Pain in Pregnancy and Labor

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Introduction

Factors Influencing the Perception of Pain in Pregnancy Compared with the Nonpregnant State

Estrogens

- Highly lipophilic and have low molecular weight thus easily penetrating CNS and affecting multiple CNS receptors and nerves in both the spinal cord and brain.
- Influence receptive field properties of primary afferents in the trigeminal and pudendal nerves [1].
- Increase GABA release.
- Up-regulate GABA-A receptors.
- Up-regulate serotonin.
- Estrogen receptors are present in lumbosacral spinal cord, especially in the substantia gelatinosa.
- Estrogen receptors present in the dorsal horn of the lumbosacral region increase in density when estrogen levels are high [2].

Behavioral, Psychological, and Social Factors

There is increased susceptibility to pain during pregnancy due to anxiety. Specific causes of anxiety include:

- Fear of pregnancy itself
- Implications on the future of the mother
- Stress about future motherhood

Positive attitudes toward pregnancy may decrease pain or increase tolerance to pain.

Cultural views of pregnancy and childbirth cannot be overlooked as factors in either decreasing or increasing pain due to preconceived notions as to what pain signifies, as well as ideas on how one should behave during pregnancy [3].

Causes of Pain in Pregnancy

Presence and Growth of the Gravid Uterus

- Increase in lumbar lordosis.
- Stretching of anterior and posterior longitudinal ligaments of the lumbar spine causes spreading of symphysis pubis and SIJ leading to pelvic pain.
- New spondylolisthesis or worsening of current spondylolisthesis (secondary to increased lordosis and laxity).
- Resultant increase in anterior pelvic tilt causing altered lower extremity mechanics.
- Increased joint stress especially in the lumbar facets, hips, sacroiliac joints, and knees.
- Weakness and separation of abdominal muscles.
- Pressure in abdomen can cause visceral pain and cramping.
- Stretching of the round ligament leading to lower pelvic pain.
- Radicular symptoms can be common and are usually due to direct compression of lumbosacral nerves from uterus/fetal head [4].

Nerve Entrapment Syndromes and Neuropathic Pain

- Cutaneous branches of thoracic nerves which pierce the abdominal wall muscles can be stretched or become entrapped as the abdominal wall is stretched. This will usually cause a unilateral pain, although bilateral pain can occur [5].

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- Similarly, the iliohypogastric, genitofemoral, and lateral femoral cutaneous nerves can become entrapped. This can lead to pain in the groin, labia, and thighs [6].
- Carpal tunnel syndrome and tarsal tunnel syndrome are more common in pregnancy due to increased fluid retention and peripheral edema [7].
- Cesarean section scars can become painful as they become stretched.

Headaches

- Unlikely to begin during pregnancy [8].
- If preexisting, they tend to improve during pregnancy [9].
- Headaches often go untreated or undertreated due to fears regarding the safety of commonly used medications.

Joint Pain

- New joint pains are very common in pregnancy. Causes include hormonal changes (higher levels of relaxin leading to increased joint laxity, increased fluid retention, and tissue swelling secondary to higher levels of cortisol, progesterone, and estrogen) and anatomic changes (as listed previously) [10].
- Pregnancy can alter the course of preexisting inflammatory conditions, but the effects are not uniform (i.e., there is increased disease activity in systemic lupus erythematosus, but decreased disease activity in rheumatoid arthritis, etc.) [11].

Principles of Pain Management in Pregnancy

Risks to the growing fetus from treatment modalities are of primary concern. It is important to make the patient an active participant in her care and to be transparent about all treatment options and what is known about their effect on the fetus, as well as what is not known.

Generally speaking, a multidisciplinary approach, closely coordinated with the obstetric team, is widely considered to be the best and safest for the pregnant patient. This will provide maximal benefit while minimizing risk to the fetus by avoiding using medications which may have unsafe for the fetus. The Federal Drug Administration (FDA) has developed categories describing the safety of medications used in pregnancy (Table 39.1). Commonly used analgesics are listed in Table 39.2, according to the FDA pregnancy classification. Of note, avoiding NSAIDS not just in the third trimester but in the first trimester should be considered.

