

# Persistent Postpartum Pain – A Somatic and Psychologic Perfect Storm

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**Abstract:** Persistent postpartum pain is common and has a complex etiology. It has both somatic and psychosocial provoking factors and has both functional and psychological ramifications following childbirth. Pain that limits the functional capacity of a person who has the daunting task to take care of all the demands of managing a growing newborn and infant can have debilitating consequences for several people simultaneously. We will review the incidence of persistent postpartum pain, analyze the risk factors, and discuss obstetric, anesthetic, and psychological tools for prevention and management. Based on the current knowledge, early antenatal screening and management is described as the most likely measure to identify patients at risk for persistent postpartum pain. Such antenatal management should be based on the close collaboration between obstetricians, anesthesiologists, and psychologists to tailor peripartum pain management and psychological support-based individual needs.

**Keywords:** persistent pain, postpartum, risk factors, analgesia, labor, delivery

## Introduction

The female reproductive system is evolutionary designed for pregnancy and childbirth. Despite the physiological nature of reproduction, pregnancy induces a myriad of changes in the body that are considered pathological under many other circumstances. For example, the cardiovascular, respiratory, hormonal, gastrointestinal and homeostatic adaptations of pregnancy share similar features with conditions such as liver failure or sepsis (eg, increased cardiac output (CO), decreased systemic vascular resistance (SVR), increased activity of the renin-angiotensin system (RAS) and interstitial fluid retention). Some of the previous conditions cause somatic and/or visceral pain. Nerve compression can be caused by retained fluid in tight spaces resulting for example in carpal tunnel syndrome (CTS). Anatomical realignments in the vertebral and thoraco-abdominal regions induce back pain, gastroesophageal reflux disease (GERD), constipation, pubic symphyseal separation, amongst other conditions. These changes contribute to the symptoms of physical discomfort that are common during pregnancy, such as fatigue, nausea, cramping, back pain, and in some instances, they add to a preexisting pain in the same region. Parturition then further superimposes severe acute pain on those changes. Finally, modern medicine has resulted in the development of several obstetrical interventions, including but not limited to induction of labor, neuraxial anesthesia, and cesarean delivery (CD). A survey of 1123 mothers examined their well-being 9–12 months following childbirth.<sup>1</sup> More than sixty-nine percent of respondents reported a condition that negatively influenced their lives, and 37% reported moderate or major severity of pain in the form of backache, abdominal pain, vaginal pain, or dyspareunia.

Patients may develop persistent postpartum pain (PPP) because of the inherent pain inducing physiological and pathological adaptation to the state of pregnancy, or because of the inherent noxious changes of operative and pharmacological interventions during labor.

As the understanding of chronic pain following medical interventions is growing, the focus has shifted from the observation of pain intensity only to include the impact of pain on the quality of life and functionality.<sup>2</sup> Chronic pain

severity is now defined as a more complex entity with three components, including intensity, pain-related distress, and pain-related interference with activities of daily living.<sup>3</sup> Following that approach, more attention has been given to the potential negative impact of pregnancy and childbirth on the woman's peripartum health and wellbeing. In addition to acute pain and its management, the significant incidence of chronic postpartum pain has been recognized in the last two or three decades.

In our narrative review of persistent postpartum pain, publications were obtained by querying databases including PubMed, MEDLINE, Embase and Google Scholar by using the search terms of "persistent postpartum pain", "chronic postpartum pain", "risk factors of persistent postpartum pain", "prevention of persistent postpartum pain" and "management of persistent postpartum pain". We also included reference lists from relevant articles in our search.

We summarize data explaining the etiology and contributing factors that lead to chronic pain in obstetric patients. Based on the diverse etiological factors, the interventions to prevent or mitigate chronic postpartum pain are analyzed as well. Finally, recognizing the complex etiology behind chronic postpartum pain, a preventative, interdisciplinary approach is recommended with the goal to alleviate the negative effect of prolonged postpartum pain on quality of life after childbirth.

## Ambiguity of the Nomenclature of Chronic Postpartum Pain

While there is a widely accepted definition of chronic postsurgical pain (CPSP), which includes pain duration of at least two to three months and the exclusion of other possible causes,<sup>4,5</sup> there is no such consensus on postpartum pain (PP) specifically.

