

# Evaluation of Factors Affecting Intrapartum Cesarean Section Rates by Comparing the Data of Patients with Vaginal Delivery: A Retrospective Case-Control Study

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**ABSTRACT Objective:** This study aimed to determine intrapartum cesarean section rates of our clinic as well as risk factors for intrapartum cesarean section. We also aimed to identify patients with risk factors beforehand and to reduce the intrapartum cesarean section rates and the complications that might occur due to intrapartum cesarean sections. **Material and Methods:** A total of 150 patients admitted to our clinic for vaginal delivery that ended up having intrapartum cesarean sections (case group) and 200 patients who had a vaginal delivery (control group) were included in our study retrospectively. Demographic, clinical, and neonatal results of the patients were compared. **Results:** Intrapartum cesarean section rate was determined to be 23% (150/654). The most common indication for intrapartum cesarean section was fetal distress (48%). We found that low gestational week at delivery, nulliparity, and polyhydramnios were independent risk factors for intrapartum cesarean section. We determined that gravidity and parity were not risk factors for intrapartum cesarean section. It was found that 1<sup>st</sup> minute APGAR scores of babies of patients with intrapartum cesarean section were significantly lower and that intrapartum cesarean section was an independent risk factor for this particular finding. **Conclusion:** The possibility of the intrapartum cesarean section should be considered in the labor follow-ups of patients with risk factors. We recommend hospital deliveries where the necessary conditions for the mother and fetus are met.

**Keywords:** Intrapartum cesarean section; fetal distress; vaginal delivery; risk factors

During normal labor, regular and painful uterine contractions cause fetal descent and expulsion, as well as progressive cervical dilatation and effacement.<sup>1</sup> Even though determining whether the labor is progressing normally is an important part of intrapartum care, determining the onset of labor, measuring its progression, and evaluating the factors affecting its course (power, passenger, pelvis) is full of uncertainties.<sup>1</sup>

Prolonged labor and arrest disorders are prevalent. This prevalence varies between studies due to differences in the definitions used by the authors as well as differences between study populations (range of gestational age, personal characteristics). Approximately 20% of all deliveries that result in live birth

involve prolonged labor and/or arrest disorders.<sup>2</sup> Abnormal progression of spontaneous labor might be associated with uterine factors, fetal factors, bony pelvis, or a combination of these factors.<sup>3</sup>

Prolongation in the first and second stages of labor has been associated with increased risks for operative vaginal delivery, third/fourth degree perineal lacerations, cesarean sections, urinary retention, postpartum bleeding, chorioamnionitis, and endometritis for the mother in observational studies.<sup>4,5</sup> If delivery does not occur in time, these newborns are at risk of hypoxic brain damage followed by neonatal encephalopathy, which is a major risk factor for long term neuro-disabilities.<sup>6</sup>

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Cesarean delivery is a common procedure in many countries around the world and the rate is rising in general.<sup>7</sup> Around 70% of cesarean sections in the United States are primary cesarean deliveries. The 3 most common indications for primary cesarean delivery in the United States are a failure in the progression of labor (35%), unreliable fetal condition (24%), and fetal malpresentation (19%).<sup>8</sup>

Compared to a planned cesarean delivery, intrapartum cesarean section is associated with an increased risk of postpartum bleeding, anesthetic complications caused by rapid administration of general anesthesia, and accidental damage to the fetus or abdominopelvic organs.<sup>9</sup>

Our study aimed to determine the intrapartum cesarean section rates of our clinic and the factors affecting the intrapartum cesarean section rates. By identifying patients with risk factors beforehand, we aimed to reduce the intrapartum cesarean section rates and complications with follow-ups by specialist doctors.

## MATERIAL AND METHODS

In our retrospective study, a total of 654 patients admitted between June 2018 and August 2020 for vaginal delivery were evaluated by examining the hospital information management system archives and patient files of Dicle University Faculty of Medicine Gynecology and Obstetrics Clinic. All 150 patients meeting the study criteria who were admitted to our clinic for vaginal delivery and ended up having intrapartum cesarean sections (case group) and 200 patients who had a vaginal delivery (control group) between the given dates were included in our study. Ethics committee approval (date: October 22, 2020; number: 328) was obtained from the Dicle University Medical Faculty Ethics Committee for Non-interventional studies. All procedures were performed according to the Declaration of Helsinki.

The deliveries of the patients in the control group, who had a vaginal delivery, were those with normal progression with no complications, and without any intervention (vacuum or forceps). Gestation below 36 weeks or over 42 weeks, multiple pregnancies, history of intrauterine ex fetus, history of previ-

ous cesarean sections or gynecological operations where the uterine cavity was opened, reception of epidural anesthesia during labor and conception through *in vitro* fertilization constituted the exclusion criteria. Patients that underwent elective cesarean section and malpresentation were also excluded from the study. As a control group, 200 patients who had vaginal delivery were randomly selected.

