

Repeated Cesarean Delivery Predicted a Higher Risk of Inadequate Analgesia Than Primary Cesarean Delivery: A Retrospective Study with Propensity Score Match Analysis

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Purpose: This study aimed to compare the analgesic outcomes between primary and repeated cesarean delivery.

Patients and Methods: We performed a retrospective analysis based on the medical records of a teaching hospital in China from January 2018 to March 2019. We collected data on demographic characteristics, perioperative complications, anesthesia, and surgical factors for cesarean delivery patients. We also recorded the postoperative analgesic strategy, pain intensity (assessed by the number rating scale) during the first 48 hrs after surgery, hospital cost, and hospital stay. Postoperative inadequate analgesia was defined by a score of ≥ 4 in the number rating scale. Analgesic outcomes after cesarean delivery between primiparas and multiparas were compared using propensity score matching analysis. Moreover, subgroup logistic analysis for different age groups (≥ 35 and < 35 years) was performed to investigate the effect of the maternal category on postoperative inadequate analgesia.

Results: A total of 1543 patients were included in the analysis and 571 pairs (1142 patients) were matched in the primiparas and multiparaparas group according to their propensity score. In both the non-matched and matched cohort, the incidence of inadequate analgesia in the primiparas group was lower than that in the multiparas group (16.7% vs. 24.0%, $P < 0.001$ and 16.1% vs. 23.5%, $P = 0.002$; respectively). The multiparas group was identified as being at risk of inadequate analgesia after cesarean delivery in both age groups (age ≥ 35 years, odds ratio: 2.18, 95% confidence interval: 1.20–3.95; age < 35 years, odds ratio: 1.43, 95% confidence interval 1.08–1.89).

Conclusion: Multiparas that undergo a repeat cesarean delivery had a significantly higher risk of inadequate postoperative pain treatment than primiparas. The maternal category should be considered when formulating the postoperative analgesia strategy after cesarean delivery.

Keywords: cesarean delivery, analgesia, primipara, multipara

Introduction

Cesarean delivery is one of the most commonly performed in-patient surgical procedures worldwide. However, despite numerous measures being taken to manage postoperative pain after cesarean delivery, inadequate pain relief remains common with a reported incidence of approximately 20–40%.^{1–3} Inadequate pain treatment after cesarean delivery is associated with delayed functional recovery, longer hospital stay, and long-term adverse outcomes such as postoperative persistent pain.^{4,5} Previous

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studies have suggested that exploring inter-individual variability in postoperative pain might be helpful toward accurately applying targeted treatment to women at risk of experiencing severe post-cesarean delivery pain and improve their clinical outcomes.⁶ Since the implementation of the new national two-child policy,^{7,8} an increasing number of women who have previously undergone cesarean delivery have received an another cesarean delivery. Thus, there is a novel clinical challenge regarding postoperative pain management in China. Given their scarred uterus, multiparas often face more operative difficulties and require longer surgery times, which may induce more serious noxious stimulation than primary cesarean delivery.^{9,10} Moreover, a previous study reported that a history of surgery was associated with a higher risk of inadequate analgesia.¹¹ In contrast, multiparas that undergo a repeat cesarean delivery are often older, which has been associated with a lower level of postoperative pain.^{12–14} There has been a lack of studies that evaluate the differences in postoperative pain control between multiparas and primiparas.

Currently, there is a one-size-fits-all approach for postoperative analgesia after cesarean delivery for both multiparas and primiparas. Furthermore, in the recent Practice Guidelines for Obstetric Analgesia and Anesthesia, no specific explanation was given regarding postoperative pain treatment for multiparas and primiparas.^{15,16} Therefore, we investigated the potential differences in postoperative analgesia outcomes by conducting a retrospective study with propensity score match analysis on primiparas undergoing

primary cesarean delivery and multiparas undergoing a repeat cesarean delivery.

