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REVIEW

Navigating Pregnancy Testing in Chronic Pain Management for Women of Reproductive Age

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Background: Women of childbearing age often require a nuanced and individualized approach to chronic pain management, especially when pregnancy is a possibility. Interventional procedures involving ionizing radiation, such as fluoroscopy-guided injections, raise specific concerns for fetal safety, including risks of embryo death, congenital anomalies, intellectual disability, and microcephaly. Despite national recommendations from organizations like the American College of Radiology (ACR), implementation of pregnancy screening in the pain management context remains limited.

Methods: This review synthesizes current literature and practice guidelines to assess the gaps in pregnancy screening protocols within chronic pain management settings. It highlights challenges in evaluating pregnancy status before initiating pharmacologic or fluoroscopic procedures, and it examines both biological testing limitations and procedural risks.

Results: Fluoroscopically guided procedures may exceed the teratogenic radiation threshold of 50 mGy, underscoring the critical need for reliable pregnancy screening. While urine and serum hCG tests are widely used, both are susceptible to false negatives and positives due to timing, hormone variants, and analytical interferences. Integrating clinical evaluation with menstrual history, point-of-care testing, and serum confirmation may improve diagnostic accuracy and ensure greater protection for the fetus.

Conclusion and Recommendations: To address safety concerns, this review proposes a structured pregnancy screening algorithm tailored for chronic pain practices. Key recommendations include: routine screening of all reproductive-age women prior to procedures involving radiation or teratogenic medications, use of serum hCG testing when uncertainty exists, optimizing radiation exposure strategies, and clear, informed consent processes outlining fetal risks. Adoption of these best practices may improve clinical consistency and enhance patient safety.

Keywords: pregnancy, chronic pain, radiation, medications, interventions

Introduction

Chronic pain is a major public health issue in the United States, affecting roughly one in five adults as of 2021. This widespread burden carries significant consequences—including increased healthcare costs, lost productivity, and a higher risk of depression, dementia, suicidal ideation, and substance abuse.[1] Among those most affected are women of childbearing age, many of whom experience chronic low back and neck pain—conditions that accounted for $134.5 billion in medical spending in 2016 alone.[2,3]

Women tend to experience chronic pain more frequently than men. A global meta-analysis involving 30 studies found that 11.2% of women reported chronic widespread pain, compared to just 7.2% of men.[4] This disparity is linked to a mix of biological, psychological, and social influences. For women in midlife—often balancing demanding roles at home and at work—chronic pain can severely impact quality of life.[5]

Pain management in women of reproductive age presents a unique challenge. During pregnancy, physiological changes—including increased levels of relaxin, estrogen, and progesterone—can lead to ligament laxity and altered biomechanics. These changes commonly result in lumbopelvic pain, which tends to intensify in the second and third

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trimesters.[6] In addition, some women develop heightened sensitivity to pain, even in the absence of mechanical issues, due to both hormonal shifts and emotional stressors.[7]

Interestingly, pregnancy itself can sometimes blunt pain perception. By the third trimester, many women experience what's known as pregnancy-induced analgesia, a phenomenon driven by hormonal changes and immune modulation through T-cell and opioid pathways.[8,9] Recent work even points to the involvement of the PD-L1/PD-1 pathway in reducing spinal inflammation and pain perception.[9] Still, despite this natural modulation of pain, many women require treatment. Studies show that women aged 18–45 represent a significant share of chronic pain clinic patients, accounting for between 25–37% of visits.[10,11]

When it comes to pain management, especially in this demographic, the opioid crisis has made things even more complicated. The CDC's 2022 guidelines for opioid prescribing underscore the importance of avoiding opioids when possible—particularly for pregnant patients—and instead encourage non-opioid medications and non-pharmacologic strategies.[12]

However, what has not yet been fully assessed in chronic pain management is pregnancy screening—especially when interventional procedures like fluoroscopy are involved as many such procedures carry risks for a developing fetus.

The American Society of Anesthesiologists (ASA) recommends considering pregnancy testing for women of childbearing age with uncertain or suggestive pregnancy histories, particularly when fluoroscopy is planned.[13] This aligns with the American College of Radiology (ACR) guidance, advising pregnancy testing within 72 hours prior to fluoroscopic procedures likely to deliver doses above 100 mGy.[14] Similarly, the American Society for Gastrointestinal Endoscopy (ASGE) advocates confirming pregnancy status before procedures involving ionizing radiation, particularly during early gestation, to mitigate potential fetal risks.[15] Still, these recommendations are often general, and pain clinics vary widely in how they implement them.