Many studies use the term persistent pain, rather than chronic pain and define persistent pain as that which lasts at least six weeks after childbirth.<sup>6-8</sup> In the opinion of these authors, this is reasonable considering the impact of such pain duration on the ability of the individual to take care of their own as well as their newborn(s)' needs, and we included literature describing persistent pain six weeks or longer following childbirth in this review. Our search results were analyzed in the context of etiology, risk factors, prevention, and management of such conditions.

## Incidence of Persistent Postpartum Pain

Due to the lack of universally accepted definition of PPP, the data on the prevalence and incidence of these conditions vary based on the definition used by a given study group. Compared to the incidence of chronic pain following different surgical procedures (20–30% at 6–12 month after surgery),<sup>9</sup> childbirth carries a lower incidence of approximately 10% for PPP.<sup>6,10</sup>

Declercq et al found that while only 2% of patients reported pain six months after a vaginal delivery (VD), 18% of those having a CD reported pain at six months.<sup>11</sup> While Hannah et al found no difference in the rate of PP at three months between CD (27.3%) and VD (25%), those with CD were more likely to report abdominal pain and less likely to report perineal pain.<sup>12</sup>

Other studies have also found a difference in the presence and intensity of pain following vaginal and cesarean birth. Molin et al reported the incidence of the former to be 6.7%, while the latter 11%.<sup>13</sup> However, a survey in Finland identified chronic pain in 10% of women one year after vaginal delivery.<sup>7</sup> It is interesting to note that instrumentally supported VD did not increase the incidence of chronic pain when compared to unassisted natural childbirth. In contrast to the above reports, their survey found the prevalence of chronic pain 1 year after CD to be nearly as high as the prevalence of CPSP in other studies. Eighteen percent of the 229 women after CD in their study experienced PPP at 12 months postpartum. The authors also made the notable observations that 55% of PP was reported mild, and PP was more common in women with history of preexisting pain, back pain, and chronic diseases, as well as when severe pain was reported on the first postpartum day.<sup>7</sup>

Although PPP after VD and CD are examined as separate entities by many studies due to the different mechanisms of tissue trauma and the consequent differences in pain location and functional disability, and while the incidence of chronic pain is lower after VD, most CDs follow labor. Intrapartum CD seems to carry the risk of more severe postoperative pain on the first postoperative day and resulted in higher opioid consumption when it was compared to those with no labor prior to CD in a multicenter prospective cohort survey study.<sup>14</sup> The authors stipulated that the difference can be related in

part to the inflammatory response to the process of labor and to the psychological stress of switching to a surgical intervention as opposed to completing the natural process of childbirth. That is another example of how intertwined the somatic and psychological aspects of pregnancy and childbirth are. Recognizing this difference of pain level between intrapartum and scheduled cesarean sections may guide obstetricians to counsel pregnant patients on not considering CD a failure early and repetitively during prenatal visits. While promoting and supporting VD has priority due to its proven benefits for both mothers and their newborns, the psychosomatic benefits of embracing a clearly indicated CD that saves the life of both the women and the newborn as a triumph for medicine instead of considering it a personal failure by both patients and obstetricians cannot be overestimated.

## Risk Factors

### Preexisting Pain and Psychosocial Factors

There are several somatic and psychological conditions that are linked to a diverse manifestation of lasting pain following childbirth. History of pregnancy-related and pre-pregnancy back pain and heavier body weight are robust risk factors for persistent back pain after pregnancy.<sup>8</sup> A history of dyspareunia is associated with persistent postpartum dyspareunia.<sup>15,16</sup> A study of 150 nulliparous women found that history of non-genito-pelvic pain may increase the risk of developing genito-pelvic pain postpartum, and pain-related anxiety may increase the risk for higher intensity postpartum genito-pelvic pain.<sup>17</sup> The latter finding adds to the evidence that preexisting psychiatric conditions, psychosocial trauma and catastrophizing pain behavior also predict the increased susceptibility for persistent pain perception following childbirth.<sup>8,18</sup>