Materials and Methods

Patients

This was a single-center retrospective cohort study. Study protocol was approved by the Institutional Ethics Committee of the Second Affiliated Hospital of Army Medical University, Chongqing, China (approved ID: 2019-040-1), which waived the requirement for obtaining informed consent from the participants. The participants' names and other forms of identification were deleted before analysis. As shown in Figure 1, from January 2018 to March 2019, we enrolled a total of 1543 Chinese women who were aged from 20 to 45 years and had undergone primary or repeat cesarean delivery via a transverse incision under the subarachnoid space block anesthesia. The inclusion criteria included women with the gestational age of 37 to 40 weeks, singleton pregnancy, and an American Society of Anesthesiology physical status I–II. The exclusion criteria included women with gemellary pregnancy, fetal death, receiving epidural or general anesthesia, and with missing data (Figure 1).

Data Source

All data were obtained from medical records from The Affiliated Hospital of Army Medical University. Preoperative demographic and baseline data were collected from the electronic medical record system and recorded by a gynecologist. Intraoperative complications

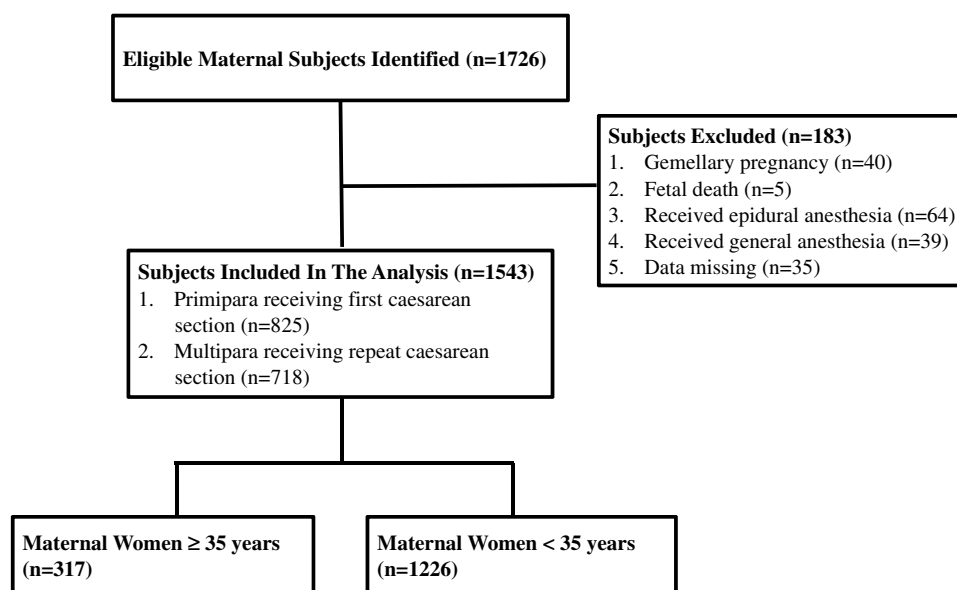


Figure 1 Flow diagram of patient inclusion.

and anesthesia-related data were recorded by an anesthetist. Postoperative pain assessment was followed up and recorded by a nurse anesthetist.

Anesthesia and Analgesia

All patients had received subarachnoid space anesthesia. Anesthesia was performed by an experienced anesthetist who administered ropivacaine (AstraZeneca AB, 20–25 mg) to the puncture site (L3-L4 or L2-L3). Postoperative analgesia was started immediately after cesarean delivery. In the hospital, patient-controlled intravenous analgesia (PCIA) was routinely performed through a mechanical infusion pump. The background volume was 4.0 mL/h and the additional dose was 1 mL with a locking time of 15 min. Tramadol (Grünenthal) 800 mg and flurbiprofen Axetil (Beijing teide pharmaceutical co. LTD) 200 mg with 200 mL 0.9% normal saline was used for PCIA.

Patient Data and Outcomes Collection

The incidence of inadequate postoperative analgesia during the first 48 hrs after cesarean delivery was used as the primary outcome. The number rating scale (NRS, 0–10, where 0 is defined as no pain and 10 as maximum pain) was used to evaluate the postoperative pain intensity at 6, 12, 24, and 48 hrs. Inadequate analgesia was defined as an NRS score ≥ 4 . In addition, cases who requested extra rescue treatment during the 48 hrs postoperative analgesia were recorded.