For all patients included in the study, age, gravidity, parity, a gestational week at delivery, systemic diseases, amniotic fluid index values, neonatal birth weights (g), 1<sup>st</sup> and 5<sup>th</sup> minute APGAR scores, indications for cesarean delivery of patients that had an intrapartum cesarean section, type of anesthesia used during the cesarean and cervical dilations (cm) were noted. Cervical dilation values were noted as the last measured value for which the decision of intrapartum cesarean was made. The gestational weeks of the patients at delivery were calculated primarily according to their last menstrual period or the ultrasonographic measurements performed in the first trimester for patients who did not remember their last menstrual period. Neonatal birth weights and 1<sup>st</sup> and 5<sup>th</sup> minute APGAR scores were determined by the neonatologist that accompanied the birth. Scores were given numerically. The follow-up of the patients admitted for vaginal delivery was performed by the same doctor with a non-stress test and digital examination. The examination results were written on the partogram. Amnion fluid values were noted according to the ultrasonographic measurements performed when the patients were admitted for delivery. When 4 quadrants were measured in ultrasonography, the values less than or equal to 5 cm were noted as oligohydramnios, values more than or equal to 24 cm as polyhydramnios, and values less than or equal to 2 cm as anhydramnios.<sup>10,11</sup>

In our clinic, vaginal delivery and cesarean section are performed by gynecologists and obstetricians, and a neonatologist is also present in each birth. The entire case group included in our study consisted of patients who were admitted to the hospital and followed up for vaginal delivery. As to the pregnancies with reassuring maternal and fetal status, if there is no change in the cervix after 4 hours of

sufficient uterine contractions (>200 Montevideo units) or after 6 hours without sufficient uterine contractions in the active phase, the decision of cesarean delivery is made during the vaginal delivery follow-up. If labor is progressing slowly or normally, we continue with the oxytocin dose required to maintain a sufficient uterine contraction pattern. In the absence of epidural anesthesia, we allow nulliparous women to push for at least 3 hours and multiparous women to push for at least 2 hours before considering operative intervention. The decision of cesarean delivery is also made for patients with fetal distress and cord prolapse. In this study, we separated and noted the intrapartum cesarean indications of the patients as cephalopelvic disproportion (CPD), non-progressive labor, fetal distress, and cord prolapse.

SPSS package program version 23 was used for statistical analysis. Descriptive statistics were given as arithmetic mean, standard deviation, number, and percentages. Kolmogorov-Smirnov test was conducted to test the normality of the data. The student's t-test was used as the parametric test for the data that showed a normal distribution. Mann-Whitney U test was used for non-normal data as the non-parametric test. The chi-square test was used to evaluate the categorical data. A p value smaller than 0.05 was considered statistically significant. For statistically significant results, linear regression was used for the analysis of numeric variables, and logistic regression was used for the analysis of categorical data.

## RESULTS

Between June 2018 and August 2020, there were a total of 2 288 cesarean sections, 922 primary cesarean sections, and 504 vaginal deliveries in our hospital. The intrapartum cesarean section rate was found to be 23% (150/654). In the case group, the number of nulliparous patients was 86 (57.3%), and there were 24 (16%) patients that were over the age of 35.

As to the comparison of the data of patients with intrapartum cesarean section and vaginal delivery, gravidity, parity, a gestational week at delivery, 1<sup>st</sup> and 5<sup>th</sup> minute APGAR scores were found to be significantly higher in the control group ( $p<0.05$ ). The number of patients with a neonatal birth weight over

4,000 grams, the number of patients with a neonatal birth weight over 4,500 grams, the number of nulliparous patients, and the number of patients with oligohydramnios and polyhydramnios were found to be significantly higher in the case group ( $p<0.05$ ). It was found that the most common indication for cesarean section in the case group was fetal distress (48%) and that spinal anesthesia was chosen as the administration method for anesthesia during cesarean section at a rate of 91.3% (Table 1).

When we selected nulliparous patients and compared the data of the patients between the 2 groups, we determined that the 1<sup>st</sup> minute APGAR score and the gestational week at delivery were significantly higher in the control group, and the number of patients with oligohydramnios and polyhydramnios was significantly higher in the case group ( $p<0.05$ ) (Table 2).