Our review focuses specifically on this gap: the unclear approach to pregnancy screening specifically in chronic pain management. We propose a more standardized approach—one that considers what kind of testing is appropriate and when those tests should be performed. By doing so, we aim to help practitioners balance effective pain care with the safety of potential pregnancies.

Methods

The literature review was conducted using PubMed and OpenEvidence. Data was collected by linking different variations of the keywords together such as pregnancy, pregnancy testing, chronic pain management, radiation, medications, interventions, guidelines. For example, "Pregnancy testing guidelines in chronic pain management". Inclusion criteria included English language and peer-reviewed articles. Exclusion criteria included articles focusing solely on non-clinical populations or animal models. There were no established time frame restrictions for the literature search.

Management of Chronic Pain in Women of Childbearing Age

Non-Pharmacological Strategies

For women who are pregnant or may become pregnant, non-pharmacological pain treatments are often the safest starting point. These treatments provide relief with minimal side effects and are considered safe in pregnancy.[16]

For pregnancy-related low back pain, interventions like progressive muscle relaxation, Kinesio Taping, and transcutaneous electrical nerve stimulation (TENS) have been shown to reduce discomfort and improve mobility.[17] Likewise, some patients with chronic pain have favorable responses to multimodal therapies such as pelvic floor physical therapy, acupuncture, psychotherapy, and neuromodulation.

Exercise-based interventions also show strong evidence for improving pregnancy-related musculoskeletal pain.[18] Complementary therapies—such as chiropractic care, craniosacral therapy, and osteomanipulative techniques—may offer additional benefit when used under the guidance of experienced providers.[19]

Because these non-pharmacological approaches are considered safe in pregnancy, pregnancy testing is usually not necessary. Though, while these interventions reduce reliance on medications, they may not eliminate the need for them altogether, in which case pregnancy testing is likely warranted.

Pharmacological Strategies

Acetaminophen remains the first-line option due to its strong safety profile across all trimesters.[20,21] However, like any medication, it should be used at the lowest effective dose and for the shortest duration necessary.

NSAIDs are generally safe during early pregnancy but are typically avoided in the third trimester due to the risk of fetal complications, including premature ductus arteriosus closure and renal impairment.[20,21]

Opioids, while sometimes required for severe pain, present complex risks. A 2024 systematic review and a 2022 meta-analysis present mixed findings on the teratogenic risks of opioids. While some studies suggest elevated risks for specific birth defects—such as cleft palate or gastrointestinal malformations—others report no significant associations with first-trimester exposure or short-term use.[22,23] To err on the side of caution, guidelines recommend limiting opioids to short-term use when absolutely necessary—and only after non-opioid alternatives have been exhausted.[12]

Other medications like gabapentinoids and tricyclic antidepressants may be cautiously considered for chronic pain during pregnancy, but safety data remain limited. These agents are typically reserved for short-term use when safer options have failed.[20] The uncertainty of teratogenic effects of both opioids and other medications underscores the importance of pregnancy screening before initiating opioid therapy in women of reproductive age.

Radiation Exposure and Pregnancy Risk

When non-pharmacological and pharmacological measures have failed, interventional pain procedures may be warranted. For women undergoing these procedures, radiation exposure introduces another layer of complexity. Fluoroscopy-guided injections can expose a developing fetus to ionizing radiation. Radiation risks are typically categorized as deterministic (eg, malformations, growth restriction) and stochastic (eg, childhood cancer, genetic mutations). The likelihood and severity of these outcomes depend on both the dose and the timing of exposure.[24]

- Below 50 mGy, fetal risk is considered negligible.
- Between 50–100 mGy, risk is unclear and varies based on gestational age.
- Above 100–150 mGy, the risk of adverse outcomes—including neurological impairments and congenital anomalies—increases significantly.[25]

Organogenesis, occurring between weeks 2 and 7 of gestation, represents the most vulnerable period for deterministic effects. For this reason, early pregnancy screening is essential when planning fluoroscopic procedures.

