

Effect of Personality and Pain Catastrophizing on Postoperative Analgesia Following Cesarean Section: A Prospective Cohort Study

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Purpose: This study aimed to investigate the effects of different psychological personalities and pain catastrophizing levels on postoperative analgesia in patients undergoing cesarean section.

Patients and Methods: Puerperas who underwent cesarean section at our hospital between January and August 2023 were recruited into the study and assessed using the Eysenck Personality Questionnaire-Revised Short Scale (EPQRSC) and Pain Catastrophizing Scale (PCS). Data on the numerical pain intensity at rest and during activity 24 h after surgery, number and dosage of analgesia pumps, and satisfaction with analgesia were recorded. According to the numerical pain score during activity 24 h post-operation, the patients were divided into the analgesia incomplete group (≥ 4) and control group (< 4). Univariate analysis, Spearman correlation analysis, and binary logistic regression analysis were used to evaluate the influence of personality characteristics and PCS on postoperative analgesia.

Results: A total of 778 women were included in the study. The incidence of inadequate analgesia was 89.8%. The satisfaction rate of analgesia was 66.8%. Univariate analysis showed that extraversion; neuroticism; PCS; numbers of previous cesarean delivery; ASA; analgesic satisfaction; and 24-h analgesia pump compressions and dosage were associated with postoperative analgesia after cesarean section ($P < 0.05$). Using binary logistic regression analysis, the first cesarean section (odds ratio [OR]=0.056, 95% confidence interval [CI]=1.913–19.174), the number of 24-h analgesic pump compressions (OR=8.464, 95% CI=0.356–0.604), extraversion (OR=0.667, 95% CI=0.513–0.866), neuroticism (OR=1.427, 95% CI=1.104–1.844), and PCS (OR=7.718, 95% CI=0.657–0.783) were factors affecting postoperative analgesia.

Conclusion: The incidence of inadequate analgesia after a cesarean section was high (89.8% on the first day after surgery). Formulating accurate analgesia programs for women undergoing cesarean section with extraversion, neuroticism personality characteristics, and pain catastrophizing behaviors is necessary for improving their postoperative analgesia effects and satisfaction and promoting postpartum comfort.

Keywords: aftercare, anesthetics, breast feeding, fear, personal satisfaction, postpartum depression

Introduction

Cesarean delivery is one of the most common surgical procedures, accounting for $>21\%$ of all live births, according to data from 169 countries.¹ In China, the annual cesarean delivery rate reached 45.2% in 2018 after relaxing the one-child policy.² Due to the influence of postpartum contractions and surgical incisions, women undergoing cesarean section often experience severe postoperative pain.^{3,4} However, despite the numerous measures developed to manage postoperative pain, inadequate analgesia following cesarean section was common, with an incidence of 68–76%.^{5,6} Inadequate pain treatment and a high risk of severe acute pain could be possible explanations.⁷ Insufficiently treated acute pain following

childbirth may become chronic; post-discharge opioid use after cesarean section may be higher than expected.^{8–10} Furthermore, severe acute post-cesarean pain triples a woman's risk of developing postpartum depression and negatively affects breastfeeding and infant care.^{11–13} Therefore, adequate postoperative analgesia is imperative for the cesarean patient population.

Pain catastrophizing is conceptualized as a negative cognitive-affective response to anticipated or actual pain, comprising elements of magnification, rumination, and helplessness.¹⁴ Pain catastrophizing is a robust predictor of adverse pain outcomes.^{15–17} In a US representative sample of 662 participants, Wilson et al¹⁸ found associations between pain catastrophizing and occurrence of late pregnancy pain in women scheduled for cesarean section. The most consistent finding is that elevated scores on measures of pain catastrophizing were associated with more severe pain.

In addition, in a prospective cohort study involving 50 women undergoing cesarean section, psychoticism in personality traits was associated with pain catastrophizing and fear of pain scores.¹⁹ A prospective cohort study of 39 pregnant women showed that personality traits (psychoticism, extraversion, and Lie) had some potential to predict labor pain, epidural local anesthetic use, and timing of epidural analgesia requests.²⁰ Puerperas with different personality characteristics tend to adopt different coping strategies for managing pain, which may lead to misunderstanding or amplification of somatic sensations related to pain, thereby affecting the level of acute postoperative pain. However, there is still a lack of large-sample studies on the relationship between personality traits, pain catastrophizing, and postoperative pain, particularly in women undergoing cesarean sections with a high incidence of inadequate postoperative analgesia. Therefore, we hypothesized that personality characteristics and the pain-catastrophizing level of women who underwent cesarean section may affect postoperative analgesia score and satisfaction. We aimed to test our hypothesis in a prospective cohort study of women who underwent cesarean section in our hospital.