The following maternal preoperative complications were recorded:

- Gestational hypertension, which included emerging hypertension during pregnancy, pre-pregnancy hypertension, eclampsia, and pre-eclampsia.
- Gestational diabetes mellitus, including emerging gestational diabetes and pre-pregnancy diabetes.
- Polyhydramnios and oligoamnios, which refers to an amniotic fluid volume > 2000 mL and < 300 mL, respectively, during pregnancy.
- Fetal macrosomia, which refers to a fetus weighing ≥ 4000 g. Placental diseases including placenta previa, placenta implantation, and placenta abruption.
- Pre-diagnosed fetal diseases including fetal congenital heart disease, kidney disease and brain disease such as hydronephrosis and hydrocephalus etc. Premature membrane rupture, which is defined as membrane rupture before formal contractions.

Patients who used intrauterine balloon tamponade for uterine inertia and postpartum hemorrhage treatment were recorded. Information on synchronized surgery after cesarean section, such as simultaneous ligation, ovarian cyst surgery, and uterine fibroid surgery were recorded.

Patient demographic data such as body mass index (BMI), age, intraoperative blood loss volume, intraoperative blood transfusion volume, neonatal Apgar score, neonatal weight, and neonatal diseases at hospitalization were measured. Postoperative intestinal function recovery which referred to the recovery of anal exhaust after operation, off-bed activity at one and two days after surgery, hospital cost, and length of hospital stay were also recorded.

Statistical Analysis

In this study, the incidence of postoperative inadequate pain control was considered the primary outcome. Through propensity score-matched analysis, the basal characteristics between multiparas and primiparas group could be balanced. Based on the similar basal characteristics, the primary and other outcomes could be compared simultaneously. Thus, propensity score-matched analysis was considered as the primary analysis in the study. The PASS software version 11.0 (company name, location) was used for power analysis. Based on a two-sided group comparison, a sample size of 571 in each group for the propensity score-matched analysis achieved 97.7% power to detect a difference of 7.4% between the multiparas and primiparas group.

Continuous variables were presented as mean \pm standard deviation while categorical variables were presented as percentages. Patients were classified as either multipara or primipara. Student's *t*-tests or Mann–Whitney *U*-tests were performed to compare the differences between the multiparas and primiparas group as appropriate. The χ^2 test was used to compare categorical variables between the two groups. The relative risk for the incidence of postoperative inadequate analgesia was calculated with a 95% confidence interval (CI).

Given the potential differences in the women's baseline data between the multiparas and primiparas group, we performed a propensity score-matched analysis to further compare the intergroup differences. The propensity score was calculated for the following baseline variables: age group (< 35 years and ≥ 35 years), placenta disease (yes/no), oligoamnios or polyhydramnios (yes/no), pre-diagnosed fetal disease (yes/no), premature membrane rupture (yes/no), hypertension (yes/no), gestational diabetes mellitus (yes/no),

emergency operation (yes/no), with or without intrauterine balloon tamponade, and other synchronized surgeries. Matching was carried out using the 1:1 nearest neighbor method without replacement under a logit model, which yielded 571 subjects in the multiparas group matched with 571 subjects in the primiparas group (Figure 2). We also used a non-matched cohort to compare baseline data and outcomes between the two groups.

Subgroup logistic analysis was performed based on the two age groups (< 35 years and ≥ 35 years). Considering the intraoperative variables such as surgery time, blood loss, and the postoperative variables such as maternal complication at hospitalization can be affected by the patients' basal inherent factors including maternal type, we only included baseline variables in the subgroup logistic analysis. The outcome variable was considered as the presence or absence of postoperative inadequate analgesia. A step-wise logistic regression analysis was performed, and all baseline variables were included in the model.

The odds ratio with a 95% CI was calculated. All data were analyzed using SPSS 22.0 and R statistical software. A two-side P-value < 0.05 was considered statistically significant.