A recent cohort study analyzed the correlation between pain perception and postpartum depression (PPD) in healthy nulliparous women who requested epidural analgesia in early labor (cervical dilation < 5 cm). They enrolled 712 patients who all received effective epidural analgesia prior to answering questionnaires pertinent to the nature of pain sensation during labor (short-form McGill pain questionnaire-2 [SF-MPQ-2]); a questionnaire examining their pain catastrophizing behavior (pain catastrophizing scale [PCS]); a screening tool for pre-delivery depressive symptoms and postnatal depression (Edinburgh postnatal depression score [EPDS]); a psychometric instrument to quantify the perception of stress (Cohen's perceived stress scale [PSS]); and an assessment of transient anxiety at the moment of scoring, the dispositional anxiety (trait), and anxiety in general (Spielberger's state-trait-anxiety inventory [STAI]). Increased sensory and neuropathic symptoms of early labor pain identified by SF-MPQ-2 were strongly correlating with pre-delivery pain catastrophizing and depressive symptoms in their cohort.<sup>19</sup> Another example of this correlation is the association of postpartum dyspareunia with pain catastrophizing behavior.<sup>20</sup>

This correlation has significant clinical implication for risk assessment for PPP. A Scandinavian study analyzed birth records, questionnaire data from week 17 of pregnancy, 8 weeks postpartum, as well as questions about pain and birth experience asked within 48 h after delivery of 645 women. In addition, the incidence of PPD was measured by the EDPS. The major finding was that preexisting pain and depression were predictors of PP (OR 3.70; 95% CI 2.71–5.04 and OR 2.31; 95% CI 1.85–2.88, respectively). Further proving the complex pathology of peripartum psychosomatic events, a negative birth experience, but not labor pain intensity was associated with PPD (OR 1.16; 95% CI 1.04–1.29). Preexisting depression and pain (OR 2.03; 95% CI 1.37–3.01) were important predictors of PPD 8 weeks after delivery (OR 3.95; 95% CI 2.92–5.34 and OR 2.03; 95% CI 1.37–3.01, respectively). However, preexisting depression and pain did not correlate with PPP at 8 weeks postpartum in this cohort of patients.<sup>21</sup> The latter finding is in contrast with previous reports suggesting such correlation,<sup>6,22</sup> and it may explain at least in part, why even the most effective intrapartum analgesia can fail to prevent PP following childbirth.

PPD and PPP are widely reported as coexisting conditions, can most likely they can be triggered by the same factors,<sup>6,14,23</sup> and they can initiate and augment each other.<sup>19</sup> However, while, at least in the developed world, a substantial effort has been invested in intrapartum analgesia, PPD and PPP remain unresolved. Conversely, less work has been done to address the prevention of PPD. While the importance of adequate and effective intrapartum analgesia cannot be emphasized enough, it is important to recognize that it is only one, and maybe not the most important factor in the prevention of postpartum psychosomatic pathology. A recent review of the pertinent literature concluded that the efficacy of epidural analgesia to prevent PPD is equivocal, and other risk factors, not pain might be more important for predicting PPD.<sup>24,25</sup>

## Labor and Labor Intervention Related Somatic and Neuropathic Risk Factors

There are certain labor and labor intervention-related conditions that have been suggested as potential predictors of the development of PPP. These are related to issues that fall under the purview of obstetric providers, while others are related to interventions that are provided by anesthesiologists. It is important to emphasize that ideally the distinct responsibilities are carried out based on well-established multidisciplinary institutional practice guidelines as well as are orchestrated by continuous collaboration and communication between the specialties. This is a relevant factor, since holding back while communicating with providers, not using pain relief medications and perceived discrimination were found to be predictors of PP in patients undergoing CD.<sup>26</sup>

The location, type and severity of pain differ between VD and CD. Lim et al found that visceral and nociceptive pain were the most common types and were different between those with VD (67.8%) and CD (48.2%).<sup>27</sup> Pain in other areas, such as back pain and CTS, occurs in both groups equally. All these conditions usually resolve within weeks normally, however, in a subset of patients they persist and become a chronic condition. Zhang et al found that a history of childbirth is associated with an increased risk of functionally significant back pain in later life.<sup>28</sup>