When we selected multiparous patients and compared the data of the patients between the 2 groups, we determined that age, gravidity, parity, and the number of patients with polyhydramnios were significantly higher in the case group; and the 1<sup>st</sup> and 5<sup>th</sup> minute APGAR scores and the gestational week at delivery were significantly higher in the control group ( $p<0.05$ ) (Table 3).

When we categorized the patients in the case group as nulliparous and multiparous and compared the data of these patients, we found that the neonatal birth weight, and CPD and fetal distress as indications for cesarean section were significantly higher in multiparous patients; and non-progressive labor as an indication for cesarean section was significantly higher in nulliparous patients ( $p<0.05$ ) (Table 4).

When we categorized the patients with the intrapartum cesarean section as under and over the age of 35 and compared their data, we found that multiparity was significantly higher in the group over the age of 35 ( $p<0.05$ ). Besides, the intrapartum cesarean section rate was 24.5% in patients under the age of 35, and 17.1% in patients aged 35 and above (Table 5).

As to the results of the regression analysis, it was determined that low gestational week at delivery, nulliparity, and presence of polyhydramnios were independent risk factors for intrapartum cesarean section.

**TABLE 1:** Comparison of demographic characteristics and data of patients who underwent intrapartum cesarean section and vaginal delivery.

| n=350                               |                             | Intrapartum cesarean section<br>(Mean±SD) n (%) 150 (42.9) | Vaginal delivery (Mean±SD)<br>n (%) 200 (57.1) | p value      |
|-------------------------------------|-----------------------------|--|--|--------------|
| Age                                 |                             | 27.8±6.0   | 27.4±5.7                                       | 0.555        |
| Age groups                          | <20                         | 8 (5.3)  | 10 (5)   | 0.430        |
|                                     | 20-24                       | 36 (24)  | 66 (33)  |              |
|                                     | 25-29                       | 57 (38)  | 57 (28.5)                                      |              |
|                                     | 30-34                       | 25 (16.7)  | 38 (19)  |              |
|                                     | 35-39                       | 19 (12.7)  | 23 (11.5)                                      |              |
|                                     | 40-44                       | 3 (2)  | 5 (2.5)  |              |
|                                     | >45                         | 2 (1.3)  | 1 (0.5)  |              |
| Gravidity                           |                             | 2.8±2.4  | 3.1±2.1  | <b>0.007</b> |
| Parity                              |                             | 1.3±1.9  | 1.7±1.7  | <b>0.000</b> |
| Neonatal birth weight (g)           |                             | 3,223.5±619.8  | 3,188.5±417.8                                  | 0.792        |
| Gestational week at delivery        |                             | 37.7±1.3   | 38.2±1.3                                       | <b>0.000</b> |
| 1 <sup>st</sup> minute APGAR scores |                             | 5.5±1.4  | 6.1±1.2  | <b>0.000</b> |
| 5 <sup>th</sup> minute APGAR scores |                             | 8±1.3  | 8.5±0.8  | <b>0.001</b> |
| Neonatal birth weight over 4,500 g  |                             | 3 (2)  | 0 (0)  | <b>0.024</b> |
| Neonatal birth weight over 4,000 g  |                             | 11 (7.3)   | 5 (2.5)  | <b>0.039</b> |
| Systemic disease                    | Yes                         | 42 (28)  | 65 (32.5)                                      | 0.982        |
|                                     | No                          | 108 (72)   | 135 (67.5)                                     |              |
| Nulliparity                         |                             | 86 (57.3)  | 57 (28.5)                                      | <b>0.000</b> |
| Multiparity                         |                             | 64 (42.7)  | 143 (71.5)                                     |              |
| Amniotic fluid index                | Normal                      | 114 (76)   | 178 (89)                                       | <b>0.000</b> |
|                                     | Polyhydramnios              | 18 (12)  | 3 (1.5)  |              |
|                                     | Oligohydramnios             | 16 (10.7)  | 12 (6)   |              |
|                                     | Anhydramnios                | 2 (1.3)  | 7 (3.5)  |              |
| Cervical dilations (cm)             |                             | 1.6±1.3  |  |              |
| Cervical dilations                  | 0 cm                        | 48 (32)  |  |              |
|                                     | 1 cm                        | 8 (5.3)  |  |              |
|                                     | 2 cm                        | 50 (33.3)  |  |              |
|                                     | 3 cm                        | 35 (23.4)  |  |              |
|                                     | 4 cm                        | 9 (6)  |  |              |
| Indications for cesarean delivery   | Cephalopelvic disproportion | 57 (38)  |  |              |
|                                     | Fetal distress              | 72 (48)  |  |              |
|                                     | Non-progressive labor       | 20 (13.3)  |  |              |
|                                     | Cord prolapse               | 1 (0.7)  |  |              |
| Type of anesthesia                  | Spinal                      | 137 (91.3)   |  |              |
|                                     | General                     | 13 (8.7)   |  |              |

Data are presented as mean±SD, frequency, percentage, Mann-Whitney U test, chi-square test; p<0.05 statistically significant (in bold); SD: Standard deviation.