Patients and Methods

Study Design and Patient Population

This prospective cohort study was conducted at a tertiary general hospital in Western China. Written informed consent was obtained from all patients before inclusion in the study. The study was conducted in accordance with the Declaration of Helsinki and the World Medical Association and approved by the Ethics Committee of Mianyang Hospital Affiliated to the University of Electronic Science and Technology of China (reference number: S20230369-01). The inclusion criteria were: (i) puerperas scheduled for cesarean section, (ii) 37–42 gestational weeks, and (iii) the ability to provide informed consent. The exclusion criteria were: (i) presence of psychiatric disease, (ii) complications with organ dysfunction, and (iii) painless labor transferred for cesarean section. The puerperas were recruited between January and August, 2023.

General Information Questionnaire

We investigated the puerperas' demographic data including age, number of previous cesarean sections, anesthesia method, ASA, and emergency cesarean section. Validated questionnaires were completed by each participant both after admission and before surgery.

Eysenck Personality Questionnaire-Revised Short Scale

Personality traits were assessed using the neuroticism subscale of the Eysenck Personality Questionnaire-Revised Short Scale (EPQRSC),²¹ which was developed by Eysenck et al to evaluate four personality domains: neuroticism, extraversion, psychoticism, and a lie detector inventory. The scale is a 48-item questionnaire ("yes" = 1 point, "no" = 0 points). Each subscale is 0–12 points, and the higher the score was, the more obvious a personality trait was. The EPQRSC has been validated in the Chinese population.

Pain Catastrophizing Scale

Pain catastrophizing was assessed using the 13-item Pain catastrophizing scale (PCS), which is a validated and widely used instrument for measuring pain-related catastrophic thinking. The participants responded to each item using a 5-point Likert scale (0 = "not at all", 4 = "all the time"). This scale provided a total score and had three subscales: rumination

(four items), magnification (three items), and helplessness (six items). The total PCS score ranged between 0 and 52, with higher scores indicating greater pain catastrophizing. According to the PCS user manual, a total PCS score of 30 was clinically significant. The Chinese version of the scale is reliable and valid.²²

Evaluation of Postoperative Analgesic

Resting and movement numerical pain rating scales for rest and movement:

Pain was assessed using Numeric Rating Scale (NRS), with numbers from 0 to 10 were used to indicate the degree of pain, 0 indicating no pain and 10 indicating the maximum pain imaginable. The resting score referred to the resting-state pain score, while the activity pain score was defined as the pain score during 90° turning over or getting out of bed. According to the NRS score of activity within 24 h after surgery, the patients were divided into mild and less severe pain groups (NRS 0–3 points) and moderate and severe pain groups (NRS 4–10 points). Moderate and severe pain was defined as inadequate analgesia.²³

Dosage and Pressing Times of Analgesia Pump

The consumption and pressing times of the analgesia pump were recorded 24 h after operation.

Satisfaction with Analgesia

Postoperative analgesia satisfaction was divided into four categories: strong satisfaction, satisfaction, neutral, and dissatisfied. The participants classifying the item as “strong satisfied” or “satisfied” were identified as analgesic satisfied.

Data Collection

The researchers received uniform training prior to conducting the survey. The structured questionnaire was administered at the time of preoperative anesthesia assessment, within 2 h before surgery. The questionnaire included general information, EPQRSC, and PCS. The study protocol was explained to the patients, then the puerperas willing to participate in the survey provided written informed consent before filling out the questionnaires independently, with unified guidance from the researchers. When the patients encountered difficulties, the researchers provided assistance, such as detailed explanations and reading items. The researchers collected questionnaires immediately after completion.