## Mode of Delivery

### Vaginal Delivery

Most births occur via VD with or without utilizing instrumental interventions, such as vacuum or forceps assisted delivery. While perineal protection is now a common practice, episiotomy is still performed with variable incidence. Furthermore, perineal protection does not eliminate perineal laceration, especially in nulliparous women, and the degree and severity of the latter has important implications for postpartum healing and functional recovery. For example, the magnitude of perineal trauma is associated with persistent vaginal and perineal pain.<sup>8</sup> Declercq et al found that while 43% of patients with a spontaneous VD had perineal pain in the first two months postpartum, this increased to 63% of those with an episiotomy and 68% of those with an instrumented delivery (the majority of whom had an episiotomy). In this study only 2% reported the pain lasting for at least six months.<sup>11</sup> The most common consequences of pelvic and perineal pain and dysfunction are dyspareunia and incontinence. Interestingly, Molin et al found that dyspareunia was equivalent after VD and CD at 19.2%.<sup>13</sup> Unfortunately, almost 50% of this of group still experience symptoms at a year post-delivery.<sup>29</sup>

### Operative Interventions

While spontaneous lacerations are associated with higher rates of perineal pain at two to twelve months compared to those with an intact perineum,<sup>30</sup> episiotomy has an even greater association with persistent perineal pain at three months.<sup>31</sup> However, this may be due to the relationship between episiotomy and third and fourth degree lacerations.<sup>32</sup> Other research has confirmed the relationship between obstetric sphincter injury and perineal PPP.<sup>33</sup> Amongst primiparous individuals, dyspareunia at six months has also been associated with degree of obstetric laceration by some investigators but not others.<sup>32,34</sup>

Nulliparous patients report higher perineal pain at six weeks postpartum even after adjusting for degree of perineal trauma,<sup>32</sup> as well as sexual problems at eight and sixteen weeks postpartum.<sup>35</sup>

Even when controlling for parity, length of labor and perineal trauma, operative VD has been found to be associated with perineal pain.<sup>35</sup> Similarly, when controlling for length of labor, degree of perineal trauma and infant birthweight, operative VD is associated with perineal pain at six to seven months postpartum.<sup>36</sup> Operative VD is also associated with dyspareunia at six months even after controlling for other factors such as degree of laceration.<sup>15</sup>

While duration of the second stage of labor has been found to be associated with increased perineal pain at the time of hospital discharge, this association is not present at six weeks or three months post-delivery.<sup>37</sup> Post-vaginal dyspareunia is thought to be due to muscle hypertonicity, scar tenderness, vestibular tenderness, and/or atrophy.<sup>38</sup>

With regard to laceration repair, while continuous suture has been associated with less short-term pain, no difference between interrupted and continuous suture has been shown with respect to long-term pain.<sup>39</sup> Similarly, suture type does not seem to impact rates of long-term perineal pain and dyspareunia.<sup>40</sup>

## Cesarean Delivery

Conversely, pain after CD is generally incisional and located in the abdomen. It results in higher intensity somatic pain initially with slower recovery to the pre-pregnancy level of functionality.<sup>41</sup> Neuropathic pain due to the entrapment of the ilioinguinal or the iliohypogastric nerve during wound closure is another form of PPP that occur following CD. Factors strongly and specifically associated with persistent incisional scar pain after CD include a coexisting persistent pain problem in another part of the body and severe acute postoperative pain.

Attempts to modify the postpartum course following CD by implementing new supportive devices to improve pain control have not achieved significant improvement. For example, Zuckerwise et al tested a panniculus elevation device during CD to reduce postoperative pain and opioid consumption as potential predictors of PPP. In their randomized, controlled study, they found no improvement comparing the outcome of 118 patients with the device vs 104 control patients.<sup>42</sup>

Interestingly, dyspareunia is seen 10 months after both scheduled and emergent CD, possibly due to pregnancy-related pelvic floor dysfunction.<sup>43</sup> Some have even found that CD is associated with higher rates of dyspareunia compared to VD.<sup>44</sup>