We determined that gravidity and parity were not risk factors for intrapartum cesarean section. We found that intrapartum cesarean section was an independent risk factor for low 1<sup>st</sup> minute APGAR scores (p<0.05) (Table 6).

## DISCUSSION

It is concerning that primary cesarean section rates are going up day by day. It has both maternal and fetal adverse effects, as well as negative effects on the cost.

**TABLE 2:** Comparison of data of nulliparous patients

| n=143                               |                             | Intrapartum cesarean section | Vaginal delivery (Mean±SD) | p value      |
|-------------------------------------|-----------------------------|------------------------------|----------------------------|--------------|
|                                     |                             | (Mean±SD) n (%) 86 (60.1)    | n (%) 57 (39.9)            |              |
| Age                                 |                             | 25.1±4.4                     | 24.7±5.3                   | 0.313        |
| Age groups                          | <20                         | 7 (8.1)                      | 8 (14)                     | 0.186        |
|                                     | 20-24                       | 30 (34.9)                    | 25 (43.8)                  |              |
|                                     | 25-29                       | 37 (43.1)                    | 15 (26.3)                  |              |
|                                     | 30-34                       | 10 (11.6)                    | 5 (8.8)                    |              |
|                                     | 35-39                       | 2 (2.3)                      | 3 (5.3)                    |              |
|                                     | 40-44                       | 0 (0)                        | 1 (1.8)                    |              |
|                                     | >45                         | 0 (0)                        | 0 (0)                      |              |
| Gravidity                           |                             | 1.3±0.8                      | 1.2±0.6                    | 0.397        |
| Parity                              |                             | 0.0±0.0                      | 0.0±0.0                    | 1            |
| Neonatal birth weight (g)           |                             | 3,112.8±586.7                | 3,090.9±402.8              | 0.969        |
| 1 <sup>st</sup> minute APGAR scores |                             | 5.5±1.4                      | 6.0±1.1                    | <b>0.041</b> |
| 5 <sup>th</sup> minute APGAR scores |                             | 8.1±1.3                      | 8.4±0.8                    | 0.201        |
| Gestational week at delivery        |                             | 37.7±1.4                     | 38.2±1.2                   | 0.020        |
| Systemic disease                    | Yes                         | 22 (25.6)                    | 14 (24.6)                  | 0.339        |
|                                     | No                          | 64 (74.4)                    | 43 (75.4)                  |              |
| Amnion                              | Normal                      | 67 (77.9)                    | 48 (84.2)                  | <b>0.021</b> |
| Fluid                               | Polyhydramnios              | 5 (5.8)                      | 0 (0)                      |              |
| Index                               | Oligohydramnios             | 13 (15.1)                    | 5 (8.8)                    |              |
|                                     | Anhydramnios                | 1 (1.2)                      | 4 (7)                      |              |
| Cervical dilations (cm)             |                             | 1.6±1.2                      |                            |              |
| Cervical dilations                  | 0 cm                        | 27 (31.4)                    |                            |              |
|                                     | 1 cm                        | 6 (7)                        |                            |              |
|                                     | 2 cm                        | 29 (33.7)                    |                            |              |
|                                     | 3 cm                        | 19 (22.1)                    |                            |              |
|                                     | 4 cm                        | 5 (5.8)                      |                            |              |
| Indications for cesarean delivery   | Cephalopelvic disproportion | 31 (36)                      |                            |              |
|                                     | Fetal distress              | 39 (45.4)                    |                            |              |
|                                     | Non-progressive labor       | 16 (18.6)                    |                            |              |
|                                     | Cord prolapse               | 0 (0)                        |                            |              |

Data are presented as mean±SD, frequency, percentage; Mann-Whitney U test, chi-square test; p<0.05 statistically significant (in bold); SD: Standard deviation.

Increasing intrapartum cesarean section rates play a role in increasing primary cesarean section rates and wield more maternal and fetal adverse effects compared to scheduled cesarean sections.<sup>9</sup> In our study, we aimed to determine the factors that affect the intrapartum cesarean section rates and to reduce the complications that may occur due to intrapartum cesarean sections or the intrapartum cesarean rates. As a conclusion of our study, we determined that lower gestational week at delivery, nulliparity, presence of polyhydramnios were independent risk factors for intrapartum cesarean section. As to the neonates, we

found that intrapartum cesarean section was an independent risk factor for lower 1<sup>st</sup> minute APGAR scores.

