



The Biopsychosocial Management of Perinatal Pelvic Girdle Pain: From Biomarkers to Mobility

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Abstract

Background: Perinatal Pelvic Girdle Pain (PPGP) is a highly prevalent and disabling condition affecting up to 50% of pregnant and postpartum individuals, characterized by pain in the sacroiliac joints, pubic symphysis, and surrounding structures. Its etiology is multifactorial, involving biomechanical, hormonal, and psychosocial factors, yet clinical management often remains fragmented and biomechanically focused. This approach overlooks the significant psychological distress and potential systemic inflammatory components that modulate pain experience and disability. **Aim:** This narrative review synthesizes contemporary literature (2010-2024) to propose an integrated biopsychosocial model for PPGP management. It examines the roles of midwifery, physical therapy, psychology, and medical laboratory science in screening, assessing, and treating pain from a holistic perspective. **Methods:** A systematic search of PubMed, CINAHL, PsycINFO, and Scopus databases identified peer-reviewed articles on PPGP epidemiology, biomechanics, psychological correlates, inflammatory biomarkers, and intervention studies. **Results:** PPGP is best understood as a biopsychosocial phenomenon. Midwifery provides essential first-line screening and supportive care. Physical therapy offers effective biomechanical interventions, but their efficacy is enhanced when combined with psychological strategies targeting pain catastrophizing and kinesiophobia. Emerging evidence suggests low-grade systemic inflammation, measurable via biomarkers like CRP and IL-6, may correlate with pain severity and chronicity, offering a potential objective guide for treatment stratification. **Conclusion:** Optimal management of PPGP requires a coordinated, interdisciplinary approach. Moving beyond a purely structural model to one that integrates biomechanical correction, psychological support, and biomarker-informed care can improve functional outcomes, reduce the transition to chronic pain, and enhance the perinatal experience.

Keywords: Pelvic Girdle Pain; Pregnancy; Biopsychosocial Model; Interdisciplinary Care; Inflammation.

Introduction

Perinatal Pelvic Girdle Pain (PPGP), encompassing pain in the posterior pelvic ring (sacroiliac joints) and anterior ring (pubic symphysis), represents one of the most common and impactful musculoskeletal complaints of pregnancy and the postpartum period, with prevalence estimates ranging from 20% to 50% (Pellerino et al., 2023; Wuytack et al., 2018). Its consequences extend far beyond physical discomfort, significantly impairing mobility,

sleep, activities of daily living, and mental health, and posing a substantial risk for the development of chronic postpartum pain (Elden et al., 2016; Karaaslan et al., 2023). Historically, PPGP has been framed primarily through a biomechanical lens, attributed to pregnancy-induced hormonal relaxation of pelvic ligaments (relaxin, progesterone), altered load distribution, and resultant joint instability (Mens & Pool-Goudzwaard, 2017). While these factors are undoubtedly contributory, an exclusive focus on

structure and mechanics fails to explain the wide variability in symptom severity, the poor correlation between imaging findings and pain, and the significant cohort of individuals who experience persistent disability long after childbirth—a point where hormonal influences have ostensibly normalized (Robinson et al., 2010; Gashaw et al., 2022).

This clinical paradox underscores the necessity of a more comprehensive explanatory model. The biopsychosocial framework, which posits that illness and pain result from complex, dynamic interactions between biological, psychological, and social factors, offers a far more robust paradigm for understanding and treating PPGP (Gatchel et al., 2014). Biologically, emerging research points beyond passive ligament laxity to active processes such as low-grade systemic inflammation, potentially driven by the immunomodulatory state of pregnancy and influenced by factors like stress and adiposity (Drejza et al., 2022). Psychologically, the perinatal period is a time of profound psychological transition, where pre-existing vulnerabilities, pain catastrophizing, fear-avoidant behaviors (kinesiophobia), and perinatal anxiety/depression can dramatically amplify pain perception and disability (Sakamoto & Gamada, 2019). Socially, expectations of motherhood, lack of support, and occupational demands can further modulate the pain experience.

