable	General anesthesia (n = 216,685)	Regional anesthesia		Odds ratio (95% CI)*	P value*
		Spinal anesthesia (n = 359,106)	Epidural anesthesia (n = 177,494)		
Region					
Seoul capital area	83,817 (22.4)	180,923 (48.4)	109,016 (29.2)	Reference	Reference
Gyeongsang	88,053 (42.5)	78,549 (37.9)	40,767 (19.7)	2.553 (2.523–2.583)	< 0.001
Jeolla	18,282 (29.8)	27,406 (44.7)	15,651 (25.5)	1.469 (1.441–1.497)	< 0.001
Chungcheoung	13,975 (16.6)	62,381 (74.2)	7,674 (9.1)	0.690 (0.677–0.704)	< 0.001
Gangwon	6,453 (37.1)	8,486 (48.8)	2,461 (20.5)	2.039 (1.975–2.105)	< 0.001
Jeju	6,105 (65.0)	1,361 (14.5)	1,925 (20.5)	6.427 (6.156–6.710)	< 0.001
Hospital size[†]					
Tertiary care hospital	27,246 (44.2)	32,681 (53.0)	1,765 (2.9)	2.300 (2.259–2.342)	< 0.001
General hospital	25,833 (34.0)	41,627 (54.8)	8,490 (11.2)	1.499 (1.473–1.525)	< 0.001
Hospital	94,840 (27.3)	140,742 (40.6)	111,310 (32.1)	1.094 (1.082–1.107)	< 0.001
Clinic	68,766 (25.6)	144,056 (53.6)	55,929 (20.8)	Reference	Reference
Age (yr)					
< 20	807 (40.4)	776 (38.8)	417 (20.9)	1.745 (1.595–1.909)	< 0.001
20–29	51,367 (29.9)	78,089 (45.5)	42,202 (24.6)	1.102 (1.088–1.116)	< 0.001
30–34	98,819 (27.9)	168,275 (47.6)	86,635 (24.5)	Reference	Reference
35–39	55,281 (28.7)	95,353 (49.5)	41,943 (21.8)	1.039 (1.026–1.051)	< 0.001
> 40	10,411 (31.2)	16,613 (49.9)	6,297 (18.9)	1.172 (1.144–1.201)	< 0.001
Parity					
Primipara	124,079 (29.6)	184,912 (44.1)	110,613 (26.4)	1.068 (1.057–1.079)	< 0.001
Multipara	89,836 (28.2)	166,194 (52.2)	62,363 (19.6)	Reference	Reference
Multiple gestation					
Singleton	203,809 (28.8)	334,692 (47.3)	169,049 (23.9)	0.814 (0.795–0.834)	< 0.001
Multiple gestation	10,106 (33.2)	16,414 (53.9)	3,927 (12.9)	Reference	Reference
Emergency state					
Emergency	69,167 (30.2)	101,587 (44.4)	58,063 (25.4)	1.147 (1.133–1.161)	< 0.001
Elective	79,547 (27.4)	139,858 (48.2)	70,786 (24.4)	Reference	Reference
Gestational age (wk)					
≤ 22	787 (49.2)	419 (26.2)	393 (24.6)	2.623 (2.377–2.893)	< 0.001
23–33	11,623 (54.9)	8,611 (40.7)	937 (4.4)	3.294 (3.204–3.386)	< 0.001
34–36	13,339 (34.0)	19,834 (50.6)	6,039 (15.4)	1.395 (1.365–1.426)	< 0.001
≥ 37	175,556 (27.0)	313,111 (48.1)	161,957 (24.9)	Reference	Reference
Fetal weight (g)[†]					
< 1,500	5,099 (57.4)	3,538 (39.8)	254 (2.9)	3.497 (3.352–3.648)	< 0.001
1,500–2,499	17,778 (38.9)	22,414 (49.0)	5,542 (12.1)	1.654 (1.622–1.686)	< 0.001
≥ 2,500	191,086 (27.8)	328,042 (47.7)	168,867 (24.5)	Reference	Reference
Hospital stay (d)					
≤ 6	99,539 (23.6)	215,235 (51.0)	107,500 (25.5)	0.563 (0.557–0.569)	< 0.001
≥ 7	117,146 (35.4)	143,871 (43.5)	69,994 (21.1)	Reference	Reference

Values are expressed as the number of parturients (%). When calculating the percentage of each category, the missing data were excluded from the evaluation. CI: confidence interval. *The odds ratios of general anesthesia analyzed by the Pearson's chi-squared test, with a P value threshold of 0.05. †General anesthesia related to larger hospital size and smaller fetal weight, $P < 0.001$, determined by linear-by-linear analysis. Data are obtained from the Korean Health Insurance Review and Assessment Service, 2013–2018.

postoperative hospital stays than regional anesthesia [15].