The postoperative intravenous analgesia pump was configured by anesthesia specialist nurses according to the doctor's advice, and analgesic-related information regarding 24 h intravenous analgesia pump consumption and pressing times were recorded. The patient-controlled intravenous analgesia (PCIA) formula was sufentanil (1 mg/L) + nalbuphine (0.4 g/L), made up to 150 mL with normal saline. The PCIA pump parameters were: background dose, 3 mL/h; PCA, 3 mL/min; lockout time, 20 min. The type of drug, drug concentration, background dose, and single boost dose were the same for all parturient analgesia pumps. The puerpera performed single-booster compressions according to their needs.

Statistical Analysis

Data analysis was performed using SPSS statistical software version 26.0. Descriptive statistics were performed; the characteristics of the study participants and inadequate analgesia are presented as the mean for continuous data and proportion for all categorical variables. Bivariate analyses were performed using the *t*-test for continuous variables and chi-square test of independence for categorical variables. Spearman correlation analysis was used to analyze correlations between personality characteristics, pain catastrophizing, and inadequate analgesia. Using the binary logistic regression, a *p*-value of <0.05 was used to confirm the presence of statistically significant associations between personality traits, pain catastrophizing, and incomplete analgesia, adjusted odds ratios (OR) with the corresponding 95% confidence intervals (CI) were used to show the precision of the strength of association measure. Omnibus and Hosmer–Lemeshow tests were used to evaluate model fit.

Results

Demographic Data and Univariate Analysis

A total of 791 women undergoing cesarean section were recruited in the study. However, 13 patients withdrew prior to 24 h follow-up (Figure 1). For the primary time point of acute post-cesarean pain at 24 h at active, 778 patients aged 21–47 years

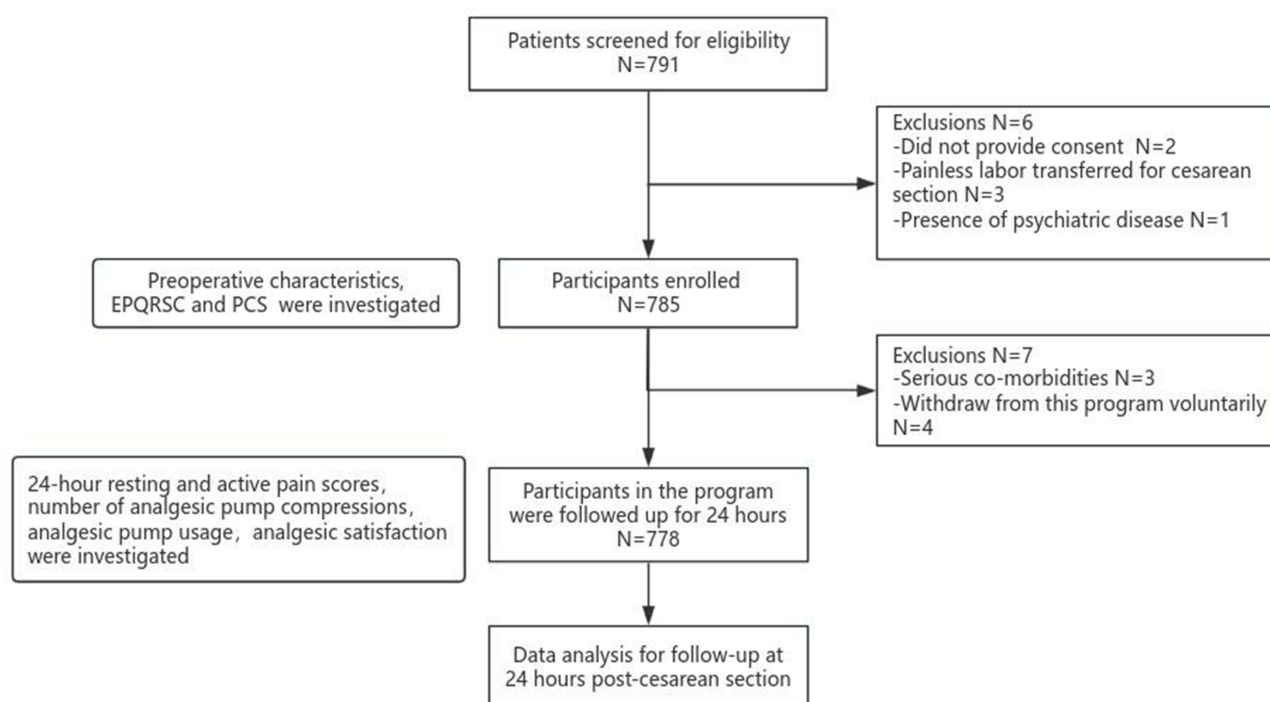


Figure I Study flow diagram.