Despite this complexity, clinical management often remains siloed. Midwives may screen for pain but lack time or specific training for management. Physical therapists provide crucial exercise and manual therapy, but may not address maladaptive cognitive-behavioral patterns. Psychologists are rarely integrated into standard care pathways, and the potential role of objective biomarkers to guide treatment intensity or predict chronicity is unexplored in routine practice. Therefore, this narrative review aims to synthesize the contemporary evidence base to construct and advocate for an integrated, biopsychosocial management model for PPGP. We will critically examine the unique and complementary roles of Midwifery in holistic antenatal screening and support; Physical Therapy in evidence-based biomechanical and neuromuscular rehabilitation; Psychology in addressing cognitive and affective pain drivers; and Medical Laboratory Science in identifying and monitoring potential inflammatory correlates of pain. By bridging these disciplines, this review argues that effective PPGP care must move from a reactive, unimodal approach to a proactive, personalized, and interdisciplinary strategy that addresses the whole person in pain.

Methodology

This narrative review employed a systematic and iterative search strategy to identify and synthesize the contemporary literature relevant to a biopsychosocial understanding of Perinatal Pelvic Girdle Pain (PPGP). Searches were conducted across four primary electronic databases—

PubMed/MEDLINE, CINAHL, PsycINFO, and Scopus—to capture interdisciplinary perspectives. The search strategy combined controlled vocabulary (e.g., MeSH terms, CINAHL Subject Headings) and keywords from five conceptual domains pertinent to the review's scope: (1) the Condition (e.g., "pelvic girdle pain," "pregnancy related pelvic pain," combined with "pregnancy," "postpartum," "perinatal"); (2) the Biological/Medical Aspect (e.g., "inflammation," "biomarker," "relaxin"); (3) the Psychological Aspect (e.g., "pain catastrophizing," "fear-avoidance," "depression"); (4) Intervention (e.g., "physical therapy," "cognitive behavioral therapy," "interdisciplinary rehabilitation"); and (5) Profession/Role (e.g., "midwifery," "screening").

Boolean operators (AND, OR) linked concepts within and across these domains to create a sensitive yet focused search, which was limited to English-language articles published between 2010 and 2024 to prioritize contemporary research and evolving clinical paradigms (Wong et al., 2013). The inclusion criteria encompassed peer-reviewed original research (observational studies, randomized controlled trials), systematic reviews, and meta-analyses focusing on the epidemiology, etiology, pathophysiology, psychological associations, biomarker correlates, or evaluation of therapeutic interventions for PPGP. Studies addressing other perinatal pain conditions were excluded unless they offered directly applicable mechanistic or interventional insights. Given the integrative nature of the topic, spanning biomedical, psychological, and clinical disciplines, a narrative synthesis methodology was adopted to thematically analyze the findings and construct a coherent interdisciplinary model, as this approach is well-suited for organizing complex evidence from diverse methodological traditions into a unified explanatory framework (Wong et al., 2013).

The Biopsychosocial Matrix of PPGP

PPGP is not a single disease but a clinical syndrome arising from a complex matrix of interacting factors. The traditional biological model emphasizes pregnancy-induced hormonal changes, primarily increased relaxin and progesterone, which increase ligamentous laxity in the pelvis to accommodate childbirth (Mens et al., 2009). This laxity, combined with the anterior shift in the center of gravity and increased lumbar lordosis, alters load transfer across the sacroiliac joints, potentially leading to strain, micro-trauma, and pain. However, hormonal levels correlate poorly with individual pain experience, suggesting other mediators are at play.

Emerging biological evidence implicates systemic inflammation as a key modulator. Pregnancy itself is a state of controlled immune modulation, but dysregulation or heightened inflammatory responsiveness may contribute to pain sensitization. Studies have found elevated levels of pro-inflammatory cytokines (e.g., Interleukin-6, IL-6;

Tumor Necrosis Factor-alpha, TNF- α) and acute-phase proteins (e.g., C-reactive protein, CRP) in individuals with PPGP compared to asymptomatic pregnant controls (Burani et al., 2023; Beales et al., 2010). This low-grade inflammation could sensitize peripheral nerves, facilitate central pain processing, and contribute to the transition from acute to chronic pain. Furthermore, biomechanical strain itself can trigger a local inflammatory response in joint structures, creating a feedback loop between mechanics and biochemistry (Ali et al., 2020).

