



Management and impacts of acute post-cesarean section pain in a usual-risk maternity hospital: cross-sectional study

Manejo e impactos da dor aguda pós-cesariana em uma maternidade de risco habitual: estudo transversal

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ABSTRACT

BACKGROUND AND OBJECTIVES: Pain management during labor has been extensively explored, but few studies investigate acute postoperative pain following the cesarean section (APPC). The objective of this study was to analyze the management and impacts of APPC among postpartum women in the immediate postoperative period.

METHODS: This was a cross-sectional and analytical study, which employed questionnaires and documentary analysis. It was conducted between March and July 2023 in a philanthropic maternity hospital for low-risk pregnancies in Northeast Brazil, affiliated with the Brazilian Public Health System (SUS), and included postpartum women in the immediate postoperative period of cesarean section. This study outcomes were inadequate management of APPC and its impacts on the well-being and activities of postpartum women. Chi-square, Fisher's Exact tests, MANOVA, Friedman's ANOVA, Bonferroni *post-hoc* test, and Poisson regression were used for data analysis.

RESULTS: A total of 321 puerperal women were included, 232 of whom (72.3%) reported APPC. Both the prevalence of moderate to severe APPC and analgesic inadequacy was 38% (n=122). Painful experience in previous deliveries was independently associated with an 88% higher prevalence of analgesic inadequacy of the APPC (95% CI: 1.32-2.69; p=0.001), when adjusted for the age of the puerperae. Moderate to severe pain had an impact on activities such as sitting/standing, dressing, bathing, intimate hygiene, walking, breastfeeding, sleep, mood and the ability to enjoy life.

CONCLUSION: Inadequate management of APPC was associated with previous painful childbirth experience and negatively impacted the well-being and daily activities of postpartum women.

KEYWORDS: Caesarean section, Postoperative pain, Obstetric nursing, Pain management.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O manejo da dor durante o trabalho de parto normal tem sido amplamente explorado, mas poucos estudos investigam a dor aguda pós-cesariana (DAPC). O objetivo deste estudo foi analisar o manejo e os impactos da DAPC entre puérperas em pós-operatório mediato.

MÉTODOS: Trata-se de um estudo transversal e analítico, que empregou aplicação de formulário e análise documental, realizado no período de março a julho de 2023 em uma maternidade filantrópica de risco habitual do Nordeste do Brasil, conveniada ao Sistema Único de Saúde, que incluiu puérperas em pós-operatório mediato de cesariana. Os desfechos do estudo foram inadequação analgésica da DAPC e seus impactos no bem-estar e nas atividades das puérperas. Os testes Qui-quadrado, Exato de Fisher, MANOVA, ANOVA de Friedman, pós-teste de Bonferroni e a regressão de Poisson foram utilizados na análise dos dados.

RESULTADOS: Foram incluídas 321 puérperas, dentre as quais 232 (72,3%) referiram DAPC. Tanto a prevalência de DAPC moderada à intensa quanto a de inadequação analgésica foram de 38% (n=122). A experiência dolorosa em partos prévios foi independentemente associada a uma prevalência 88% maior de inadequação analgésica da DAPC (IC 95%: 1,32-2,69; p=0,001), quando ajustada à idade das puérperas. A intensidade moderada à intensa da dor impactou atividades como se sentar/levantar-se, vestir-se, banhar-se, higiene íntima, deambulação, amamentação, o sono, o humor e a habilidade em apreciar a vida.

CONCLUSÃO: A inadequação analgésica da DAPC esteve diretamente associada à experiência dolorosa prévia e impactou o bem-estar e atividades da vida diária das puérperas.

DESCRIPTORIOS: Cesariana, Dor pós-operatória, Enfermagem obstétrica, Manejo da dor.

HIGHLIGHTS

Analgesic inadequacy for acute post-cesarean pain (APPC) can impact surgical recovery

The adequacy of pharmacological analgesia was estimated using the Pain Management Index (PMI)

Moderate to severe APPC had a negative impact on the puerperal women's activities of daily living

Previous pain experience was associated with the analgesic inadequacy of APPC

GRAPHICAL ABSTRACT

Management and impacts of acute post-cesarean section pain in a usual-risk maternity hospital: cross-sectional study

Method

Study design Cross-sectional and analytical study.	Sample n=320 Low-risk postpartum women in the mediate postoperative period of cesarean section.	Outcomes Management of acute post-cesarean pain (APCP) and its impacts on the well-being and activities of postpartum women.	Study period and location March to July 2023 in a low-risk maternity hospital in northeastern Brazil
Statistical analysis The impacts of DAPC were represented by median and interquartile ranges. Chi-square, Fisher's exact test, MANOVA, Friedman's ANOVA, Bonferroni post-test and Poisson regression.			