completed the follow-up. At 24 h post-cesarean delivery, 778 patients were categorized into two groups, with the first having minimal to mild pain scores of 0–3 ($n=79$), and the other having moderate-to-severe pain scores of 4–10 ($n=699$). In this study, the incidence of hypoanalgesia after cesarean section was 89.8% ($699/778$). In addition, 520 participants rated the program as “very satisfied” or “satisfied”, with an analgesic satisfaction rate of 66.8% ($520/778$). The demographic data of the women who underwent cesarean section in the two groups are summarized in Table 1. There were statistically significant differences in the times of previous cesarean sections and ASA score between the two groups ($p < 0.05$).

Table I General Demographic of Cesarean Delivery Women with Inadequate Analgesia ($n=778$)

Variable	Inadequate Analgesia Group ($n=699$)	Adequate Analgesia Group ($n=79$)	t/ χ^2	P
Age	31.38 $\pm$ 4.33	32.05 $\pm$ 3.56	-1.545	0.125
Number of previous cesarean sections			10.769	0.005
I	532 (76.12)	50 (63.30)		
2	152 (21.74)	29 (36.70)		
3	15 (2.14)	0 (0)		
Anesthesia method			1.666	0.435
Intravertebral anesthesia	643 (91.99)	72 (91.14)		
General anesthesia	30 (4.29)	2 (2.53)		
Intraspinal anesthesia combined with general anesthesia	26 (3.72)	5 (6.33)		
ASA			21.606	0.000
I	656 (93.85)	0 (0)		
II	37 (5.29)	17 (21.52)		
III	6 (0.86)	62 (78.48)		
Emergency cesarean section			2.301	0.129
Yes	681 (97.42)	74 (93.67)		
No	18 (2.58)	5 (6.33)		

Abbreviation: ASA, American Society of Anesthesiologists.

Table 2 Pain Characteristics and Univariate Analyses (Based on 24 Hours Acute Post-Cesarean Pain Score, at Active)

Variable	Inadequate Analgesia Group (n=699)	Adequate Analgesia Group (n=79)	t/x ²	P
NRS-R	2.70±1.607	1.04±0.406	-0.913	0.000
NRS-A	6.88±1.271	3.00±0.210	-27.098	0.000
Satisfaction with analgesia			68.462	0.000
Strong satisfaction	1 (0.13)	7 (8.86)		
Satisfaction	443 (63.38)	69 (87.34)		
Neutral	218 (31.19)	3 (3.80)		
Dissatisfaction	37 (5.30)	0 (0)		
24-hour number of analgesic pump presses	7.71±2.57	3.90±2.71	-8.076	0.000
24-hour dose of Analgesic pump (mL)	88.38±14.38	74.53±15.00	-12.401	0.000
Psychoticism	3.30±1.937	3.54±2.156	0.290	0.222
Extroversion	6.67±4.812	8.71±3.649	3.644	0.000
Neuroticism	5.89±3.855	4.01±3.280	-0.416	0.000
Lie	6.98±2.408	6.53±2.224	-1.595	0.111
PCS	45.76±8.804	23.38±8.048	-21.595	0.000

Abbreviations: NRS, Numeric rating scale; A, active; R, resting; PCS, Pain Catastrophizing Scale.

Univariate analysis showed statistically significant differences in pain catastrophization; analgesic satisfaction; extraversion; neuroticism; and 24-h analgesic pump use and number of compressions between the two groups ($p < 0.05$) (Table 2).

Spearman Correlation Analysis

Correlation analysis showed that extraversion, neuroticism, PCS with analgesia were correlated with 24-h activity NRS score ($r = -0.400$, $r = 0.478$, $r = 0.613$, $p < 0.05$) (Table 3).