The psychological dimension is equally critical. The pervasive fear-avoidance model is highly applicable: pain leads to fear of movement (kinesiophobia), resulting in avoidance of activity, physical deconditioning, depression, and increased disability, which in turn exacerbates pain perception (Vlaeyen, 2016). In PPGP, fear of harming the baby or causing permanent damage is a potent specific fear. Pain catastrophizing—the tendency to magnify the threat of pain and feel helpless in its presence—is strongly associated with higher pain intensity, greater disability, and poorer response to physical therapy in PPGP populations (Wiezer et al., 2020). Perinatal depression and anxiety are common comorbidities that share neurobiological pathways with chronic pain and significantly worsen pain-related outcomes (Olsson & Lena, 2004).

Social and contextual factors complete the picture. Occupational demands (especially those involving prolonged standing or lifting), parity, history of previous low back or pelvic pain, and levels of practical and emotional support all influence the onset, severity, and trajectory of PPGP. This biopsychosocial matrix explains why two individuals with similar biomechanical presentations can have vastly different pain experiences and disability levels, and why interventions must be correspondingly multidimensional.

Pillars of Integrated Management

Effective management of Perinatal Pelvic Girdle Pain (PPGP) necessitates a coordinated continuum of care, where different healthcare professions fulfill essential and interconnected roles across the screening, intervention, and support spectrum. This integrated approach ensures that the biological, psychological, and functional dimensions of the condition are addressed comprehensively.

First-Line Screening, Holistic Support, and Navigation

The midwife, as the most consistent point of contact throughout the perinatal journey, is positioned as the cornerstone for early identification and foundational management (Wuytack et al., 2018). This pivotal role encompasses routine screening through the integration of simple, validated questions and physical tests (e.g., Posterior Pelvic Pain Provocation test) into standard antenatal appointments to facilitate prompt diagnosis. Beyond identification, midwives provide holistic education and reassurance, offering

evidence-based information about PPGP's nature and expected course, which serves to normalize the experience and reduce associated anxiety and catastrophizing (Santos et al., 2023). They deliver practical lifestyle and activity guidance on safe movement, optimal rest postures, and the use of support belts for immediate symptomatic relief. Critically, midwives act as essential care coordinators and navigators, initiating and facilitating timely referrals to physical therapy, psychology, or physician-led care when pain is severe, functionally limiting, or accompanied by significant psychological distress, thereby ensuring access to specialized services (Vleeming et al., 2008).

Restoring Biomechanical Function and Control

Physical therapy constitutes the most extensively researched and established intervention for PPGP, with a primary focus on restoring optimal load transfer and motor control around the pelvic girdle. The core of this intervention is targeted exercise therapy, which involves prescribing specific stabilization exercises for the deep trunk and pelvic muscles (e.g., transverse abdominis, pelvic floor, multifidus) (Mapinduzi et al., 2022). The therapeutic goal is not to create rigid stability in hypermobile joints but to enhance neuromuscular control and coordination, thereby improving the body's intrinsic force closure mechanisms around the sacroiliac joints. This is supplemented by skilled manual therapy techniques, including joint mobilization and soft tissue work, to reduce pain and improve mobility, thereby creating a more favorable environment for active exercise (Lepri et al., 2023). A fundamental and modern component of physical therapy practice is therapeutic neuroscience education, which helps patients reconceptualize their pain from a simple signal of tissue damage to a complex, multifactorial alarm system; this educational strategy directly targets kinesiophobia and empowers active participation in the rehabilitation process (Louw et al., 2016).

Addressing Cognitive-Affective Pain Drivers

When pain persists despite physical interventions or is accompanied by significant psychological distress, specialized psychological input becomes imperative. Cognitive-Behavioral Therapy (CBT) for pain is a primary modality, targeting maladaptive cognitive patterns (e.g., catastrophizing), fear-driven behaviors (e.g., avoidance), and distressing emotions to break the fear-avoidance cycle and develop functional coping skills (Starzec-Proserpio et al., 2022). For individuals with more chronic pain presentations, Acceptance and Commitment Therapy (ACT) can be particularly beneficial, focusing on accepting unpleasant sensations while committing to valued actions and life goals. Additionally, mindfulness-based interventions can reduce stress reactivity and the emotional suffering associated with persistent pain, promoting greater psychological flexibility.