Therefore, regional anesthesia is preferred over general anesthesia when performing cesarean section [16]. The compilation of recent statistics on anesthetic methods for cesarean section in Korea from 2013 to 2018 showed that

the rate of spinal anesthesia is steadily increasing, and the use of general anesthesia is decreasing. This may be due to the increasing preference for spinal anesthesia in terms of safety in accordance with the global trend. The area with the highest number of cesarean sections was the Seoul

capital area (49.6%), presumably due to the concentration of population in that area. Reductions in general anesthesia use were observed throughout South Korea, but the specific proportions varied by regions. This is possibly attributed to several causes, such as differences in the number of medical institutions located in each region, hospital size, parturients' characteristics, and anesthesiologists' preferences in the regions. However, it was difficult to accurately identify the exact cause of the regional differences in the choice of anesthetic methods for cesarean section.

The rate of general anesthesia increased with the size of hospitals, which was presumably due to the differences in the characteristics of the parturients' group. One tertiary care hospital reported that 91.2% of cesarean sections were performed under general anesthesia, with 71.4% of parturients in the high-risk groups, and 64.6% of cesarean sections were emergency operations [17]. A higher number of pregnant women with greater risks and parturients with existing systemic diseases were admitted to tertiary hospitals. Parturients in such conditions may be contraindicated for regional anesthesia. Furthermore, parturients are often admitted to the hospital through the emergency department in tertiary hospitals than the clinics, and the frequency of emergency cesarean sections may increase in tertiary hospitals due to several variables including sudden changes in the fetus or the parturient's condition. As the frequency of general anesthesia increases in emergency cesarean sections, such aspects are suggested to have influenced the increase in the rate of general anesthesia in large hospitals.

As general anesthesia results in higher cost and postoperative complications compared to regional anesthesia, hospitals categorized as clinics may have been reluctant to induce general anesthesia. Additionally, the potential risk for fetal suppression, which may occur during general anesthesia induction, can also be the cause for small hospitals without onsite pediatricians to avoid performing cesarean sections under general anesthesia. Considering these reasons, the proportion of parturients who were indicated to receive general anesthesia was considered to increase in larger hospitals.

Parturient's parity also influences the choice of anesthetic method. The ratio of epidural anesthesia and general anesthesia is higher in primiparas than that in multiparas. This may be due to the conversion to cesarean section in primiparas undergoing labor under the epidural analgesia. Parturients with single fetuses had a higher percentage of regional anesthesia use than parturients with multiple fe-

tuses. The percentage of general anesthesia use increased with shorter gestational age and smaller fetal weight, which may have occurred as majority of deliveries through cesarean sections before the fetus is mature are emergency cesarean sections.

Parturients who delivered via cesarean section under general anesthesia were hospitalized for longer than 7 days compared to parturients who received regional anesthesia. The association between general anesthesia and extended hospital stays is considered to be affected by both early hospitalization for high-risk obstetric care before cesarean section and by prolonged hospitalization due to complications after the cesarean section. To analyze the adverse effects related to anesthesia, the duration of postoperative hospital stay in relation to the anesthetic method can be investigated through future studies.

This study has some limitations. First, a multivariate analysis was not performed in this study. The exact association between each factor and general anesthesia is unclear. Furthermore, the reasons for choosing cesarean section or anesthetic methods could not be clearly investigated as the analysis was derived from the data claimed from the HIRA, rather than the medical records of parturients. Second, the number of cesarean sections performed annually in each hospital is also an important factor that influences the decision regarding the anesthetic method and anesthesia-related complications [18], but such data were not obtained in this study. Anesthesiologists trained to induce an obstetric anesthesia are also significantly important factors that could reduce the unnecessary induction of general anesthesia [19], but the presence or absence of the anesthesiologist at each hospital was also not confirmed in this study. Third, the association between the anesthetic method and DRG payment system was not analyzed. The entire study cohort in this study was using the DRG payment system. Therefore, further studies are required to better understand the factors affecting anesthesia induction for cesarean sections in South Korea. Studies have reported that 44% of parturients in the United States who received general anesthesia had no indication for general anesthesia [2]. Considering that the rate of general anesthesia use in Korea is significantly higher than that in the United States, it can be assumed that general anesthesia received by several parturients can be replaced by regional anesthesia. Additional studies will be required for such investigations, and it will be necessary to perform such an analysis in conjunction with the occurrence of anesthe-

sia-related complications.

In conclusion, the common anesthetic induced when performing cesarean sections in South Korea is spinal anesthesia, and the rate of spinal anesthesia use is gradually increasing. Furthermore, factors related to anesthetic methods performed during cesarean section were identified to be significantly associated with the region, hospital size, maternal age, parity, number of fetuses, gestational age, fetal weight, need for emergency cesarean section, and duration of hospital stays.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

AUTHOR CONTRIBUTIONS

Conceptualization: Ji In Park, Sang Hi Park, Sang Tae Kim. Data acquisition: Min Seok Kang, Gil Won Kang. Formal analysis: Min Seok Kang, Gil Won Kang, Sang Hi Park, Ji In Park. Supervision: Sang Tae Kim. Writing—original draft: Ji In Park, Sang Hi Park, Sang Tae Kim. Writing—review & editing: Ji In Park, Sang Hi Park, Sang Tae Kim.

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