Results

Pain prevalence 232 (72.3%) postpartum women reported APCP. Pain was not systematically recorded in 317 medical records (98.8%). The experience of pain in previous deliveries was associated with an 88.0% higher prevalence of analgesic inadequacy.	Mild pain vs. Severe pain <table border="1"> <tr> <td> Mood 0 vs. 2 (p= 0.019) </td> <td> Ambulation 3 vs. 6 (p=0.008) </td> <td> Sleep 1 vs. 5 (p=0.003) </td> <td> Sit/stand 4 vs. 8 (p<0.001) </td> </tr> <tr> <td> Bath 0 vs. 3 (p= 0.007) </td> <td> Dress up 2 vs. 3 (p= 0.010) </td> <td> Intimate hygiene 0 vs. 1 (p= 0.013) </td> <td></td> </tr> <tr> <td> Enjoy life 0 vs. 0 (p= 0.001) </td> <td> Breastfeeding 0 vs. 2 (p= 0.042) </td> <td> Hold newborn 0 vs. 0 (p= 0.026) </td> <td></td> </tr> </table>	Mood 0 vs. 2 (p= 0.019)	Ambulation 3 vs. 6 (p=0.008)	Sleep 1 vs. 5 (p=0.003)	Sit/stand 4 vs. 8 (p<0.001)	Bath 0 vs. 3 (p= 0.007)	Dress up 2 vs. 3 (p= 0.010)	Intimate hygiene 0 vs. 1 (p= 0.013)		Enjoy life 0 vs. 0 (p= 0.001)	Breastfeeding 0 vs. 2 (p= 0.042)	Hold newborn 0 vs. 0 (p= 0.026)		Mild pain vs. Moderate pain <table border="1"> <tr> <td> General activities 3 vs. 5 (p= 0.004) </td> </tr> <tr> <td> Ambulation 3 vs. 4 (p= 0.032) </td> </tr> <tr> <td> Sit/stand 4 vs. 6 (p<0.001) </td> </tr> <tr> <td> Dress up 2 vs. 4 (p= 0.029) </td> </tr> </table>	General activities 3 vs. 5 (p= 0.004)	Ambulation 3 vs. 4 (p= 0.032)	Sit/stand 4 vs. 6 (p<0.001)	Dress up 2 vs. 4 (p= 0.029)
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Conclusion

The analgesic inadequacy of APCP was associated with previous painful experience and impacted the well-being and activities of daily living.

INTRODUCTION

Cesarean section is one of the most common surgeries among pregnant women. In Brazil, in 2023, 59.6% of live births were surgical, 86% of which in the private health network. The Northeast is just below the national rate, with 57.38%¹. This percentage, although lower than that of the Midwest, South and Southeast regions, which have rates above the national average, is still considered alarming, considering the target of between 10% and 15% suggested by the World Health Organization (WHO) over the last 30 years².

Cesarean section is associated with hormonal and emotional changes inherent to the pregnancy-puerperium cycle, a period of significant changes in women's lives. These intense and short-lived changes between the pre- and post-operative periods can negatively influence post-operative pain (POP), given the multidimensionality of this experience. POP can delay surgical recovery and return to daily functional activities³. In this context, acute post-cesarean pain (APCP) can be influenced by demographic, surgical and

gyneco-obstetric factors^{4,5}, compromising the puerperal woman's self-care and the mother-child bond⁶.

The management of POP is essential in the care of patients undergoing surgical interventions, with the aim of minimizing suffering, promoting rapid recovery and preventing complications related to chronic pain (CP). This management involves multimodal analgesic strategies, including the use of drugs (such as opioid and non-opioid analgesics), regional blocks and adjuvant therapies, as well as non-pharmacological approaches. An effective approach must balance analgesic efficacy with minimizing adverse effects and promoting the patient's general well-being⁷. The fundamental principles of management include early and continuous pain assessment, effective and safe relief, and customization of treatment according to the patient's needs and characteristics.

The challenges in managing POP include the variability in the individual response to pain, the risk of adverse effects from analgesics and the assessment of pain intensity. In addition, inadequate management of acute pain can contribute to the

development of CP, representing an additional risk for the patient^{7,8}. When the pain management index (PMI) is less than zero, this characterizes analgesic inadequacy⁹⁻¹¹.

Post-surgical pain has a high prevalence, with estimates that 70% to 80% of patients can experience significant pain after abdominal surgery, ranging from moderate to severe⁸. APPC is a particular concern, since studies show that between 50% and 70% of women undergoing cesarean sections experience moderate to severe pain after the procedure, with a prevalence of CP in up to 20% of cases, often associated with inadequate analgesia in the immediate postoperative period¹². The lack of effective acute pain management can contribute to the development of CP and is a relevant risk factor for increased morbidity. In the context of cesarean section, inadequate analgesia has been linked to a worse recovery experience, with a negative impact on the patient¹³.