Results

Comparisons in Non-Matched Patients

We enrolled 1543 patients, 825 and 718 of whom underwent primary and repeat cesarean delivery, respectively. The demographic and preoperative baseline data of the two groups are shown in Table 1. The mean age of patients in the primiparas group was lower than that of those in the multiparas group ($P < 0.001$). There were significant between-group differences in the incidences of placental disease, oligoamnios or polyhydramnios, pre-diagnosed fetal disease, premature membrane rupture, hypertension, gestational diabetes, emergency operation, intrauterine balloon tamponade, and other synchronized surgeries ($P < 0.05$). There was no significant between-group difference in the other preoperative parameters ($P > 0.05$).

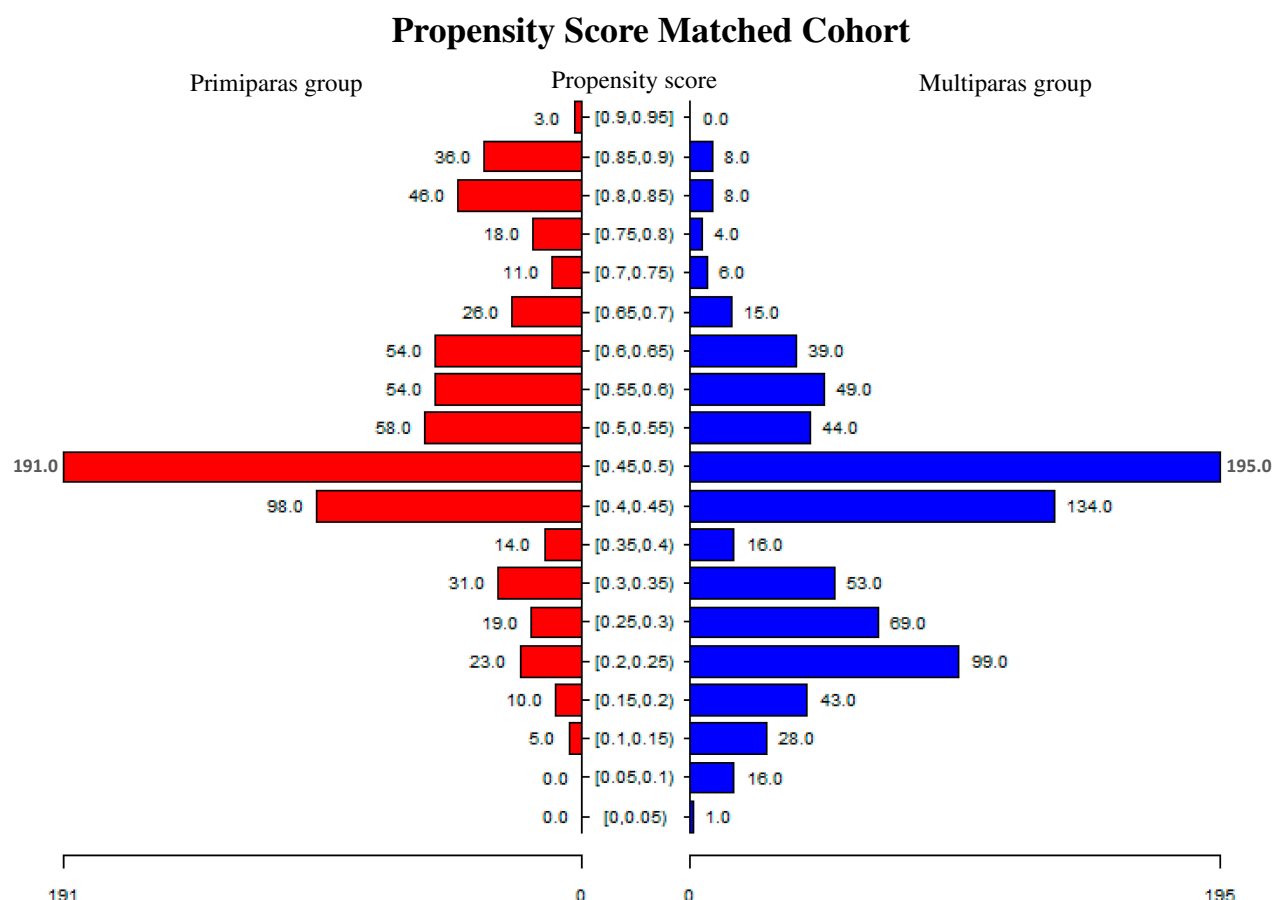


Figure 2 Distributions of subjects in the primiparas and multiparas group after matching of the propensity scores. The distributions of included matched pairs at different propensity scores (from [0–0.05] to [0.90–0.95]) in the multiparas and primiparas group, respectively, were presented.

Table 1 Demographic and Preoperative Baseline Data for All Included Non-Matched Patients

	Primiparas Group (n=825)	Multiparas Group (n=718)	P values
Age (year)	29.6±4.6	32.6±14.7	<0.001
Age group (≥35)	183(16.1%)	133(25.5%)	<0.001
BMI (kg/m ²)	27.5±3.5	27.7±3.4	0.259
Placenta disease	81(9.8%)	107(14.9)	0.002
Oligoamnios or polyhydramnios	82(9.9%)	26(3.6%)	<0.001
Prediagnosed fetal disease	96(11.6%)	27(3.8%)	<0.001
Premature rupture of membrane	129(15.6%)	47(6.5%)	<0.001
Hypertension	95(11.5%)	43(6.0%)	<0.001
Gestational diabetes mellitus	111(13.5%)	124(17.3%)	0.037
Smoking	3(0.4%)	3(0.4%)	0.865
Alcohol drinking	2(0.2%)	0(0.0%)	0.187
Fetal macrosomia	58(7.0%)	40(5.6%)	0.241
History of surgery	139(16.8%)	116(16.2%)	0.715
Emergency operation	345(41.8%)	234(32.6%)	<0.001
Intrauterine Balloon Tamponade	70(8.5%)	100(13.9%)	0.001
Synchronized other surgery	28(3.4%)	123(17.1%)	<0.001

Note: Data were presented as Means ± SD, median (interquartile range) or as numbers (percentage).

Abbreviation: BMI, body mass index.