## Peripartum Analgesia

As mentioned among risk factors, untreated, or inadequately managed labor pain is considered a contributor to the development of PPP. Furthermore, the presence of birth-related pain at 2 weeks postpartum is a predictor of the development of PPP.<sup>45</sup> Consequently, there have been considerable efforts to examine the effect on peripartum pain control on long-term postpartum recovery. For example, it was suggested that severity of postpartum pain predicts PPP,<sup>22</sup> regardless of mode of delivery,<sup>6</sup> and Nikolajsen and Sng found a reduction of post CD chronic pain related to the choice of anesthetic.<sup>46,47</sup> Others did not prove a strong correlation between the degree of pain during or after labor and PPP.<sup>21</sup>

We briefly review the impact of commonly used intra- and postpartum analgesia options from the perspective on their impact on decreasing the risk of PPP development.

Neuraxial analgesia has been the gold standard to provide intrapartum pain control. The three techniques are continuous epidural, combined subarachnoid/epidural and continuous subarachnoid local anesthetic infusions with or without the addition of an opioid. Several recent publications describe the anesthetic methods that can play a significant role in providing adequate pain control.<sup>48–50</sup> There has been no association suggested between the utilization of these methods and the prevention of PPP by these authors. While data on direct correlation between labor epidural analgesia and the decreased incidence of PPP is lacking, effective labor analgesia does not seem to reduce the incidence of PPD.<sup>51,52</sup> As we describe elsewhere, psychological factors, including PPD are linked to PPP, and therefore, it is unlikely that PPP in general can be prevented by intrapartum neuraxial analgesia alone.

Peripheral nerve blocks have also been utilized in the management of post CD analgesia.<sup>50,53</sup> A meta-analysis found that ilio-inguinal, ilio-inguinal–iliohypogastric, transversalis fascia, erector spinae, transverse abdominis blocks, wound catheter infusion quadratus lumborum block and wound infiltration improved immediate postoperative analgesia when opioid consumption was used as a metric,<sup>53</sup> however, there are no studies specifically exploring their potential long-term benefit on the reduction of PPP.<sup>54</sup>

Systemic and parenteral analgesia can be provided in any phase of labor. For example, inhaled nitrous oxide is being used in many obstetric units during early labor.<sup>55</sup> It has been shown to display superior analgesia effect when compared to placebo, however, it is inferior to the analgesia profile of both systemic opioids and regional analgesia techniques. Data is lacking on any long-term effect of nitrous oxide on the development of PPP.

Systemic opioids are also utilized commonly, and both the analgesic efficacy and their safety have been proven by multiple analyses for both the mother and the fetus. Remifentanyl patient-controlled infusion has gained popularity in some institutions, but intravenous bolus doses of both traditional mu-receptor agonists and partial agonists are still used extensively.<sup>55–57</sup> However, similarly to regional analgesia, there are no data showing evidence of decreasing the incidence of PPP.

The concept of multimodal analgesia, ie, the concomitant utilization of different analgesia techniques, such as regional interventions, systemic opioids, non-steroidal anti-inflammatory drugs (NSAIDs) and acetaminophen, has found its role in the management of obstetric patients. The goal of this approach to simultaneously augment the efficacy

of pain control and decrease the occurrence of the inherent side effects of each individual method or drug. Multimodal analgesia shows promising results when postpartum opioid consumption is used as a metric of success.<sup>58</sup> It is one of the cornerstones of the enhanced recovery after surgery (ERAS) initiative for CD patients, but the concept could be expanded for all peripartum patients. Although the data on the impact of multimodal analgesia and ERAS are encouraging from the perspective of several metrics improved analgesia the immediate peripartum period has not been proven consistently. In a prospective study of patients who underwent non-emergent CD after 37 weeks, no difference was found in opioid consumption between the ERAS and the control groups in a total of 118 patients.<sup>59</sup> On the contrary, in a study of pre and post ERAS implementation, both lower pain scores and less opioid consumption were found in the ERAS group.<sup>60</sup> Another cohort study found lower opioid consumption in the ERAS group as well, however, pain scores did not differ between the study and control groups.<sup>61</sup> The different findings perhaps are related to study protocol differences, study size and they might be related to the controversy of utilizing opioid consumption as a surrogate measure for the severity of pain. Therefore, additional, well-designed prospective studies in large patient population are needed that are tailored to the capturing strong data on analgesia interventions to prevent PPP.