Fluoroscopically guided interventions can deliver higher than 50 mGy doses, particularly if multiple views or prolonged imaging are needed. For reference, the International Commission on Radiological Protection (ICRP) notes that most *diagnostic* imaging procedures fall below the 50 mGy threshold which is not associated with significant risks such as miscarriage, genetic damage, or teratogenicity.[26,27]

Pregnancy screening is a simple, low-cost safeguard. However, despite the pre-procedure pregnancy testing recommendations from professional societies like the ACR and ACC, there remains a lack of formalized, consistent pregnancy testing protocols specifically tailored to chronic pain management settings.

Pregnancy Testing

Biological Basis of hCG Testing

Pregnancy tests typically rely on detecting intact human chorionic gonadotropin (hCG), a hormone produced shortly after implantation, around 8–10 days post-ovulation.[28–32] hCG levels rise through the first trimester, peak, and gradually decline by mid-pregnancy.[30,33] After a pregnancy ends—whether through delivery or miscarriage—levels typically normalize within 4–6 weeks.

hCG exists in multiple forms due to glycosylation apart from intact hCG, including free subunits, and nicked variants.[34–36] This variability can affect test performance, especially early in gestation.

While clinical history can sometimes exclude pregnancy—such as in patients with hysterectomy or active cancer treatment—most cases require testing to confirm pregnancy status.

Urine Pregnancy Tests

Urine-based hCG tests are widely used due to their convenience and affordability. They offer results within minutes and are reliable once hCG levels exceed 20 mIU/mL.[28]

Serum Pregnancy Tests

Serum beta-hCG tests are more sensitive and can detect pregnancy earlier. Results below 5 mIU/mL indicate a non-pregnant state; results above 25 mIU/mL confirm pregnancy. Indeterminate values (6–24 mIU/mL) warrant repeat testing after 48 hours.[37]

Though more accurate, serum testing takes longer and may not be feasible in urgent scenarios. It is especially important in high-risk populations or when urine tests are incongruent with clinical signs.[14]

However, these tests may yield false negatives or false positives in specific clinical contexts.

False Negatives

While pregnancy testing is accessible and effective, clinicians must recognize its limitations and the potential for diagnostic errors. The most common cause of false-negative results is early testing, before hCG levels rise above the detection threshold.[38,39] Variations in ovulation, fertilization, implantation, or delayed menses can all contribute to this.

Another cause is the hook effect, where extremely high hCG levels (eg, in gestational trophoblastic disease) oversaturate the test, leading to a falsely negative result.[40–42] A related issue, the variant hook effect, occurs when specific hCG isoforms (eg, free beta-subunit) interfere with test accuracy, especially between 7–12 weeks of gestation, leading to false-negative urine results.[41] The presence of these variants can lead to significant discrepancies in hCG measurements, which are critical for diagnosing and monitoring pregnancy-related conditions. Therefore, it may be essential to choose immunoassays that can accurately detect and differentiate between the various forms of hCG, including the free beta-subunit, to avoid diagnostic errors caused by these effects.

False Positives

False-positive pregnancy test results can arise in a variety of clinical scenarios. One common situation involves biochemical pregnancies, such as those occurring after miscarriage, abortion, or delivery, where human chorionic gonadotropin (hCG) remains detectable in the bloodstream before it has fully cleared.[34] Another cause is the use of exogenous hCG in fertility treatments or performance-enhancing doping, with the hormone remaining traceable for up to two weeks after injection.[43] Certain tumors can also secrete hCG, leading to elevated levels in individuals who are not pregnant.[44] In perimenopausal or postmenopausal women, the pituitary gland may produce hCG, contributing to false-positive results in this population.[43] Test interference is another consideration—high doses of biotin, for example, can distort serum-based assay results, although this typically does not affect urine tests, which remain negative in such cases.[45] Lastly, familial hCG syndrome, a rare inherited condition, can lead to persistently elevated hCG levels, creating a clinical picture that mimics pregnancy despite the absence of gestation.[46]

A false negative may expose a fetus to teratogenic interventions, while a false positive could prevent a patient from receiving potentially beneficial therapies due to fetal risk. Pregnancy testing is a critical tool for early pregnancy detection, but given the above limitations clinicians must interpret results with a nuanced understanding of timing and hormone dynamics.