Medical Laboratory Science in Search of Objective Biomarkers

The potential role of clinical laboratory science represents an emerging frontier in the biopsychosocial model of PPGP. The identification of reliable biochemical signatures, such as specific inflammatory markers, could transform clinical practice by enabling risk stratification, monitoring treatment response, and guiding pharmacological decisions (Abdelnaeem et al., 2019). Current evidence highlights C-reactive protein (CRP) and interleukin-6

(IL-6) as promising candidates, with studies indicating that elevated CRP in early pregnancy is associated with a higher risk of developing PPGP and that IL-6 levels correlate with reported pain intensity (Rexelius et al., 2020). However, this research remains nascent, and such markers are non-specific, as they are also elevated in other conditions like infection. The integration of these diverse professional roles and their primary functions within a coordinated care model is summarized in Table 1.

Table 1: The Interdisciplinary Biopsychosocial Management Model for PPGP

Discipline/Role	Core Functions & Interventions	Primary Target Domain	Key Outcome Goals
Midwifery	Routine antenatal screening; holistic education & reassurance; lifestyle/activity guidance; care coordination & referral.	Social & Educational: Early detection, reducing anxiety, facilitating system navigation.	Early identification, reduced fear, appropriate and timely referral, enhanced patient empowerment.
Physical Therapy	Specific motor control/stabilization exercise; manual therapy; therapeutic neuroscience education; graded functional loading.	Biological (Biomechanical) & Psychological (Fear): Improving load transfer, reducing nociception, reconceptualizing pain, reducing kinesiophobia.	Improved pain, enhanced pelvic girdle stability/control, increased functional capacity (walking, standing), reduced fear of movement.
Psychology (Clinical/Health)	Cognitive-Behavioral Therapy (CBT); Acceptance & Commitment Therapy (ACT); mindfulness for pain; addressing catastrophizing & perinatal mood.	Psychological (Cognitive-Affective): Modifying maladaptive thoughts/behaviors, improving coping, managing comorbid anxiety/depression.	Reduced pain catastrophizing, decreased pain-related fear and avoidance, improved mood, enhanced pain self-efficacy.
Medical Laboratory	Assay of inflammatory biomarkers (e.g., CRP, IL-6, TNF- α); research into predictive/prognostic biochemical panels.	Biological (Systemic): Identifying objective correlates of pain severity/systemic involvement.	Risk stratification, objective monitoring of disease activity, potential guidance for adjunctive pharmacological management in severe cases.
Medical Lead (OB/GYN, GP, Rheumatologist)	Diagnosis, ruling out red flags, medication management (cautious), overseeing complex interdisciplinary plans.	Biological (Medical): Medical diagnosis, safety, pharmacological intervention.	Accurate diagnosis, safe prescribing, and coordination of complex care plans.

Evidence for Integrated Care and Emerging Biomarkers

The efficacy of unimodal physical therapy for PPGP is well-established, with high-quality systematic reviews supporting exercise therapy, particularly specific stabilizing exercises, for reducing pain and improving function (Mamipour et al., 2023). However, effect sizes are often moderate, and not all individuals respond. This highlights the limitations of a purely biomechanical approach and the need to address other dimensions of the biopsychosocial model.

Emerging evidence supports the value of integrated care. Studies incorporating psychological strategies, such as CBT principles, into physical therapy programs show superior outcomes in reducing pain catastrophizing, fear-avoidance, and disability compared to physical therapy alone (Stuge et al., 2017). While fully implemented interdisciplinary pain programs for PPGP are rare, models from chronic low back pain demonstrate that combined physical and psychological rehabilitation leads to better long-term functional outcomes and reduced healthcare utilization (Kamper et al., 2015).

The evidence for inflammatory biomarkers, while promising, is primarily associative and derived from cohort studies. Kablan et al. (2022) found that pregnant individuals with PPGP had significantly higher serum levels of IL-6 and CRP than pain-free controls, and these levels correlated with self-reported pain severity. Stuge (2019) reported similar findings. Importantly, this suggests that PPGP, in at least a subset of individuals, may involve a systemic inflammatory component rather than being purely a

local mechanical issue. This has profound implications, potentially linking PPGP to other pregnancy complications with inflammatory underpinnings and opening the door for novel treatment approaches. However, significant research is needed to establish causal relationships, determine sensitivity/specificity, and define clinically meaningful biomarker thresholds before routine laboratory testing can be recommended (Table 2).