As shown in Table 2, the incidence of inadequate postoperative analgesia in the primiparas group was lower than that in the multiparas group (16.7% vs. 24.0%, $P < 0.001$). The odds ratio for the multiparas to experience inadequate analgesia was 1.57 (95% CI, 1.22–2.02). And the incidence of extra analgesia requirement for the multiparas group was higher than that in the primiparas group (9.5% vs. 6.2%, $P=0.016$). Intraoperative blood loss, the ratio of women with intraoperative blood loss ≥ 500 mL, and intraoperative blood transfusion volume were higher in the multiparas group than in the primiparas group ($P < 0.001$). The surgery duration in multiparas group was higher than that in primiparas group (83.1 ± 26.4 vs. 76.9 ± 25.2 min, $P < 0.001$). The incidence of presenting an Apgar score ≤ 7 at 1 and 5 min after fetal delivery was higher in the primiparas group than in

Table 2 Intraoperative and Postoperative Outcomes for All Included Non-Matched Patients

	Primiparas Group (n=825)	Multiparas Group (n=718)	P values
Intraoperative blood loss (mL)	320±219	378±290	<0.001
Intraoperative blood loss ≥ 500 mL	91(11.0%)	133(18.5%)	<0.001
Intraoperative blood transfusion (mL)	60(7.3%)	92(12.8%)	<0.001
Surgery duration (min)	76.9±25.2	83.1±26.4	<0.001
Neonatal weight (kg)	3.22±0.59	3.17±0.54	0.062
Apgar score (1min) ≤ 7	45(5.5%)	19(2.6%)	0.006
Apgar score (5min) ≤ 7	22(2.7%)	7(1.0%)	0.015
Apgar score (10min) ≤ 7	16(1.9%)	7(1.0%)	0.119
Intestinal function recovery at 1 day after cesarean delivery	212(25.7%)	152(21.2%)	0.037
Intestinal function recovery at 2 day after cesarean delivery	556(67.4%)	503(70.1%)	0.261
Off-bed activity at 1 day after cesarean delivery	85(10.3%)	70(9.7%)	0.718
Off-bed activity at 2 day after cesarean delivery	527(63.9%)	482(67.1%)	0.180
Neonatal diseases at hospitalization	44(5.3%)	16(2.2%)	0.002
Maternal complication at hospitalization	34(4.1%)	54(7.5%)	0.004
Inadequate analgesia	138(16.7%)	172(24.0%)	<0.001
Extra analgesia requirement	51(6.2%)	68(9.5%)	0.016
Hospital stay(day)	4.4±2.4	4.2±2.5	0.048
Hospital cost(yuan)	16,616±5362	16,398±5570	0.434