Women undergoing cesarean section have a higher risk of postpartum depression and CP compared to those who deliver vaginally¹⁴. It is estimated that severe acute postpartum pain increases the risk of postpartum depression threefold and the risk of chronic post-operative pain (CPOP) 2.5-fold^{15,16}. Postpartum depression, present in around 9.2% to 18% of women who undergo cesarean section, negatively affects breastfeeding and infant care^{6,16}. Considering that the experience of pain is highly variable, multimodal analgesic strategies should be implemented to prevent long-term complications^{7,8}.

Adequate management of acute pain is essential to avoid chronification of the painful process¹⁷. The management of APPC differs from other surgeries because the woman needs to recover quickly in order to care for her newborn (NB)¹⁸. Drugs and techniques that do not alter the ability to walk and consciousness should be chosen. In this sense, pain relief is not only a woman's right, but also a necessity, since nociception triggers the release of catecholamines that harm the mother's body¹⁹.

The management of pain during labor has been widely explored²⁰, but few studies have been investigating the management of APPC during the immediate postoperative period²¹⁻²³. In view of the above, the aim of this study was to analyze the management and impact of APPC among puerperae in the immediate postoperative period in a low-risk maternity hospital in the interior of Northeastern Brazil.

METHODS

This was a cross-sectional, analytical study carried out between March and July 2023, using an interview with a structured form to collect the outcomes and an analysis of the medical records and the pregnant woman's notebook to obtain information on the patient's identification, anthropometric measurements and perioperative assessment, such as the duration and technique of the surgery, the type of anesthesia and the drugs prescribed. This study was approved by the Research Ethics Committee of the Federal University of Sergipe - Lagarto Campus (CEP UFS/Lag/HUL- CAAE: 61063322.3.0000.0217; Opinion number: 5.793.230). The ethical precepts for research involving human beings, contained in Resolution 466/2012 of the Brazilian National Health Council (*Conselho Nacional de Saúde* - CNS) and the Declaration of Helsinki, were followed at all stages of the research.

Data collection took place at a philanthropic, low-risk maternity hospital which provides private assistance and is affiliated to the Brazilian Public Health System (*Sistema Único de Saúde* - SUS) services to the population of Lagarto and surrounding areas. Its range of services includes assistance with delivery and birth at normal risk, high-risk prenatal care, childcare and complementary tests. Its physical structure consists of a normal delivery center with six prenatal, delivery and immediate postpartum (IPP) suites, a surgical center and 12 wards.

Puerperae at usual risk in the immediate post-operative period (>24 hours post-cesarean section) were included, classified by gestational risk stratification as pregnant women who did not meet the criteria for high-risk classification, such as chronic diseases, previous clinical conditions, drug use, comorbidities, a history of complications in previous pregnancies or complications in the current pregnancy. The exclusion criteria were altered level of consciousness, neurodevelopmental disorders, cognitive disorders that prevented speech or language comprehension, insensitivity to pain, peripheral neuropathy, neurological disorders and incomplete answers to the questionnaire $\geq 20\%$.

The sampling process used in the study was non-probabilistic, by convenience and consecutive. The sample size was calculated, considering that 1,067 were carried out in 2021, an approximation of the sample size of 400, a tolerable sampling error of 5% and an addition of 10% for possible losses. The sample size was therefore 320 participants.

The dependent variables, or outcome variables, were analgesic inadequacy and the impacts caused by APPC, assessed through an interview and the application of a questionnaire with a numerical pain scale. Analgesic inadequacy was operationally represented by the Pain Management Index (PMI), calculated by subtracting the type of analgesic treatment (analgesic potency) from the intensity of pain reported by the patient.

Pain intensity was measured using the Verbal Numeric Scale (VNS), with which the participant was asked to rate their pain on a scale from 0 to 10, so that zero represented no pain and 10 the worst possible pain. Participants were interviewed after 24 hours and 48 hours post-surgery. Analgesics were administered at different times, according to each patient's individual needs and medical prescription. In addition, if the patient was experiencing pain at the time of the interview, the team was notified to provide appropriate pain management.

IMD score ranges from -3 (no analgesia for patients with severe pain) to +3 (opioid analgesia for patients without pain)^{13,14}. Therefore, negative scores represented analgesic inadequacy and scores ≥ 0 were related to analgesic adequacy¹⁵. To operationalize the analyses, IMD was dichotomized, considering negative scores (< 0) as the outcome of interest (analgesic inadequacy - "yes") and positive scores (≥ 0) (analgesic adequacy - "no") (Table 1).