Boriboonhirunsarn and Waiyanikorn compared women with gestational diabetes mellitus (GDM) and normal pregnant women in terms of emergency cesarean section. They found the emergency cesarean section rate to be 19.4% in normal pregnant women. And emergency cesarean section rate was significantly higher in patients with GDM (31.6%). They noted that emergency cesarean section was signifi-

**TABLE 3:** Comparison of data of multiparous patients.

| n=207                               |                             | Intrapartum cesarean section | Vaginal delivery (Mean±SD) | p value      |
|-------------------------------------|-----------------------------|------------------------------|----------------------------|--------------|
|                                     |                             | (Mean±SD) n (%) 64 (30.9)    | n (%) 143 (69.1)           |              |
| Age                                 |                             | 31.5±5.9                     | 28.5±5.5                   | <b>0.001</b> |
| Age groups                          | <20                         | 1 (1.6)                      | 2 (1.4)                    | <b>0.027</b> |
|                                     | 20-24                       | 6 (9.4)                      | 41 (28.7)                  |              |
|                                     | 25-29                       | 20 (31.2)                    | 42 (29.4)                  |              |
|                                     | 30-34                       | 15 (23.4)                    | 33 (23)                    |              |
|                                     | 35-39                       | 17 (26.6)                    | 20 (14)                    |              |
|                                     | 40-44                       | 3 (4.7)                      | 4 (2.8)                    |              |
|                                     | >45                         | 2 (3.1)                      | 1 (0.7)                    |              |
| Gravidity                           |                             | 4.8±2.5                      | 3.8±2.0                    | <b>0.005</b> |
| Parity                              |                             | 3.1±1.9                      | 2.3±1.6                    | <b>0.005</b> |
| Neonatal birth weight (g)           |                             | 3,372.2±636.2                | 3,227.4±418.6              | 0.137        |
| 1 <sup>st</sup> minute APGAR scores |                             | 5.5±1.4                      | 6.2±1.2                    | <b>0.002</b> |
| 5 <sup>th</sup> minute APGAR scores |                             | 8.0±1.3                      | 8.5±0.8                    | <b>0.001</b> |
| Gestational week at delivery        |                             | 37.6±1.3                     | 38.2±1.3                   | <b>0.01</b>  |
| Systemic disease                    | Yes                         | 20 (31.2)                    | 51 (35.7)                  | 0.830        |
|                                     | No                          | 44 (68.8)                    | 92 (64.3)                  |              |
| Amniotic fluid index                | Normal                      | 47 (73.4)                    | 130 (91)                   | <b>0.000</b> |
|                                     | Polyhydramnios              | 13 (20.3)                    | 3 (2.1)                    |              |
|                                     | Oligohydramnios             | 3 (4.7)                      | 7 (4.8)                    |              |
|                                     | Anhydramnios                | 1 (1.6)                      | 3 (2.1)                    |              |
| Cervical dilations (cm)             |                             | 1.6±1.3                      |                            |              |
| Cervical dilations                  | 0 cm                        | 21 (32.8)                    |                            |              |
|                                     | 1 cm                        | 2 (3.1)                      |                            |              |
|                                     | 2 cm                        | 21 (32.8)                    |                            |              |
|                                     | 3 cm                        | 16 (25)                      |                            |              |
|                                     | 4 cm                        | 4 (6.3)                      |                            |              |
| Indications for cesarean delivery   | Cephalopelvic disproportion | 27 (42.2)                    |                            |              |
|                                     | Fetal distress              | 33 (51.5)                    |                            |              |
|                                     | Non-progressive labor       | 3 (4.7)                      |                            |              |
|                                     | Cord prolapse               | 1 (1.6)                      |                            |              |

Data are presented as mean±SD, frequency, percentage; Mann-Whitney U test, chi-square test; p<0.05 statistically significant (in bold); SD: Standard deviation.

cantly more frequent in nulliparous patients with GDM.<sup>12</sup> Jang et al. examined the impact of intrapartum cesarean section on neonatal outcomes. They compared patients who gave birth in private and public hospitals in Australia and found that the intrapartum cesarean section rate in public hospitals was 15.2%, which was significantly higher than in private hospitals. Scheduled cesarean sections were more common in private hospitals (32.3%). The most common indication for intrapartum cesarean sections was found to be non-progressive labor and fetal distress in

both private and public hospitals. Neonatal outcomes of intrapartum cesarean sections were also reported to be significantly poorer in public hospitals. The results were attributed to quick decisions for intrapartum cesarean section in private hospitals and better neonatal interventions.<sup>13</sup> We found the intrapartum cesarean section rate to be 23% in our study, which was in agreement with the current literature. When we compared these patients with the control group, we found no significant difference between the 2 groups in terms of systemic disease presence.

