



# Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression

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## Abstract

Cesarean delivery rates continue to increase, and surgery is associated with chronic pain, often co-existing with depression. Also, acute pain in the days after surgery is a strong predictor of chronic pain. Here we tested if mode of delivery or acute pain played a role in persistent pain and depression after childbirth. In this multicenter, prospective, longitudinal cohort study, 1288 women hospitalized for cesarean or vaginal delivery were enrolled. Data were obtained from patient interviews and medical record review within 36 h postpartum, then via telephone interviews 8 weeks later to assess persistent pain and postpartum depressive symptoms. The impact of delivery mode on acute postpartum pain, persistent pain and depressive symptoms and their interrelationships was assessed using regression analysis with propensity adjustment. The prevalence of severe acute pain within 36 h postpartum was 10.9%, while persistent pain and depression at 8 weeks postpartum were 9.8% and 11.2%, respectively. Severity of acute postpartum pain, but not mode of delivery, was independently related to the risk of persistent postpartum pain and depression. Women with severe acute postpartum pain had a 2.5-fold increased risk of persistent pain and a 3.0-fold increased risk of postpartum depression compared to those with mild postpartum pain. In summary, cesarean delivery does not increase the risk of persistent pain and postpartum depression. In contrast, the severity of the acute pain response to childbirth predicts persistent morbidity, suggesting the need to more carefully address pain treatment in the days following childbirth.

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## 1. Introduction

The cesarean delivery (CD) rate has risen over 10-fold in the last 70 years, and now approaches 39% [15]. The long-term consequences of this increased exposure to surgery in young women have not been thoroughly explored. Tissue trauma from surgery

represents a common cause of chronic pain and disability [13,20], and women are at increased risk compared to men of developing chronic pain after surgery [17,26], and exhibit higher chronic pain severity [9]. As such, CD could result in chronic pain. One small survey in a non-US population demonstrated an incidence of persistent daily pain 1 year after CD of 6% [16], but there are no prospective studies comparing the incidence of persistent pain between CD and vaginal delivery (VD). With over 4 million deliveries annually in the US alone, even a small prevalence of persistent pain carries important public health consequences. The primary purpose

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of this study was to determine whether CD increases the risk of persistent pain after childbirth.

Medical surveillance and intervention, intense during labor and delivery, are abruptly reduced or withdrawn after delivery, when there is a rapid transition to a more home-like environment in the hospital. The consequences of this abrupt withdrawal on pain treatment have not been adequately explored. Poorly controlled acute post-procedural pain may result in harmful physiologic and psychological consequences, including prolonged hospitalization and delayed return to normal activities [25], and is associated with an increased risk of chronic pain [13,20]. The prevalence of severe pain after surgery has not decreased in the last two decades [2]. Pain treatment after childbirth may be even less adequate than after surgery, due to relatively few nurses in postpartum wards and a reluctance to use non-steroidal anti-inflammatory drugs or adequate doses of opioids due to concerns of the use of these drugs during breastfeeding. A secondary purpose of this study was to quantify acute pain following CD and VD and to determine whether severity of acute pain predicts persistent pain.

Chronic pain and depression commonly co-exist, and postpartum depression, a complication affecting 8–15% of postpartum women [6], affects both maternal and neonatal health [24]. CD, whether elective or emergent, most likely does not increase the risk of postpartum depression over VD [19]. In contrast, in one small study, the presence of persistent pain after childbirth increased the risk of postpartum depression 3-fold [11]. Since acute pain predicts persistent pain after surgery, a final purpose of this study was to determine the risk imparted by severity of acute pain after childbirth to the development of postpartum depression. The results of this study demonstrate that pain in the hours after childbirth imparts an important risk for persistent pain and depression and provides a new target to reduce such morbidity.

## 2. Materials and methods

This is a prospective, longitudinal cohort study from Forsyth Medical Center, Wake Forest University, Winston-Salem, New York, NC, USA, and Columbia University Medical Center, NY, USA. Following Institutional Review Board approval and written informed consent, women hospitalized for CD or VD from September 2004 to December 2005 were enrolled, except during weekends and holidays when research interviewers were unavailable. Within 36 h following delivery, women were questioned using a scripted interview to assess their acute pain after delivery, pre-existing pain, pain treatment before or during pregnancy, demographic variables, degree of somatization [3], previous medical and social history, and height and weight at the end of pregnancy (Entrance Questionnaire – Appen-

dix 1). Women were asked to quantify pain at the time of the interview and since delivery using an eleven point numerical rating pain score from 0 to 10, with 0 indicating no pain, and 10 the worst pain imaginable. Pain was considered mild if scored 0–3, moderate if scored 4–6, and severe if scored 7–10. Data were also collected regarding maternal and neonatal factors during labor and delivery (Delivery Information Questionnaire – Appendix 2).

At 8 weeks after delivery, patients were contacted and a computer-assisted, scripted telephone interview was conducted by the Research Survey Center of Wake Forest University to assess the presence of persistent postpartum pain, including intensity, frequency, location, treatment and impact on daily activities, postpartum depression (using the validated Edinburgh Postnatal Depression Scale; [7]), and other health changes since delivery (8-week Questionnaire – Appendix 3). Persistent pain was defined as  $>0$  pain scores which began at or immediately after childbirth for either the average, worst or current pain during the week of the telephone interview. Postpartum depression was defined by a score of  $>12$  on the Edinburgh Postnatal Depression Scale [7,21]. The primary outcome variables were acute pain after delivery and presence of persistent pain and depressive symptoms 8 weeks after delivery.

### 2.1. Statistical methods

Patient recruitment was based on the goal of identifying stable estimates of pain prevalence at 8-weeks postpartum. Previous estimates of 6–12 weeks postpartum pain revealed pain prevalence ranging from 8% to 23%, so a sample size of  $N = 1000$  would provide confidence in the estimate of  $\pm 1.9\%$ . To measure the impact of delivery mode on the primary outcome measures, we used propensity score adjustment in which we defined and controlled for 16 measured patient variables that were considered a priori to contribute to the probability that an individual would have a CD (Table 1). The use of propensity score adjustment was intended to better isolate the impact of delivery mode on outcome while simultaneously controlling for many of the other independent influences that are associated with delivery mode. Propensity scores were developed using a non-parsimonious logistic model with all 16 designated predictors (plus site) entered simultaneously. The discriminative power of the propensity scores was quantified using the area under the receiver-operating-characteristic curve (*C*-index). Prior to the primary analysis, a missing values analysis was performed and missing values of continuous (scale) variables were singularly imputed using the EM algorithm. The results of the primary analyses were compared with the missing data imputed vs. left missing and were similar, so only the imputed results are presented.

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