The potential impacts of APPC on the following activities: general activity, walking, mood, sleep, interpersonal relationships, sitting, standing, dressing, urination, defecation, intimate hygiene, bathing, feeding, breastfeeding, changing diapers and holding the NB were measured on an ordinal scale from 0 to 10, where zero represented no impact and 10 the greatest possible impact.

The independent variables, classified as multinominal or dichotomous, were extracted from the patient's medical records

Table 1. Description of the scores for calculating the Pain Management Index (PMI).

Scores	Analgesic power	Pain intensity
0	Absence of analgesic drug	Painless (VNS = 0)
1	Simple analgesic or non-steroidal anti-inflammatory drug	Mild pain (VNS ≤ 4)
2	Weak opioids (codeine, tramadol)	Moderate pain (5 ≤ VNS ≤ 7)
3	Strong opioids (morphine, meperidine)	Severe pain (VNS ≥ 8)

VNS = verbal numeric scale.

and the pregnant woman's booklet. These variables included sociodemographic data, such as city of origin, age, skin color, marital status, employment, receipt of government aid, number of people in the household, area of residence, type of housing, schooling (years of study) and access to health services. In addition, health history was taken into account, such as the presence of comorbidities, perioperative data and gynecological-obstetric history, including a history of previous abdominal and gynecological surgeries, number of pregnancies, deliveries, abortions, previous cesarean sections, previous instrumental deliveries, pain in previous deliveries, planned pregnancy, number of prenatal consultations and duration of cesarean section (in minutes).

Data collection

Data collection was carried out by a team of four duly trained research assistants, by means of an interview with the application of a form and documentary analysis of the pregnant woman's medical records and notebooks. The instrument was registered on the REDCap platform, which allowed it to be filled in online and fed simultaneously into a spreadsheet for later analysis^{16,17}.

The assistants invited the puerperae to take part in the study 24 hours after the cesarean section, when they explained the relevance, objectives, risks and benefits of their participation. Before the interview, the participants were asked if they were in pain at the time and how severe it was. If so, the care team was called to check whether the prescribed analgesia had already been administered. If not, the assistants waited for the analgesics to be administered and collected the data from the medical records until the drug had reached its peak action. If the patient was not in pain during the initial approach, the interview data was collected before the documentary data.

Statistical analysis

IBM SPSS[®] version 27.0 software was used to analyze the data. Initially, an exploratory analysis was carried out and the symmetry of the data distribution was checked using the Shapiro-Wilk test. Categorical variables were described as absolute and relative frequencies, while quantitative variables were described as measures of central tendency (mean and median) and dispersion (standard deviation and interquartile range - IQR).

In the bivariate analysis, the association between analgesic inadequacy (yes/no) and the independent variables was examined using the chi-square and Fisher's exact tests. Crude prevalence

ratios (PR) and their 95% confidence intervals (95% CI) were calculated. Variables with a p-value <0.20 were eligible for multivariate analysis.

The Poisson generalized linear model with a log-linear link function, hybrid parameter estimation method, robust variance estimator and type III analysis for testing the effects of the model was chosen to investigate the factors independently associated with analgesic inadequacy. The Akaike Information Criterion (AIC), variance and log-likelihood parameters were used as a reference for choosing the best-fitting model. The significance of the adjusted PRs (PRa) of the variables was analyzed using the Wald chi-square test. Variables with a p-value <0.05 in the final model were considered significant.

A Multivariate Analysis of Variance (MANOVA) was carried out with the aim of investigating the extent to which the levels of APPC impacts varied according to pain intensity (mild vs. moderate vs. severe). The Box's M test was used to assess the assumption of homogeneity of covariance. The Friedman ANOVA test was then used to individually assess each of the 16 outcomes of interest. Those with significant intergroup differences were subjected to *post hoc* analysis using the Bonferroni test. A statistical significance level of 5% was adopted for all analyses.

RESULTS

The sample consisted of 321 puerperae in the immediate post-operative period of cesarean section surgery, of whom 232 (72.3%) reported acute pain at the time of the interview. Of these, 110 (47.4%) reported mild pain, 75 (32.3%) moderate pain and 47 (20.3%) severe pain. There was inadequate analgesia in 122 cases (38.0%). Pain was not systematically recorded in 317 medical records (98.8%). Table 2 summarizes the characteristics of the study participants.

Post-cesarean women were predominantly from other municipalities (231; 72.0%), <35 years old (259; 80.7%), ≥12 years of schooling (180; 56.1%), non-white skin color (283; 88.2%), with a partner (254; 79.1%), not employed (254; 79.1%), receiving government aid (188; 58.6%), were dependent of the Brazilian public health care (243; 75.7%), living in their own homes (220; 68.5%), in urban areas (184; 57.3%), in households with <4 people (211; 65.7%).