**TABLE 4:** Comparison of data of nulliparous and multiparous patients in the group with intrapartum cesarean section.

| n=150                               |                             | Intrapartum cesarean section | Vaginal delivery (Mean±SD) | p value      |
|-------------------------------------|-----------------------------|------------------------------|----------------------------|--------------|
|                                     |                             | (Mean±SD) n (%) 86 (57.3)    | n (%) 64 (42.7)            |              |
| Age                                 |                             | 25.1±4.4                     | 31.5±5.9                   | <b>0.000</b> |
| Gravidity                           |                             | 1.3±0.8                      | 4.8±2.5                    | <b>0.000</b> |
| Parity                              |                             | 0.0±0.0                      | 3.1±1.9                    | <b>0.000</b> |
| Neonatal birth weight (g)           |                             | 3,112±586                    | 3,372±636                  | <b>0.027</b> |
| 1 <sup>st</sup> minute APGAR scores |                             | 5.5±1.4                      | 5.5±1.4                    | 0.701        |
| 5 <sup>th</sup> minute APGAR scores |                             | 8.1±1.3                      | 8.0±1.3                    | 0.580        |
| Gestational week at delivery        |                             | 37.7±1.4                     | 37.6±1.3                   | 0.097        |
| Systemic disease                    | Yes                         | 22 (25.6)                    | 20 (31.2)                  | 0.636        |
|                                     | No                          | 64 (74.4)                    | 44 (68.8)                  |              |
| Amniotic fluid index                | Normal                      | 67 (77.9)                    | 47 (73.4)                  | <b>0.016</b> |
|                                     | Polyhydramnios              | 5 (5.8)                      | 13 (20.3)                  |              |
|                                     | Oligohydramnios             | 13 (15.1)                    | 3 (4.7)                    |              |
|                                     | Anhydramnios                | 1 (1.2)                      | 1 (1.6)                    |              |
| Cervical dilations (cm)             |                             | 1.6±1.2                      | 1.6±1.3                    | 0.790        |
| Indications for cesarean delivery   | Cephalopelvic disproportion | 31 (36)                      | 26 (40.6)                  | <b>0.040</b> |
|                                     | Fetal distress              | 39 (45.4)                    | 34 (53.1)                  |              |
|                                     | Non-progressive labor       | 16 (18.6)                    | 3 (4.7)                    |              |
|                                     | Cord prolapse               | 0 (0)                        | 1 (1.6)                    |              |

Data are presented as mean ± SD, frequency, percentage; Mann-Whitney U test, chi-square test; p<0.05 statistically significant (in bold); SD: Standard deviation.

We found, in our study, that nulliparity was an independent risk factor for intrapartum cesarean section, and the 1<sup>st</sup> and 5<sup>th</sup> minute APGAR scores were significantly lower in the intrapartum cesarean section group as a neonatal outcome, without a difference between the 2 groups in terms of neonatal birth weight. We think that intrapartum cesarean section being an independent risk factor for lower 1<sup>st</sup> minute APGAR scores may be related to fetal distress indication, amniotic fluid index anomalies (polyhydramnios and oligohydramnios), and the lower gestational week at delivery. In line with the given study, cesarean indications were revealed to be most frequently fetal distress, followed by CPD and non-progressive labor, respectively in this study. We conducted our study at a university hospital, where neonatal interventions were performed by neonatologists. Patients of the intrapartum cesarean section had a maximum of 4-cm cervical dilatation, which indicates that we take quick cesarean section decisions in our clinic. Therefore, we believe that the reason for the negative impacts of intrapartum cesarean sections on neonatal outcomes

should be investigated with more comprehensive studies.

Fuma et al. reported in their study, which included patients over the age of 40, that the number of patients with intrapartum cesarean section was 43 (10.3%). They also reported that nulliparity, pregnancies with assisted reproductive technology, and labor induction affected the intrapartum cesarean section rate. In the conclusion of the study, it was emphasized that pregnancy at and over the age of 40 was not an obstacle to vaginal delivery, and these patients could be encouraged for vaginal delivery.<sup>14</sup> Crequit et al. included nulliparous patients in their study and reported no significant difference between patients aged 20-34 and over 35 years in terms of intrapartum cesarean section rate. It was also noted that advanced maternal age in nulliparous patients did not affect intrapartum cesarean section.<sup>15</sup> Muto et al. included nulliparous patients over 35 years of age in their study. They found the intrapartum cesarean section rate to be 18.3% in patients aged 35-39 and 28.3% in patients over 40 years of age. No difference was ob-