Note: Data were presented as Means ± SD or as numbers (percentage).

the multiparas group ($P < 0.05$). The incidence of neonatal diseases at hospitalization was higher in the primiparas group than in the multiparas group (5.3% vs. 2.2%, $P = 0.002$). The incidence of intestinal function recovery at 1 day was higher in the primiparas group than in the multiparas group (25.7% vs. 21.2%, $P = 0.037$) while the incidence of maternal complications at hospitalization was lower in the primiparas group than in the multiparas group (4.1% vs. 7.5%, $P = 0.004$). The length of hospital stay was longer in the primiparas group than in the multiparas group (4.4 ± 2.4 days vs. 4.2 ± 2.5 days, $P = 0.048$).

Comparisons in Matched Patients

After propensity score matching, there was no significant between-group difference in the demographic and preoperative baseline data (Table 3, $P > 0.05$). As shown in Table 4, the surgery duration in the multiparas group was higher than that in primiparas group (82.8 ± 25.9 vs. 74.0 ± 21.2 min, $P < 0.001$). The incidence of inadequate analgesia was lower in the primiparas group than in the multiparas group (16.1% vs. 23.5%, $P = 0.002$), and the odds ratio for a multipara to experience inadequate analgesia was 1.59 (95% CI, 1.19–2.15). The incidence for the needing an extra analgesia in the multiparas group was higher than that of the primiparas group (10.1% vs. 6.5%, $P = 0.026$). The length of hospital stay was longer in the primiparas group than in the multiparas group (4.5 ± 2.8 vs. 4.1 ± 2.5 days, $P = 0.019$) and the hospital cost was higher in the primiparas group than in the

Table 3 Demographic and Preoperative Baseline Data for Matched Patients

	Primiparas Group (n=571)	Multiparas Group (n=571)	P values
Age group (≥ 35)	125(21.9%)	117(20.5%)	0.612
BMI (kg/m^2)	27.4 ± 3.4	27.7 ± 3.4	0.242
Placenta disease	72(12.6%)	75(13.1%)	0.860
Oligoamnios or polyhydramnios	23(4.0%)	26(4.6%)	0.770
Prediagnosed fetal disease	21(3.7%)	26(4.6%)	0.551
Premature rupture of membrane	41(7.2%)	43(7.5%)	0.910
Hypertension	45(7.9%)	40(7.0%)	0.652
Gestational diabetes mellitus	92(16.1%)	104(18.2%)	0.388
Smoking	0(0.0%)	0(0.0%)	1.000
Alcohol drinking	0(0.0%)	0(0.0%)	1.000
Fetal macrosomia	40(7.0%)	32(5.6%)	0.394
History of surgery	103(18.0%)	89(15.6%)	0.303
Emergency operation	201(35.2%)	208(36.4%)	0.711
Intrauterine Balloon Tamponade	66(11.6%)	89(15.6%)	0.058
Synchronized other surgery	29(5.1%)	34(6.0%)	0.604

Note: Data were presented as Means \pm SD, median (interquartile range) or as numbers (percentage).

Abbreviation: BMI, body mass index.