Unfortunately, some of the side effects of the utilized analgesia methods may induce persistent pain. Most notable example for the latter is chronic back pain and transient neurological symptoms following neuraxial analgesia. Dural puncture, especially the inadvertent form during epidural needle placement may rarely result in chronic headache that does not respond to the conventional management of the resulting cerebrospinal fluid leak.<sup>62,63</sup> Non-infectious arachnoiditis, a rare, but potentially devastating complication of epidural blood patch necessitated by either inadvertent dural puncture during labor epidural analgesia or rarely by planned intrathecal neuraxial anesthesia and may be behind a severe back pain and functional disability.<sup>64</sup> Finally, while rare, peripartum opioid administration may result in opioid-induced hyperalgesia, especially in patients who receive remifentanyl for labor analgesia and those with history of opioid dependence.<sup>65–67</sup>

## Discussion and Recommendations

Prolonged pain following childbirth is complex multifactorial and influenced by somatic and psychosocial factors. Therefore, no single intervention can be identified that will reliably prevent the occurrence of PPP.

Even though current data about the impact of labor analgesia on the development of PPP is ambiguous, it is without question that providing effective intrapartum analgesia and anesthesia for operative deliveries is a medical, ethical, and moral imperative. Although the long-term benefits of such thorough care might not be detectable due to study design, sample size or other methodological factors at this time, multidisciplinary efforts are warranted to prove the desired outcome of reduced incidence and severity of persistent PPP.

Unfortunately, the most efficacious analgesia approaches are either invasive procedures, or utilization of opioid medications. Invasive procedures carry the risk of procedural complications, while opioids have important systemic side effects. NSAIDs and acetaminophen are not only relatively weak antinociceptive drugs and their dosing is also limited by their respective hepatic, renal and gastrointestinal side effects.

To further complicate the quest for finding the silver bullet for effective peripartum pain control with long-term benefits, other, sometimes to most physiological conditions can contribute to PPP. One such example is breastfeeding that is also known to be associated with postpartum dyspareunia.<sup>16,68</sup>

Therefore, it will be worth considering some of the new pathways of antinociception that are investigated and might be introduced in peripartum analgesia in the future.

The relatively novel recognition of the potential analgesic property of oxytocin might be a future target of optimizing long-term postpartum outcome.<sup>41</sup> It has been suggested that endogenous oxytocin release during labor attenuates acute pain and promotes “nociceptive amnesia”, and putative mechanisms were proposed.<sup>69–71</sup>

The findings by Ende et al, while pain is higher initially following intrapartum CD compared to CD not preceded by labor, but the difference diminishes after the first postoperative day,<sup>14</sup> indirectly highlight the putative long-term antinociceptive role of oxytocin. The rapid elimination of the initial difference in pain perception between the two groups in their study population might support the intermediate and long-term postpartum antinociceptive effect of stimulating the endogenous oxytocin secretion and/or administering exogenous oxytocin during labor. In addition,

oxytocin has been shown to positively modify psychosocial behavior, and it was shown to reduce the incidence and severity of PPD. Since there is a correlation between PPD and PPP, the role of oxytocin in mitigating the latter is a viable theory. Further studies might elucidate more clearly whether manipulating endogenous oxytocin secretion or the administration of exogenous oxytocin could play a role in mitigating PPP.