Most of the participants had no comorbidities (249; 77.6%), no history of abdominal surgery (307; 95.6%) or previous gynecological surgery (285; 88.8%), two or more previous pregnancies (180; 56.1%), one previous delivery (162; 50.5%), one previous cesarean

Table 2. Characterization of the participants in this study.

Variables	Analgesic inadequacy				Total (n=321)		PR (CI 95%)	p-value	
	Yes [PMI < 0] (n=122)		No [PMI ≥ 0] (n=199)		n	%			
	n	%	n	%					
City of origin	Lagarto ^[ref]	40	55.6	50	44.4	90	28.0	0.80 (0.60-1.07)	0.138
	Other	82	35.5	149	64.5	231	72.0		
Age	< 35 years ^[ref]	98	37.8	161	62.2	259	80.7	1.02 (0.72-1.45)	0.899
	≥ 35 years	24	38.7	38	61.3	62	19.3		
Skin color	White ^[ref]	19	50.0	19	50.0	38	11.8	1.37 (0.97-1.96)	0.105
	Non-white	103	36.4	180	63.6	283	88.2		
Marital status	With a partner ^[ref]	96	37.8	158	62.2	254	79.1	0.97 (0.69-1.37)	0.879
	Without a partner	26	38.8	41	61.2	67	20.9		
Work	Yes ^[ref]	25	37.3	42	67.2	67	20.9	1.02 (0.72-1.45)	0.896
	No	97	38.2	157	61.8	254	79.1		
Government aid	Yes ^[ref]	71	37.8	117	62.2	188	58.6	1.01 (0.77-1.35)	0.916
	No	51	38.3	82	61.7	133	41.4		
Number of people in the household	< 4 people ^[ref]	73	34.6	138	65.4	211	65.7	1.29 (0.97-1.70)	0.081
	≥ 4 people	49	44.5	61	55.5	110	34.3		
Area of residence	Countryside ^[ref]	55	40.1	82	59.9	137	42.7	0.91 (0.69-1.20)	0.496
	Urban	67	36.4	117	63.6	184	57.3		
Type of home	Owned ^[ref]	83	37.7	137	62.3	220	68.5	1.02 (0.76-1.38)	0.879
	Rented	39	38.6	62	61.4	101	31.5		
Schooling (years of study)	< 12 years	49	34.8	92	65.2	141	43.9	0.86 (0.64-1.14)	0.288
	≥ 12 years ^[ref]	73	40.6	107	59.4	180	56.1		
Access to health services	Public-dependent	96	39.5	147	60.5	243	75.7	1.18 (0.83-1.68)	0.328
	Supplement/private ^[ref]	26	33.3	52	66.7	78	24.3		
Comorbidity	Yes	34	47.2	38	52.8	72	22.4	1.34 (0.99-1.80)	0.067
	No ^[ref]	88	35.3	161	64.7	249	77.6		
Previous abdominal surgery	Yes	4	28.6	10	71.4	14	4.4	0.74 (0.32-1.72)	0.457*
	No ^[ref]	118	38.4	189	61.6	307	95.6		
Previous gynecological surgery	Yes	19	52.8	17	47.2	36	11.2	1.46 (1.03-2.06)	0.053
	No ^[ref]	103	36.1	182	63.9	285	88.8		
Number of pregnancies	1	50	35.5	91	64.5	141	43.9	0.89 (0.67-1.18)	0.406
	≥ 2 ^[ref]	72	40.0	108	60.0	180	56.1		
Number of deliveries	1	56	34.6	106	65.4	162	50.5	0.83 (0.63-1.10)	0.200
	≥ 2 ^[ref]	66	41.5	93	58.5	159	49.5		
Number of abortions	None ^[ref]	98	37.5	163	62.5	261	81.3	1.07 (0.75-1.51)	0.724
	≥ 1	24	40.0	36	60.0	60	18.7		
Previous cesarean section	Yes	41	39.0	64	61.0	105	32.7	1.18 (0.83-1.68)	0.351
	No ^[ref]	39	33.1	79	66.9	118	36.8		
Previous instrumental delivery	Yes	10	58.8	7	41.2	17	5.3	1.70 (1.09-2.65)	0.048*
	No ^[ref]	63	34.6	119	65.4	182	56.7		
Pain in previous births	Yes	33	51.6	31	48.4	64	19.9	1.71 (1.22-2.40)	0.003
	No ^[ref]	47	30.1	109	69.9	156	48.6		
Planned gravity	Yes ^[ref]	47	37.0	80	63.0	127	39.6	1.04 (0.78-1.39)	0.766
	No	75	38.7	119	61.3	194	60.4		
Number of prenatal consultations	< 7	14	28.6	35	71.4	49	15.3	0.72 (0.45-1.15)	0.139
	≥ 7 ^[ref]	108	39.7	164	60.3	272	84.7		
Duration of cesarean section (in minutes)	≤ 60 ^[ref]	110	37.5	183	62.5	293	91.3	1.39 (0.90-2.15)	0.177*
	> 60	11	52.4	10	47.6	21	6.5		

^[ref]reference category for calculating PRs; PR = prevalence ratio; *p-values<0.05; PMI = Pain Management Index.

section (118; 36.8%), no history of instrumental delivery (182; 56.7%) or pain in previous deliveries (156; 48.6%). The current pregnancy was unplanned for most of the postpartum women (293; 91.3%), they had ≥ 7 antenatal visits (272; 84.7%) and the cesarean section lasted ≤ 60 minutes (293; 91.3%).