Table 4 Intraoperative and Postoperative Outcomes for Matched Patients

	Primiparas Group (n=571)	Multiparas Group (n=571)	P values
Intraoperative blood loss (mL)	342 ± 253	369 ± 277	0.086
Intraoperative blood loss ≥ 500 mL	81(14.2%)	101(17.7%)	0.125
Intraoperative blood transfusion (mL)	53(9.3%)	70(12.3%)	0.127
Surgery duration	74.0 ± 21.2	82.8 ± 25.9	<0.001
Neonatal weight (kg)	3.26 ± 0.55	3.18 ± 0.54	0.009
Apgar score (1min) ≤ 7	20(3.5%)	13(2.3%)	0.289
Apgar score (5min) ≤ 7	10(1.8%)	5(0.9%)	0.298
Apgar score (10min) ≤ 7	7(1.2%)	4(0.7%)	0.545
Intestinal function recovery at 1 day after cesarean delivery	135(23.6%)	123(21.5%)	0.436
Intestinal function recovery at 2 day after cesarean delivery	382(66.9%)	400(70.1%)	0.279
Off-bed activity at 1 day after cesarean delivery	55(9.6%)	58(10.2%)	0.843
Off-bed activity at 2 day after cesarean delivery	360(63.0%)	380(66.5%)	0.239
Neonatal diseases at hospitalization	0(0.0%)	0(0.0%)	1.000
Maternal complication at hospitalization	32(5.6%)	35(6.1%)	0.801
Inadequate analgesia	92(16.1%)	134(23.5%)	0.002
Extra analgesia requirement	37(6.5%)	58(10.1%)	0.026
Hospital stay(day)	4.5 ± 2.8	4.1 ± 2.5	0.019
Hospital cost (yuan)	$17,125 \pm 5790$	$16,111 \pm 5051$	0.002

Note: Data were presented as Means \pm SD or as numbers (percentage).

multiparas group ($17,125 \pm 5790$ vs. $16,111 \pm 5051$ Yuan, $P = 0.002$). In addition, the neonatal weight was higher in the primiparas group than in the multiparas group (3.26 ± 0.55 vs. 3.18 ± 0.54 kg, $P = 0.009$) (Table 4).

Subgroup Analysis

For all included maternal women, the results of stepwise logistic regression analysis showed that only multiparas was identified as a risk factor of inadequate analgesia (OR = 1.53, 95% CI: 1.19–1.97, $P = 0.001$; Table 5). In maternal women with an age ≥ 35 years, multiparas (OR = 2.18, 95% CI: 1.20–3.95, $P = 0.010$) and gestational diabetes mellitus

Table 5 Factors with Statistical Significance on Inadequate Analgesia in Stepwise Logistic Regression Analysis for Different Age Groups

Subjects	Factors with Statistical Significance	Wald	P value	OR	95% CI
All maternal women(n=1543)					
	Multipara	11.05	0.001	1.53	1.19 to 1.97
Maternal Women≥35 years(n=317)					
	Multipara	6.56	0.010	2.18	1.20 to 3.95
	Premature rupture of membrane	4.56	0.033	0.11	0.02 to 0.83
	Gestational diabetes mellitus	4.76	0.029	1.96	1.07 to 3.58
Maternal Women<35 years(n=1226)					
	Multipara	6.06	0.014	1.43	1.08 to 1.89

Abbreviations: CI, confidence interval; OR, odds ratio.

(OR = 1.96, 95% CI: 1.07–3.58, $P = 0.029$) were identified as risk factors of inadequate analgesia while premature membrane rupture (OR = 0.11, 95% CI: 0.02–0.83, $P = 0.033$) was the protective factor against inadequate analgesia. In contrast, for maternal women with an age < 35 years, multiparas was the only risk factor of inadequate analgesia (OR = 1.43, 95% CI: 1.08–1.89, $P = 0.014$).

Discussion

To the best of our knowledge, this is the first study to explore the differences in postoperative analgesia between primiparas undergoing primary cesarean delivery and multiparas undergoing a repeat cesarean delivery through retrospective analysis. Our findings showed that the incidence of inadequate analgesia was significantly lower in the primiparas group than in the multiparas group. This finding was further validated in the matched cohort obtained after propensity score matching and also by a subgroup analysis of both age groups (≥ 35 and < 35 years).

