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Prediction of outliers in pain, analgesia requirement, and recovery of function after childbirth: a prospective observational cohort study

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Abstract

Background: Prediction models to identify parturients who experience protracted pain, prolonged opioid use, and delayed self-assessed functional recovery are currently inadequate.

Methods: For this study, 213 nulliparous women who planned vaginal delivery were enrolled and assessed daily until they completed three outcomes: (1) pain resolution; (2) opioid cessation; and (3) self-assessed functional recovery to predelivery level. The primary composite endpoint, 'pain and opioid-free functional recovery' was the time required to reach all three endpoints. The subjects were divided into two categories (the worst (longest time) 20% and remaining 80%) for reaching the primary composite endpoint, and each individual component. Prediction models for prolonged recovery were constructed using multivariate logistic regression with demographic, obstetric, psychological, and health-related quality of life characteristics as candidate predictors.

Results: Labour induction (*vs* spontaneous labour onset) predicted the worst 20% for the primary composite endpoint in the final multivariate model. Labour induction and higher postpartum day 1 numerical rating score for pain were predictors for being in the worst 20% for both functional recovery and pain burden. Labour type, delivery type, Patient-Reported Outcomes Measurement Information System (PROMIS) anxiety score, RAND 36 Item Health Survey 1.0 (SF-36) physical health composite score, and postpartum breastfeeding success were predictive of delayed opioid cessation.

Conclusions: Labour induction and elevated numerical rating score for pain are predictive of poor recovery after childbirth. Further research is necessary to determine whether modification would benefit mothers at risk for poor recovery.

Keywords: analgesia; pain; postpartum period

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Editor's key points

- A minority of women remain on prolonged opioids after childbirth, with potential long-term harms.
- Identifying those at risk at the time of delivery would allow targeted management and support.
- This study explored factors associated with worse pain, continued opioid use, and poorer functional recovery.
- Induction of labour and high pain scores on day 1 were predictors of poorer outcomes.

Most women report opioid-free functional recovery approximately 3 weeks after vaginal delivery and 4 weeks after Caesarean delivery.[1] However, outliers report severe pain for months and may never stop taking the opioids they were introduced to at childbirth.[2] In the USA, the majority of women are discharged home with a prescription for opioids, and therefore childbirth is a common source of opioid exposure in a large population. Limited information is available to predict which women will have poor recovery or require opioids for protracted period.[2] Patient-centred management incorporating these expectations is important. A 'one size fits all' model is a significant hazard as larger opioid prescriptions enhance risk for conversion to chronic opioid use.[3]

Severe acute postpartum pain,[4,5] previous pain diagnosis,[4] and history of chronic disease have been reported as risk factors for persistent pain after childbirth, while degree of tissue trauma and previous pain diagnosis have been associated with acute pain. However, risk factors for protracted postpartum recovery in healthy parturients may remain unidentified, and an information gap exists because pain assessment beyond hospital stay has only been conducted at remote time points months after delivery.[6]

The objective of this study was to identify factors that identify parturients who are likely to have a difficult postpartum recovery with respect to pain, opioid use, and recovery of function. The aim of this analysis was to identify demographic, obstetrical, and psychological risk factors for being in the worst 20 percentile for a composite endpoint of pain and opioid-free functional recovery to allow for future individualised intervention.

Methods

We conducted a prospective, daily, longitudinal, observational cohort study of three study endpoints (pain resolution, opioid cessation, and self-reported functional recovery to predelivery level) in nulliparous parturients. For functional recovery outcome, we defined predelivery as the last week of pregnancy before the delivery while the patients were not in pain. A participant's completion of the study was predefined as the completion of the composite outcome ('pain and opioid-free functional recovery'; i.e. when all three of the above-mentioned study endpoints were attained). We considered that attainment of all three individual recovery endpoints (i.e. pain resolution, opioid cessation, and functional recovery) are equally important with regard to length of medical leave after childbirth, and related employment and social policy. Therefore, we opted to use the composite outcome as the primary endpoint, which is the time to all three endpoints are met. We obtained institutional review board approval from Stanford University (Protocol #30758, approved on July 11, 2014) for this study. Written informed consent was obtained from all participants. This manuscript adheres to the applicable Equator guidelines.

We attempted daily contact with women to determine pain scores, analgesic use, and functional status after both vaginal and Caesarean delivery. A detailed description of the outcome inter-individual variability has been published previously.[1] In this work, we identified that some patients have prolonged recovery associated with severe pain and continued need for opioids. The construction of a prediction model was planned *a priori*, was part of the original institutional review board protocol and the neuropsychological testing was conducted before delivery. The descriptive data was reported previously; this predictive modelling was a planned subsequent analysis. The current manuscript investigates prediction of these severe outliers using demographic, obstetric and neuropsychological testing administered prepartum.

Participants

Nulliparous women planning vaginal delivery at Lucile Packard Children's Hospital, Stanford University between August 2014 and June 2016 were approached and enrolled in this prospective cohort study. This was a convenience sample in that women who were admitted to the hospital during nights and weekends were not approached. Women provided written informed consent, and were enrolled before induction, in early labour when they were not in pain, or after labour analgesia had been established. Inclusion criteria were: age $\geq$18 yr, gestational age $\geq$35 weeks, absence of severe maternal or fetal comorbidities, and ability to understand English to provide consent and complete questionnaires. Patients with multiple pregnancy, diabetes mellitus (pre-existing or gestational) requiring pharmacological treatment, hypertension (chronic or gestational) or pre-eclampsia requiring pharmacological treatment, or treatment for depression or anxiety were excluded from participation. Patients with chronic pain or ongoing opioid use were also excluded.

Procedures

Baseline demographic and obstetric data was obtained after enrolment. Starting on postpartum day 1, the subjects were contacted daily by one of two investigators (the first author or a research assistant), either in person during their hospitalisation, and by telephone after discharge. Using a standardised questionnaire (Supplementary Appendix S1), women were asked about their pain (average daily pain using a 0–10 verbal numeric rating scale (NRS) where 0 is no pain and 10 is the worst possible pain), analgesic use and functional recovery. The subjects who underwent Caesarean delivery were specifically instructed to report pain levels in the perineum, pelvis, and surgical site, and those who underwent vaginal delivery were instructed to report pain levels in the perineum and pelvis. All reported medications used on each postpartum day were reviewed by a study physician to ascertain whether opioid, non-opioid analgesic, or both medications were taken. To assess functional recovery, the subjects were asked, "Do you feel you have functionally recovered to the level you were during the last week of pregnancy before delivery?" Daily follow-ups were continued until the participants met all three study endpoints; an additional 5 days after zero average pain and opioid cessation were attained to ascertain there was no