As for pain management, simple analgesics (316; 98.4%) were prescribed systematically to 310 participants (98.1%). Only 21 participants (6.5%) reported using non-pharmacological resources for pain relief, of which 18 said they had used massage (85.7%; 18/21).

In the bivariate analysis, having a history of instrumental delivery (95% CI: 1.09-2.65) and pain in previous deliveries (95% CI: 1.22-2.40) were associated with a 70% higher prevalence of analgesic inadequacy. Of the nine variables eligible for inclusion in the explanatory model, only the experience of pain in previous deliveries remained significant ($X^2(2)=6.88$; p -value=0.032), representing an 88% higher prevalence of analgesic inadequacy, when adjusted for the age of the puerperal woman (PRA=1.88; 95% CI: 1.32-2.69; p -value=0.001).

For the analysis of the impacts of the APPC, only puerperae who reported pain at the time of the interview were considered ($n=232$). The MANOVA results were interpreted considering Pillai's screening corrections, since the assumption of homogeneity of covariance was not met (Box's $M=1763.05$; p -value<0.001). Overall, a significant difference was observed between the different groups in terms of the intensity of the APPC at the level of the 16 impacts investigated [$F(51, 909)=2.635$; p -value<0.001; η^2 -partial=0.129).

A bivariate analysis of the impacts of the APPC was then carried out using Friedman's ANOVA (Table 3). Of the 16 variables investigated, 11 had a significant impact on pain intensity. The activities of sitting/standing (median=8; IQR:4;10) and walking (median=6; IQR: 0;8) showed the greatest median impact among puerperae with severe APPC.

Figure 1 shows the *post hoc* analysis with the Bonferroni test. When compared to mild pain, severe pain had a higher median impact on mood ($p=0.019$), walking ($p=0.008$), sleep ($p=0.003$), ability to enjoy life ($p=0.001$), sitting/standing ($p<0.001$), intimate hygiene ($p=0.013$), bathing ($p=0.007$), dressing ($p=0.010$), breastfeeding ($p=0.042$) and holding the NB ($p=0.026$). Moderate pain had a higher median impact when compared to mild pain on general activity ($p=0.004$), walking ($p=0.032$), sitting/standing ($p<0.001$) and dressing ($p=0.029$).

DISCUSSION

The present study's findings have drawn attention to an underappreciated problem in labor and birth care: cesarean section-related APPC. Although there is a lot of evidence on pain management during normal labor²⁰, few studies have investigated the impacts of APPC during the immediate postoperative period^{5,21-23}. This was the first study to assess the factors associated with analgesic inadequacy of APPC and to examine its impacts during the hospitalization of puerperal women using PMI as a method of assessing analgesic adequacy.

Table 3. Bivariate analysis of the impact of acute post-cesarean pain.

Pain Impact	Pain intensity (n=232) Median (Q1; Q3)			p-value
	Mild	Moderate	High	
	(n=110)	(n=75)	(n=47)	
General activity	3 (0; 5)	5 (1; 8)	4 (0; 9)	0.004
Mood	0 (0; 3)	1 (0; 5)	2 (0; 8)	0.016
Walking	3 (1; 5)	4 (2; 7)	6 (0; 8)	0.003
Interpersonal relationships	0 (0; 0.25)	0 (0; 1)	0 (0; 4)	0.108
Sleep	1 (0; 5)	3 (0; 7)	5 (0; 8)	0.003
Ability to appreciate life	0 (0; 0)	0 (0; 2)	0 (0; 6)	<0.001
Sitting down and standing up	4 (3; 6.25)	6 (4; 9)	8 (4; 10)	<0.001
Urination	0 (0; 3)	0 (0; 5)	0 (0; 6)	0.491
Defecation	0 (0; 4)	0 (0; 5)	0 (0; 5)	0.827
Intimate hygiene	0 (0; 2)	0 (0; 5)	1 (0; 7)	0.010
Bathing	0 (0; 3)	1 (0; 5)	3 (0; 7)	0.008
Dressing	2 (0; 4)	4 (0; 7)	3 (0; 9)	0.003
Feeding	0 (0; 0)	0 (0; 1)	0 (0; 1)	0.307
Breastfeeding	0 (0; 3)	0 (0; 4)	2 (0; 6)	0.045
Changing diapers	0 (0; 0)	0 (0; 1)	0 (0; 1)	0.050
Holding the NB	0 (0; 1.25)	0 (0; 4)	0 (0; 6)	0.031