In the United States, it has been reported that repeat cesarean delivery due to a previous uterine scar contributed to more than 30% of all cesarean deliveries.^{17,18} Therefore, it is important to understand the difference in the degree of postoperative pain between patients with primary and repeat cesarean delivery to improve postoperative analgesic management. We found that the incidence of inadequate analgesia was lower in the primiparas group than in the multiparas group in both the non-matched and matched cohorts. The results showed that the multiparas are more likely to require extra analgesia than the primiparas, which could be an indicator for postoperative analgesia requirement. In the logistic analysis, multiparas was identified as a risk factor of inadequate analgesia in all maternal women (OR = 1.53, 95% CI:

1.19–1.97) and in those in the different age groups. This further demonstrated that multiparas is a significant predictor of inadequate analgesia in women undergoing cesarean delivery and should be considered when formulating the postoperative analgesic strategy.

Based on the current and previous findings, this phenomenon could be attributed to several reasons. First, a previous history of surgery might increase patients' pain sensitivity^{11,19} and has been identified as a risk factor for experiencing inadequate postoperative pain treatment.²⁰ Second, severe adhesions induced by previous surgery are often inevitable, and thus could increase operative difficulties.^{21,22} The surgery duration in multiparas group was higher than that in primiparas group in both the non-matched and matched cohorts, suggesting increased operative difficulties in patients who underwent a previous cesarean delivery. Therefore, based on the above information, it can be speculated that multiparas might experience more postoperative pain than primiparas. However, the mean hospital stay was longer in the primiparas group than in the multiparas group in both non-matched and matched cohorts. This suggests that primiparas might need more care than multiparas after cesarean delivery. Moreover, the hospital cost was higher in the primiparas group than in the multiparas group in the matched cohort, which might due to the longer hospital stay.

Our results showed that gestational diabetes mellitus (OR = 1.96, 95% CI: 1.07–3.58) was a risk factor for inadequate analgesia in maternal women with an age ≥ 35 years. Since the age of the multiparas was higher than that of the primiparas, their chance of developing diabetes was higher. A previous study has reported increased pain sensitivity in diabetic patients,^{23,24} which could have also attributed to the inadequate analgesia. Moreover, we found

that premature membrane rupture (OR = 0.11, 95% CI: 0.02–0.83), which can induce uterine contraction, was a protective factor against inadequate analgesia in maternal women with an age ≥ 35 years. We speculated that early uterine contraction may be an influencing factor in postoperative pain treatment. This interesting finding can be considered in postoperative analgesia for older parturient women; however, future studies should provide direct clinical evidence.

Several limitations should be considered when interpreting the results of the current study. First, this was a retrospective study, which limits the collection of relevant data for this investigation. Second, only Chinese women from urban areas were included; therefore, race and socioeconomic status should be considered when interpreting the current results.^{25,26} Thirdly, instead of neuraxial analgesic, tramadol and flurbiprofen axetil were used as PCIA after cesarean section. Therefore, the possible difference in analgesia outcomes between primiparas and multiparas when using other analgesic strategies require further validation. In addition, in our hospital mechanical pump was used for PCIA, which could not record the analgesic consumption and we were not able to report the amount of analgesic used between the two groups. Thus the analgesic consumption between primiparas and multiparas should be studied in the future.

In summary, compared to primiparas, multiparas undergoing a repeat cesarean delivery had a significantly higher risk of experiencing inadequate postoperative pain treatment. Individual differences between primiparas and multiparas should be considered when formulating the postoperative analgesia strategy after cesarean delivery in the future.

Abbreviations

OR, Odds ratio; CI, Confidence interval; BMI, body mass index; PCIA, patient-controlled intravenous analgesia.

Ethics and Consent Statement

The study protocol was approved by the Institutional Ethics Committee of Second Affiliated Hospital of Army Medical University, Chongqing, China (approved ID: 2019-040-1)

Data Sharing Statement

All data can be acquired from the corresponding author (HL) by request.

Author Contributions

All authors contributed to data analysis, drafting and revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no competing interests.

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