**TABLE 5:** Comparison of data of patients under the age of 35 and over.

| n=150                               | Intrapartum cesarean section (Mean±SD) n (%) 150 (42.9) |                    |              |       |
|-------------------------------------|---|--------------------|--------------|-------|
|                                     | Under age of 35   | Age of 35 and over | p value      |       |
|                                     | 126 (84)  | 24 (16)            |              |       |
| Age                                 | 25.9±4.2  | 38±2.8             | <b>0.000</b> |       |
| Gravidity                           | 2.2±1.9   | 5.9±2.6            | <b>0.000</b> |       |
| Parity                              | 0.8±1.5   | 3.8±2.3            | <b>0.000</b> |       |
| Neonatal birth weight (g)           | 3,194±627   | 3,376±566          | 0.156        |       |
| 1 <sup>st</sup> minute APGAR scores | 5.5±1.5   | 5.6±1.0            | 0.839        |       |
| 5 <sup>th</sup> minute APGAR scores | 8.0±1.4   | 8.0±0.7            | 0.414        |       |
| Gestational week at delivery        | 37.6±1.3  | 37.8±1.5           | 0.606        |       |
| Intrapartum cesarean section rates  | 126/514 (24.5)  | 24/140 (17.1)      |              |       |
| Nulliparity                         | 84 (66.7)   | 2 (8.3)            | <b>0.000</b> |       |
| Multiparity                         | 42 (33.3)   | 22 (91.7)          |              |       |
| Systemic disease                    | Yes   | 35 (27.8)          | 7 (29.1)     | 0.609 |
|                                     | No  | 91 (72.2)          | 17 (70.9)    |       |
| Amniotic fluid index                | Normal  | 99 (78.6)          | 15 (62.5)    | 0.072 |
|                                     | Polyhydramnios  | 11 (8.7)           | 7 (29.2)     |       |
|                                     | Oligohydramnios   | 14 (11.1)          | 2 (8.3)      |       |
|                                     | Anhydramnios  | 2 (1.6)            | 0 (0)        |       |
| Cervical dilations (cm)             | 1.6±1.2   | 1.5±1.3            | 0.565        |       |
| Indications for cesarean delivery   | Cephalopelvic disproportion                             | 46 (36.5)          | 11 (45.8)    | 0.496 |
|                                     | Fetal distress  | 60 (47.6)          | 12 (50)      |       |
|                                     | Non-progressive labor                                   | 19 (15.1)          | 1 (4.2)      |       |
|                                     | Cord prolapse   | 1 (0.8)            | 0 (0)        |       |

Data are presented as mean±SD, frequency, percentage; Mann-Whitney U test, chi-square test; p<0.05 statistically significant (in bold); SD: Standard deviation.

**TABLE 6:** Regression analysis of factors affecting intrapartum cesarean section.

| n=350                               | BETA   | Wald   | p value      | 95% CI        |
|-------------------------------------|--------|--------|--------------|---------------|
| Gravidity                           | -0.086 |        | 0.471        | -0.070-0.032  |
| Parity                              | 0.169  |        | 0.157        | -0.017-0.106  |
| 1 <sup>st</sup> minute APGAR scores | 0.193  |        | <b>0.003</b> | 0.024-0.118   |
| 5 <sup>th</sup> minute APGAR scores | 0.056  |        | 0.395        | -0.033-0.084  |
| Gestational week at delivery        | 0.152  |        | <b>0.004</b> | 0.018-0.093   |
| Neonatal birth weight over 4,000 g  | 1.029  | 2.900  | 0.089        |               |
| Neonatal birth weight over 4,500 g  | 21.078 | 0.000  | 0.999        |               |
| Nulliparity/multiparity             | -1.291 | 31.179 | <b>0.000</b> |               |
| Polyhydramnios                      | 3.045  | 8.984  | <b>0.003</b> | 2.868-153.754 |

Logistic regression, linear regression; p<0.05 statistically significant (in bold); CI: Confidence interval.