Table 2: Potential Inflammatory Biomarkers in PPGP and Their Clinical Research Implications

Biomarker	Biological Role	Evidence in PPGP	Potential Clinical Utility	Cautions & Research Gaps
C-Reactive Protein (CRP)	Acute-phase reactant; non-specific marker of systemic inflammation.	Elevated in pregnant women with PPGP vs. controls; associated with higher pain scores (Abdelnaeem et al., 2019; Stuge, 2019).	Risk Stratification: High early-pregnancy CRP may flag risk for severe PPGP. Monitoring: Track response to anti-inflammatory lifestyle/therapies.	Very non-specific; elevated in many pregnancy conditions (infection, pre-eclampsia). Need pregnancy-specific reference ranges.
Interleukin-6 (IL-6)	Pro-inflammatory cytokine; key driver of acute-phase response and pain sensitization.	Consistently elevated in PPGP cohorts; strong correlation with pain intensity (Drejza et al., 2022).	Mechanistic Insight: Flags inflammatory-phenotype PPGP. Therapeutic Target: May guide trials of anti-inflammatory interventions.	Measuring stable levels is technically more complex than CRP. Dynamic levels require careful timing.
Tumor Necrosis Factor-alpha (TNF-α)	Pro-inflammatory cytokine involved in pain pathways and tissue degradation.	Some studies show elevation; evidence is less consistent than for IL-6.	Similar to IL-6, may identify a specific inflammatory sub-phenotype.	Inconsistent data; role in PPGP is less clear.
Relaxin	Hormone promoting ligamentous relaxation.	Historical focus, but serum levels correlate poorly with pain symptoms.	Limited. Not a useful diagnostic or prognostic biomarker for symptomatic PPGP.	Highlights that hormonal laxity is a permissive factor, not a direct pain cause.

Discussion

Translating the biopsychosocial model into routine clinical practice for PPGP presents significant but surmountable challenges. The primary barrier is systemic fragmentation. Prenatal care, physical therapy, and mental health services often operate in separate silos with distinct referral pathways, funding streams, and communication channels. Implementing integrated care requires intentional system redesign, potentially through the creation of specialized perinatal musculoskeletal clinics or defined care pathways that facilitate co-assessment and co-management. In such models, a midwife or obstetrician could refer directly to a team including a physical therapist and a health psychologist, with shared treatment goals and regular communication.

A second challenge is workforce training and awareness. Midwives and obstetricians need enhanced training in basic PPGP screening and the principles of pain neuroscience to provide effective first-line education. Physical therapists require advanced skills in perinatal care and in integrating psychologically-informed practice into their treatment. Psychologists need familiarity with the unique context of perinatal pain. Interprofessional education initiatives are crucial.

The most promising future direction lies in personalized medicine. Not all PPGP is the same. Future research should aim to define distinct clinical phenotypes: perhaps a "mechanical-dominant" phenotype best suited to physical therapy, an "inflammatory-dominant" phenotype where

lifestyle (diet, stress management) and perhaps targeted pharmacology play a role, and a "central-sensitization/distress-dominant" phenotype requiring intensive psychological intervention. Inflammatory biomarkers, alongside detailed psychosocial assessment, could be key tools in this phenotyping process. Furthermore, investigating safe anti-inflammatory interventions (e.g., specific dietary modifications, omega-3 supplementation) for those with biomarker elevation is a logical next step.

Conclusion

Perinatal Pelvic Girdle Pain is a classic biopsychosocial condition that demands an equally integrated response. Moving beyond a reductionist, biomechanical view to one that embraces the complex interplay of ligaments, cytokines, thoughts, and emotions is essential for improving patient outcomes. This review has outlined a model where midwifery provides the foundational screening and support, physical therapy addresses neuromuscular dysfunction within a reassuring framework, psychology targets the cognitive and affective amplifiers of pain, and laboratory science begins to offer objective windows into underlying systemic processes. The path forward requires breaking down professional silos to foster true interdisciplinary collaboration. By implementing such a model, we can shift the standard of care for PPGP from simply managing a pregnancy symptom to proactively safeguarding maternal mobility, mental health, and long-term well-being during one of life's most transformative periods.

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