Recommendations for Best Practices

This paper focuses on refining pregnancy screening in chronic pain management. While general safety protocols exist, this review tailors specifically to the chronic pain population, where medication use and ionizing radiation is common. In women of childbearing age who may be candidates for certain pain medications or interventional procedures, consider the following:

Pregnancy Screening

All females of reproductive age should be screened using a standardized questionnaire or direct inquiry. Proceed only if:

- The last menstrual period (LMP) was within 7 days, or

- LMP was <4 weeks ago and the patient has had no sexual activity since, or
- LMP >7 days and the patient has had a sterilization procedure like a tubal ligation or hysterectomy.

If these are not met:

- Obtain a POC urine pregnancy test.
- If positive or ambiguous, conduct serum hCG.
- If pregnancy is confirmed, discuss risks, benefits, alternatives ± and obtain informed consent for fluoroscopy-guided procedure.
- If refusing pregnancy testing, document this clearly in the medical record and obtain informed consent for fluoroscopy-guided procedure.

If there is any doubt about pregnancy status, confirmatory testing with serum hCG should always be performed.

See Pregnancy Screening Flowchart and Questionnaire for Women of Reproductive Age in Appendices 1 and 2, respectively.

Informed Consent

Clear, empathetic communication is critical. Risks to both mother and fetus should be explained in understandable language. Explain both deterministic effects (eg, developmental delay from high-dose exposure) and stochastic effects (eg, theoretical cancer risk). Provide printed materials and encourage patient questions. Document patient understanding and consent. (See Appendix 3 for example informed consent).

Optimized Radiation Exposure

In addition to using the lowest effective radiation dose, incorporate strategies to minimize radiation exposure such as Lead shielding over the abdomen and pelvis whenever feasible, Modified imaging protocols that reduce fluoroscopy time and dose rate, Collimation to limit the x-ray beam to the area of interest, Last-image hold and pulsed fluoroscopy to reduce exposure duration, and When appropriate, opt for non-ionizing modalities, such as ultrasound or MRI.

For example, in a retrospective study comparing ultrasound- and fluoroscopy-guided selective nerve root blocks for lumbar radicular pain showed no significant difference in six-month outcomes.[47] While some systematic reviews favor fluoroscopy for functional outcomes,[48] MRI and ultrasound remain viable alternatives for minimizing fetal risk.

Exposure After Unknown Pregnancy

Counsel patients about relative fetal risks. If the procedure delivers radiation doses below 50 mGy, reassure them that these levels are not associated with significant risks to the fetus. If the procedure exceeded 50 mGy, or if there is significant patient concern, have them follow-up with their obstetrics provider.

Discussion

This review adds clinical context and a structured pregnancy screening protocol tailored for chronic pain management. By providing screening guidance, this paper closes a critical gap in pregnancy safety protocols.

These tools can be seamlessly integrated into clinical workflows, providing guidance that may inform institutional policy updates and influence national guidelines, including those from interventional pain societies.

To enhance clinical practice and improve patient safety, several actionable recommendations can be implemented. First, integrating the screening algorithm directly into electronic health records (EHRs) can help streamline decision-making and ensure consistent application across clinical settings. Consent forms should also be updated to explicitly include information on both radiation and medication risks, promoting informed decision-making. When feasible and clinically appropriate, ultrasound should be prioritized as the first-line imaging modality due to its safety profile, particularly in reproductive-age patients.

Looking ahead, future research should focus on several key areas. Prospective studies comparing clinical outcomes using different screening protocols will be vital to understanding the real-world effectiveness of current approaches. Additionally, investigating patient understanding and satisfaction regarding counseling on radiation risks will offer insight into communication strategies and informed consent processes. Research should also explore the optimal timing and type of screening in diverse patient populations to ensure equitable and personalized care. Finally, studies comparing the outcomes of algorithm-driven screening protocols versus routine clinical practice could provide valuable evidence to support broader implementation.

Conclusion

With the exception of non-pharmacologic interventions, oftentimes, pharmacologic or interventional procedures involving ionizing radiation necessary in chronic pain management pose unique risks to women who may be pregnant. A thoughtful, patient-centered approach to pregnancy screening can prevent avoidable harm and support better outcomes. Adopting structured screening and consent protocols may improve maternal-fetal outcomes, better risk stratify, and increased clinician confidence in procedural safety. To guide widespread implementation, future research should evaluate the effectiveness of different screening strategies and compare the efficacy of algorithm-driven versus routine screening approaches.

Disclosure

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