served in the cesarean section indications between the 2 age groups. Nulliparity over the age of 40 was found to be an independent risk factor for intrapartum cesarean section.<sup>16</sup> Nakano et al. included patients over the age of 35 who received nulliparous labor in-

duction in their study. They reported the intrapartum cesarean section rate to be 44% and that patients with immature cervical ripening and hypertensive disease were independent risk factors for intrapartum cesarean section.<sup>17</sup> In our study, we found no signifi-



cant difference in terms of maternal age between patients who had intrapartum cesarean section and those who had a vaginal delivery, and when we divided the patients into age groups, there was again no difference in terms of age. Nulliparity, on the other hand, was found to be an independent risk factor for intrapartum cesarean section. In our study, there were 19 (12.7%) patients between the ages of 35-39 and 5 (3.3%) patients over the age of 40 who had an intrapartum cesarean section. We found the intrapartum cesarean rate to be 17.1% in patients aged 35 and above. When we categorized the patients of intrapartum cesarean as under and over 35 years of age, we found no difference in terms of neonatal outcomes, amniotic fluid index, and cesarean indications. When we compared the data of only nulliparous patients between the case and the control groups, we found no difference between ages and age groups. When we compared the data of only multiparous patients, we found that the age of patients that had intrapartum cesarean section was significantly higher, and especially the number of patients over the age of 35 was higher in the case group. Unlike other studies in the literature, we found that age over 35 in multiparous patients was a risk factor for intrapartum cesarean section. However, we believe that this result may be due to a small number of nulliparous patients over the age of 35 in our study. We know that pregnancy is now delayed to later stages of life and the number of nulliparous patients over the age of 35 is increasing. So, we believe that comprehensive studies involving nulliparous and multiparous patients over the age of 35 are needed.

Pritchard et al. investigated in their study whether large-for-gestational-age (LGA) infants affected the intrapartum cesarean section. Fetuses identified as LGA according to their mother's height were found to be risky for intrapartum cesarean section.<sup>18</sup> Muto et al. found large-for-date fetuses to be an independent risk factor for intrapartum cesarean section.<sup>16</sup> In our study, we found that the number of patients with a neonatal birth weight over 4,000 g was higher in the intrapartum cesarean section group. However, over 4,000 g of neonatal birth weight was not found to be an independent risk factor for intrapartum cesarean section.

Flatley et al. found the rate of patients that had intrapartum cesarean section due to fetal distress to be 4.2% in their study with term pregnant women. They stated that the gestational week at delivery did not affect intrapartum cesarean sections.<sup>19</sup> In our study, we determined the lower gestational week at delivery to be an independent risk factor for intrapartum cesarean section. We found that most of the studies in the literature did not evaluate the gestational week at delivery. Comprehensive studies are therefore needed in this area.

Looking at the literature, we found that the factors that affected patients with intrapartum cesarean sections were not extensively investigated, which can be considered a gap in the literature. Often nulliparous patients and patients with advanced ages were examined in the previous studies. However, we know that multiparous and younger patients also undergo an intrapartum cesarean section. We could not find any study in the literature investigating whether amniotic fluid anomalies affected the intrapartum cesarean section. However, we found polyhydramnios to be an independent risk factor for intrapartum cesarean section in our study and we should keep this risk in mind in patients with polyhydramnios. In our study, we tried to determine risk factors by comparing nulliparous, multiparous patients and patients under and over the age of 35 with the control group.

One of the limitations of our study was that we could not reach the following patient information: body mass index, the position of the fetus, whether meconium could be seen in the amniotic fluid, whether amniotomy was performed, and oxytocin augmentation. Other limitations included that long-term neonatal effects could not be followed and all patients in the case group were in the latent phase of labor. The advantage of our study was that we made comparisons with the control group. Another advantage was that the study consisted of patients (both the control and case group) followed by the same team in a single center.

## CONCLUSION

We determined that lower gestational week at delivery, nulliparity, presence of polyhydramnios were in-

dependent risk factors for intrapartum cesarean section. We found that intrapartum cesarean section was an independent risk factor for lower 1<sup>st</sup> minute APGAR scores. We recommend that patients with identified risk factors should deliver to hospitals where necessary conditions are provided for the mother and the fetus to reduce the intrapartum cesarean section rates and to protect the patients from the negative effects of intrapartum cesarean section.

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### Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

### Authorship Contributions

**Idea/Concept:** Reyhan Gündüz, Elif Ağaçayak; **Design:** Reyhan Gündüz, Elif Ağaçayak, Uğur Çalışır, Talip Gül; **Control/Supervision:** Reyhan Gündüz, Elif Ağaçayak, Abdurrahman Şengi, Uğur Çalışır, Talip Gül; **Data Collection and/or Processing:** Reyhan Gündüz, Abdurrahman Şengi, Uğur Çalışır; **Analysis and/or Interpretation:** Reyhan Gündüz, Elif Ağaçayak, Abdurrahman Şengi, Uğur Çalışır, Talip Gül; **Literature Review:** Reyhan Gündüz, Talip Gül; **Writing the Article:** Reyhan Gündüz, Elif Ağaçayak; **Critical Review:** Reyhan Gündüz, Elif Ağaçayak, Abdurrahman Şengi, Uğur Çalışır, Talip Gül.

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