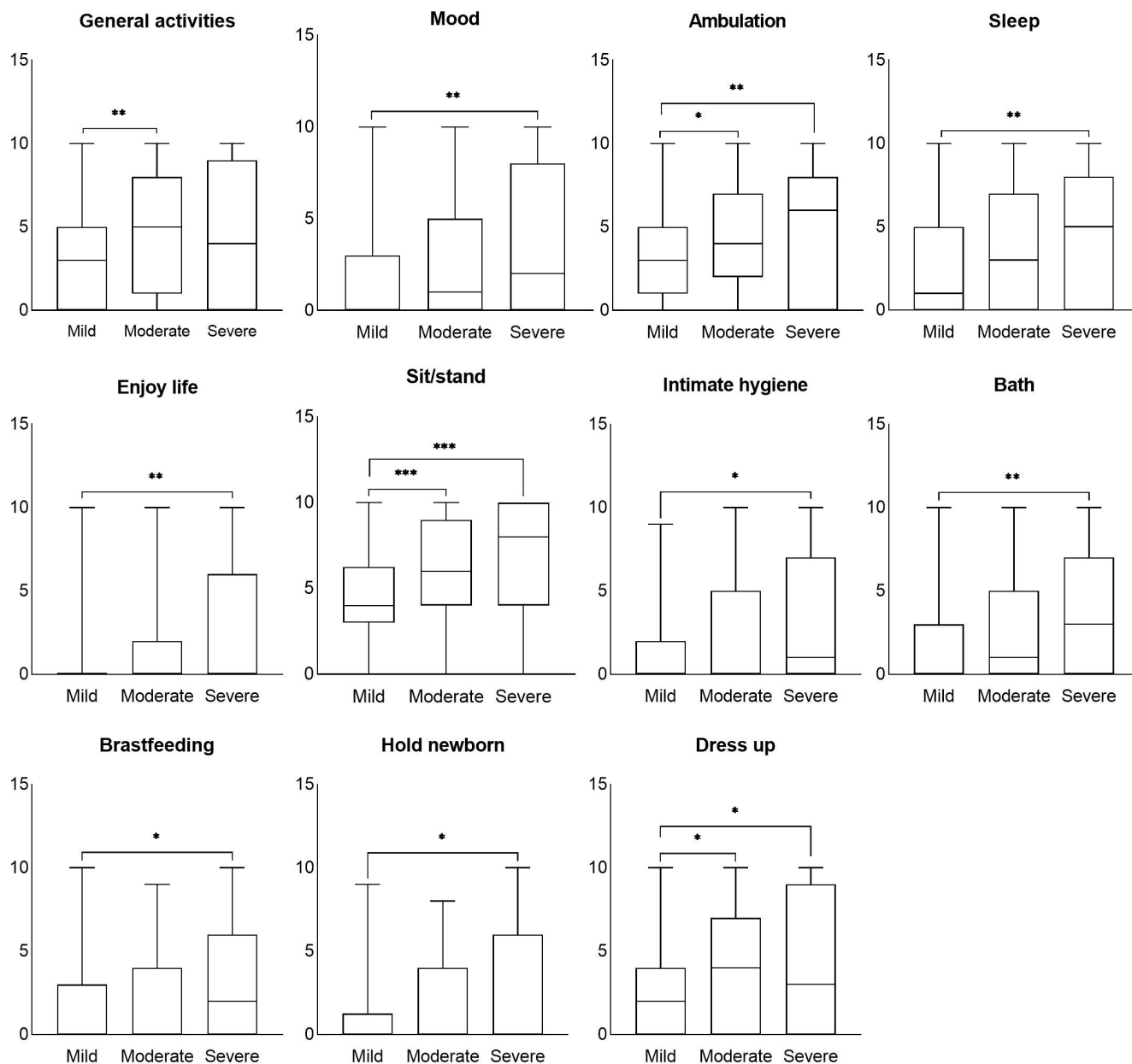


Figure 1. Post hoc analysis of the impacts of the acute post-cesarean pain. *p-value<0.05; **p-value<0.01.

The present study showed a high prevalence of APPC and, in more than a third of the cases, there was inadequate analgesia, i.e. the analgesics prescribed were not compatible with the intensity of the pain reported by the participants, so that more than half reported moderate to severe pain. However, almost all the medical records did not have a systematic record of the pain phenomenon. These results show that although pain is considered the fifth vital sign, it has not been recorded with the same rigor as the others.