Binary Logistic Regression Analysis

Binary logistic regression analysis was performed including the number of previous cesarean sections, ASA score, psychoticism, extraversion, neuroticism, lie and pain catastrophizing score as independent variables and occurrence of

Table 3 Correlation Analysis of Preoperative Personality Characteristics, Pain Catastrophizing, and 24-h Analgesic Effect After Cesarean Section

Variable	Psychoticism	Extroversion	Neuroticism	Lie	PCS	NRS-R	NRS-A
Psychoticism	1	0.079	-0.013	0.027	-0.118*	-0.018	-0.028
Extroversion	0.079	1	-0.041	-0.091	0.145*	-0.029	-0.400*
Neuroticism	-0.013	-0.041	1	-0.064	-0.028	0.120*	0.478*
Lie	0.027	-0.091	-0.064	1	0.153*	0.039	0.018
PCS	-0.118*	0.145*	-0.028	0.153*	1	0.144*	0.613*
NRS-R	-0.018	-0.029	0.120*	0.039	0.144*	1	0.331*
NRS-A	-0.028	-0.400*	0.478*	0.018	0.613*	0.331*	1

Note: * $P < 0.05$.

Abbreviations: NRS, Numeric rating scale; A, active; R, resting; PCS, Pain Catastrophizing Scale.

Table 4 Factors Affecting Inadequate Analgesia Outcomes Among the Study Population Using Binary Logistic Regression Analysis Considering Adequate Analgesia as Reference

Variable	Category	B	p	OR	95% CI for OR	
					Lower Bound	Upper Bound
No. of previous cesarean sections	I	−1.801	0.002	1.056	1.913	19.174
	2	15.592	0.999	0	0	
	3	Reference				
ASA	I	0.999	0.719	2.039	0.042	98.153
	II	0.935	0.803	1.256	0.21	7.514
	III	Reference				
24-hour number of analgesic pump presses		0.769	0.000	8.464	0.356	0.604
24-hour dose of Analgesic pump		0.123	0.936	1.131	0.057	22.336
Psychoticism		−0.193	0.165	0.825	0.628	1.083
Extroversion		0.355	0.002	0.667	0.513	0.866
Neuroticism		7.372	0.007	1.427	1.104	1.844
Lie		−0.017	0.745	0.983	0.888	1.088
PCS		0.732	0.000	7.718	0.657	0.783

Abbreviations: OR, odds ratio; CI, confidence interval; PCS, Pain Catastrophizing Scale.

insufficient analgesia as the dependent variable. Omnibus tests (chi-square = 378.392, $p < 0.05$) and Hosmer-Lemeshow tests (chi-square = 9.695, $p = 0.207$) showed that the model fit was good. The number of 24-h analgesic pump compressions and first cesarean section were correlated with insufficient analgesia (OR=8.464, 95% CI=0.356–0.604; OR=0.056, 95% CI=1.913–19.174). Binary logistic regression analysis further confirmed that extraversion (OR=0.667, 95% CI=0.513–0.866), neuroticism (OR=1.427, 95% CI=1.104–1.844), and PCS (OR=7.718, 95% CI=0.657–0.783) were factors affecting postoperative analgesia. (Table 4)

Discussion

Attention should be paid to the high incidence of inadequate analgesia during a cesarean section. At present, although PCIA with sufentanil (a μ -receptor agonist) is usually used clinically to relieve maternal pain and can effectively relieve the level of incision pain, it is not effective in oxytocin-induced uterine contractions. In our study, women undergoing cesarean delivery still experienced obvious postoperative pain, despite receiving routine postoperative PCIA; the incidence of inadequate postoperative analgesia was as high as 89.85%, which is similar to that reported by Borges et al,²⁴ but much higher than that reported by Bekele et al.²⁵ Another study of 2323 Chinese women who underwent cesarean section showed that 59.1% of women had inadequate analgesia 48 h after surgery, despite using a mixture of tramadol and furoprofen acetate.³ One reason for our result is that we used a 24-h activity NRS score of ≥ 4 to assess inadequate analgesia, and the analgesia score at 24 h was higher than that at 48 h, thereby the incidence of analgesia is higher. Furthermore, the numerical pain scale used was subjective, and the results might differ in people with different ethnic and cultural backgrounds.²⁶ Recent studies have focused on the development of more objective predictors to evaluate pain after cesarean section.^{27,28} On the one hand, postoperative pain affects maternal mental health, increases healing time, and reduces early mobility and functional activities, thereby increasing the length of hospital stay and leading to chronic postoperative pain.^{29,30} However, it also prolongs the mother-infant relationship, affects breastfeeding, and affects the growth and development of newborns.³¹ Taking appropriate measures and implementing more accurate evaluations to reduce acute postpartum pain after a cesarean section are necessary.