Other novel targets of the pain pathways with minimal systemic side effects are on the horizon as well. VX-548, a highly selective Na-channel inhibitor that binds to the  $Na_v1.8$  voltage-gated sodium channel on peripheral nociceptive neurons, thereby inhibiting the transmission of nociceptive signals shows encouraging dose-dependent pain control results with minimal systemic side effects following abdominoplasty and bunionectomy.<sup>72</sup> While it always takes more time to approve a new drug for pregnant patients due to concerns regarding their effect on the developing fetus, if this drug is deemed safe during pregnancy and lactation, it will hopefully either eliminate the need for, or may decrease the dose of opioids, NSAIDs and acetaminophen. Effective suppression of the propagation of a nociceptive peripheral input towards the spinal cord and to higher pain processing centers may also decrease the need for invasive procedures targeting the same pathways in the future.<sup>73</sup>

Virtual reality (VR) technology has been shown to improve pain control in a variety of settings, such as burn and other injuries. VR is thought to work via distraction, and by suppressing the pain processing network through intercortical modulation of the afferent noxious information.<sup>74</sup> Recent studies, involving small number of patients, showed that intrapartum VR improved labor analgesia.<sup>75,76</sup> VR seems to be effective in the management of chronic pain as well.<sup>77</sup> It might be interesting to expand studying the efficacy of VR into the postpartum period and examine its impact on functional recovery.

However, in the opinion of these authors, there is already a significant opportunity to improve the patient experience following childbirth. As we have shown, the current techniques of both obstetric maneuvers and anesthetic and analgesic options, albeit effective and important for providing adequate comfort during labor and in the immediate postpartum period, fall short of eliminating PPP. There are opportunities, however, in antenatal care to alter the course of postpartum pain and its psychological side effects. Pauley et al found that patients want more evidence-based education about behavioral strategies for postpartum pain management.<sup>78</sup>

We believe that identifying and addressing preexisting pain conditions and the psychosocial risk factors as early as possible, even before or in the early stage of pregnancy may have the highest yield in improving both intra and postpartum pain behavior. Such approach requires a multidisciplinary effort, including obstetricians, psychologists, and social workers.<sup>25</sup> Early referral of patients with identified risk factors for PPP to an obstetric anesthesiologist is recommended. Tong et al found that participation in an obstetrical anesthesia clinic combined with epidural anesthesia was associated with a lower rate of PPD.<sup>54</sup>

A positive modification of the identifiable risk factors could predictably promote an emotionally more fulfilling birth experience and faster postpartum recovery both physically and psychologically. Traumatic birth experience and postpartum psychological derangements have short- and long-term negative impact on both the mother and the newborn (eg, suicide, killing the newborn, feeding difficulties, impaired psychosocial development of the newborn).<sup>18,79,80</sup> By preventing or modifying the course of postpartum dysfunction and psychological, behavioral ailment, both mothers and their children can anticipate a healthier and more productive life.

In conclusion, PPP is a result of diverse etiology, including an interplay between somatic and psychosocial factors. Despite the availability of multiple reliable and effective methods to relieve acute intra- and immediate postpartum pain, our understanding of PPP remains limited. Further studies are required to elucidate the relationship between intrapartum interventions and the incidence of PPP. In addition, it will be beneficial to explore existing as well as new multi-modal treatment avenues for patients with PPP which may include drug therapy, surgical interventions, psychotherapeutic approaches, and counseling. Therefore, a multidisciplinary, systematic, and protocol-based screening of patients for individual psychosomatic risk factors for PPP is strongly recommended. Prenatal management, both medical and psychological, should be tailored to individual needs based on the result of such screening. Intrapartum communication and analgesic efforts, including a multimodal pain regimen and early introduction of intrapartum, and continued postpartum analgesia should be considered the cornerstone of peripartum management.

## Abbreviations

CD, Cesarean Delivery; CO, Cardiac Output; CPSP, Chronic Post-Surgical Pain; CTS, Carpal Tunnel Syndrome; EPDS, Edinburgh Postnatal Depression Score; ERAS, Enhanced Recovery After Surgery; GERD, Gastroesophageal Reflux Disease; NSAIDs, Non-Steroidal Anti-Inflammatory Drugs; PCS, Pain Catastrophizing Scale; PP, Postpartum Pain; PPD, Postpartum Depression; PPP, Persistent Postpartum Pain; PSS, Cohen's Perceived Stress Scale; RAS, Renin-Angiotensin System; SF-MPQ-2, Short-Form McGill Pain Questionnaire-2; STAI, Spielberger's State-Trait-Anxiety Inventory; SVR, Systemic Vascular Resistance; VD, Vaginal Delivery; VR, Virtual Reality.

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