Proper pain management includes a comprehensive and systematic assessment. This is essential because the use of valid and reliable scales can help assess the effectiveness of interventions, as well as respecting the subjectivity of patients, since they are able to accurately describe their pain²⁴. Therefore, the absence of data in medical records makes it difficult for the multi-professional team

to make decisions when choosing and administering analgesic therapy²⁵.

In the institution where the research was carried out, post-operative analgesia was standardized, and all the women were prescribed simple analgesics or non-steroidal anti-inflammatory drugs (NSAIDs). Multimodal analgesia is the fundamental principle for the treatment of APPC²⁶. The use of neuroaxial morphine and opioid-sparing adjuvants, such as scheduled NSAIDs and paracetamol, is recommended for all women undergoing cesarean section with neuroaxial anesthesia, unless contraindicated²⁷.

As for the factors associated with analgesic inadequacy, only previous painful experience was associated with a higher prevalence of the outcome in question, when adjusted for the age of the puerperae. No studies were found that investigated the factors

associated with analgesic inadequacy. On the other hand, there is evidence of an association between chronic pain and a history of antepartum pain. A previous study pointed out that individual factors, rather than the degree of tissue trauma, are involved in the persistence of postpartum pain: such as a history of pain before delivery and greater intensity of pain on movement, particularly in the 24 hours postpartum²⁸.

One study analyzed the prevalence, characteristics and impact of postpartum pain and found that abdominal pain was the most frequent (64.7%), followed by pain in the perineal and genital regions (38.4%). In addition, the authors pointed out that abdominal pain in the puerperium can be associated with the surgical incision, in the case of a cesarean section, and can also be related to breastfeeding, since oxytocin is released and uterine tone increases, which increases abdominal cramps²³.

It is important to emphasize that pain can increase the physical and emotional demands on the puerperal woman, which slows down her recovery and independence in terms of self-care and caring for her NB^{5,21-23}. That said, the results of the multivariate analysis revealed that the impacts investigated are grouped into a cluster of impairments to the well-being and activities of daily living of puerperae with moderate to severe pain during hospitalization. This shows that even the variables that did not show a significant difference in the bivariate analysis, when analyzed together, are influenced by the intensity of the pain.

Among the activities investigated, sitting down and standing up had the greatest impact. In association with walking, these activities are important in the immediate postoperative period, as they promote venous return and prevent thromboembolism²⁹. Compared to normal childbirth, cesarean sections tend to have more negative implications for women's functionality in the postpartum period, especially in terms of walking^{30,31}.

Other noteworthy impacts were observed on sleep, mood and the ability to enjoy life. Together, these factors may be related to the worsening of puerperal blues and progression to postpartum depression^{16,32}. In addition, bathing, intimate hygiene and dressing are necessary activities for promoting puerperal women's self-care, self-image, comfort and infection prevention³³ and were significantly impacted by moderate to severe pain in this study.

In addition, it is important to mention the importance of non-pharmacological methods for pain relief, since the labor and birth scenario must have new practices to minimize the discomfort caused in the parturition process. In this study, only 21 participants reported having used such resources for pain relief. Although more widely investigated in the normal delivery process³⁴, it is known that there are non-pharmacological methods that could be offered to puerperal women during hospitalization³⁵.

Although this study stands out for its novelty in using robust statistical methods in its analysis and PMI to estimate the management of APPC, it was not without its limitations. The fact that it consisted of a single-center study that included only postpartum women at usual risk may make it difficult to generalize the findings. Therefore, multicenter studies with the inclusion of high-risk maternity hospitals and larger samples could find associations between predictors and analgesic inadequacy of APPC that were not observed in this study.

In addition, future longitudinal studies are needed to investigate the extent to which the inadequate analgesia of APPC in the immediate postoperative period may be associated with negative outcomes at home or in the community, such as the development of CP, postpartum depression, difficulties in returning to activities of daily living and caring for the NB.

Thus, it is essential that labor and birth care institutions adopt systematic pain assessment and multimodal analgesia protocols that consider the particularities of the cesarean section context, incorporating not only pharmacological methods, but also non-pharmacological resources. This could contribute to a reduction in suffering, faster surgical recovery and greater satisfaction with surgical delivery care for puerperal women.

CONCLUSION

The prevalence of APPC was 72.3% and there was inadequate analgesia in more than two thirds of the cases. Previous painful experience was independently associated with a higher prevalence of APPC in the current delivery. Moderate to severe APPC was reported by 79.7% of the puerperae who reported pain and negatively impacted 11 of the outcomes investigated. Therefore, multimodal strategies should be adopted in order to ensure humanized maternal care with better outcomes for the mother-baby binomial.

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