In our study, extraversion and neuroticism were found to be associated with inadequate postoperative analgesia ($r = -0.400$, $r = 0.478$, $p < 0.05$). Binary logistic regression further showed that extraversion was a protective factor for postoperative analgesia (OR=0.667, 95% CI=0.513–0.866). Furthermore, neuroticism was a risk factor for postoperative analgesia (OR=1.427, 95% CI=1.104–1.844), which was consistent with Sutin et al's study.³² Park³³ showed that the degree of

extraversion was associated with fewer unpleasant responses to sadness and fewer heart rate responses to pain and sadness. Introduction or extraversion may lead to the worsening of chronic pain. Therefore, introversion and extraversion personality factors should be considered in the individualized management of pain.³⁴ Neuroticism is an important factor in pain control.³⁵ Elgaeva et al³⁶ showed that neurotic personality traits may influence pain through a positive feedback loop. However, the mechanisms by which personality traits affect surgical pain and demand for analgesic drugs are still not fully understood and require further research.

A meta-analysis of psychological factors related to acute postoperative pain showed that neuroticism and pain catastrophizing influenced acute postoperative pain.³⁷ Moreover, another study showed that neuroticism and PCS aggravate pain.³⁸ PCS in our study were associated with numeric pain scores at 24 h of activity ($r=0.613$, $p<0.05$). Logistic regression analysis also showed that PCS was a high risk factor for postoperative analgesia (OR=7.718, 95% CI=0.657–0.783). Previous studies have also shown that PCS was significantly associated with both acute and chronic pain after surgery.^{39,40} In addition, the emerging pattern of findings supports the view that the relationship between PCS and pain experience could be likely bidirectional, as the experience of pain could give rise to catastrophic thinking, contributing to adverse pain outcomes.⁴¹ It has been shown that PCS was associated with greater acute pain intensity and increased risk of persistent pain after cesarean section.^{26,42} In the present study, pregnant women with PCS had significantly higher pain scores after cesarean section, which in turn may have increased their risk of ongoing pain and postpartum depression. The focus on PCS may become an important way to manage pain after cesarean section. Finally, binary logistic regression analysis showed that the first cesarean section (OR=1.056, 95% CI=1.913–19.174) and number of 24-h analgesic pump compressions (OR=8.464, 95% CI=0.356–0.604) were risk factors for inadequate analgesia within 24 h after cesarean section. In our study, there was a higher incidence of analgesia during primary cesarean section compared to secondary and tertiary cesarean sections. The findings by Duan et al⁴³ also confirmed our results: women, particularly primiparas, often experience great anxiety and fear of childbirth during the prenatal period.^{44,45} Namely, the incidence of inadequate analgesia in women undergoing secondary cesarean section may be lower. Therefore, more attention should be paid to primiparous pain management in the future, including the development of personalized interventions for women with different parities undergoing cesarean section.

Limitations

This study has several limitations. First, it only included women who underwent cesarean delivery at a tertiary hospital in western China. Second, owing to time limitations, we did not record the analgesic effect or chronic pain status at 48 h or longer. Therefore, racial and regional economic factors and follow-up duration should be considered when interpreting these results. In the future, multicenter studies with larger sample sizes and longer follow-up periods, including other populations, may be needed to address these limitations.

Conclusion

Despite using postoperative controlled intravenous analgesia, the lack of analgesia after cesarean section is still relatively common. Based on the results of this study, we should consider the personality differences among patients undergoing cesarean section, particularly extraversion and neuroticism, and pay attention to the level of PCS for analgesia after cesarean section. Identifying women who are at a higher risk for severe postoperative pain before surgery, we may target this group for more intensive analgesic interventions to improve postoperative analgesia, promote postpartum comfort, and improve analgesic satisfaction.

Data Sharing Statement

No additional data are available.

Patient Consent

Informed consent was obtained from all participants.

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Disclosure

The authors have declared that no competing interests exist.

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