Table 39.1 FDA pregnancy categories

Category	Description
A	Well-controlled studies in humans show no risk to the fetus
B	No well-controlled studies have been conducted in humans Animal studies show no risk to the fetus
C	No well-controlled studies have been conducted in humans Animal studies have shown an adverse effect on the fetus
D	Evidence of human risk to the fetus exists; however, benefits may outweigh the risks in certain situations
X	Controlled studies in animals or humans demonstrate fetal abnormalities; the risk in pregnant women clearly outweighs any possible benefit

Table 39.2 FDA pregnancy categories of common pain medications

Category	Description
A	
B	Acetaminophen, oxycodone, lidocaine, and ibuprofen (first and second trimester), naproxen (first and second trimester)
C	All opioids except oxycodone, gabapentin, topiramate, tricyclic antidepressants, SNRIs, muscle relaxants, benzodiazepines (temazepam is X), steroids, ketorolac, nabumetone, and etodolac
D	Aspirin, NSAIDS (third trimester)
X	

Common Conditions

Low Back Pain

Low back pain is extremely common in pregnancy due to the changes mentioned earlier. Recommended treatments include:

- Prophylactic strengthening and exercise therapies.
- Education: Posture education, ergonomics, braces to help teach correct posture, and ergonomics. Bracing should only be used temporarily for teaching purposes.
- Scheduled rest for spasms and acute pain [12].
- Physical therapy: Especially postural modifications, back strengthening, stretching, and self-mobilization techniques.
  - Lumbar spine flexion exercises help strengthen abdominal muscles and decrease lordosis which is accentuated in pregnancy.
  - Extension exercises help improve paraspinal muscle strength/function providing more lumbar support.
  - Other popular PT exercises which have been shown to help women during pregnancy include pelvic tilt, knee pull, straight leg raising, curl up, lateral straight leg raises, and Kegel exercises [13].

- Acupuncture has been shown to be superior to physical therapy with no significant adverse effects. It is recommended that acupuncture points which stimulate the cervix and uterus are avoided as they may stimulate labor [14].
- Manual therapy has also been shown to be effective, especially osteopathic manipulative treatment [15].
- Water therapy, which occasionally gets grouped with physical therapy, has been shown to improve pain while decreasing demand for sick leave for back pain [16].
- TENS has been shown by small studies to be more effective than exercise and acetaminophen with no noted adverse effects. The recommendation is to keep the current density low [17].
- Medication should be used judiciously and with risks for both the patient and the fetus weighed against the potential benefit.
  - Acetaminophen is considered a first-line analgesic.
  - Opioids should be used for severe pain with the understanding that when they are given chronically in the perinatal period, they can cause a withdrawal syndrome in the newborn. NSAIDs should generally be avoided throughout pregnancy, especially during the first and third trimesters. In the third trimester, they can cause uterine artery vasoconstriction and premature closing of the ductus arteriosus in the fetus.
  - Gabapentin is associated with craniofacial abnormalities, neural tube defects, and mental deficiency.
  - When taken in the third trimester, amitriptyline causes withdrawal symptoms in neonates which presents with cardiac problems, irritability, respiratory distress, muscle spasms, urinary retention, and seizures. When taken earlier in pregnancy, developmental delay and limb abnormalities have been reported.
  - Steroids have been studied in patients with chronic conditions which require daily steroid use throughout pregnancy. These studies are mostly inconclusive. An earlier study, which was slightly underpowered, showed an increase in cleft lip/palate incidence from 1/1000 in the general population to 3–6/1000 in patients with chronic steroid use. Later, better powered studies either failed to show a correlation or showed an even smaller increase of cleft lip/palate in chronic steroid users. Studies on these patients have also showed a higher likelihood of preterm birth and low birth weight. However, due to concomitant rheumatic or autoimmune diseases in these patients, it was unclear if the steroids were the causative agents. There have also been studies showing that the use of prednisone or prednisolone may help improve pregnancy outcomes.
  - Local anesthetics can be given intravenously, epidurally, or intramuscularly for the treatment of different types of pain in pregnancy. There is theoretical local anesthetic ion trapping in the fetus due to the lower pH of fetal blood as well as higher free (nonprotein bound) concentration of local anesthetic making it more likely to cross the placenta. However, fetuses have been shown to be more resistant to local anesthetic toxicity than adults, so it is more likely to see toxic side effects in the mother prior to the fetus being affected.
- Interventional procedures are always an option in the pregnant patient but with certain precautions. While it is well known and repeatedly proven that fluoroscopically guided injections are superior to blind injections, the use of fluoroscopy in early pregnancy should be avoided.
  - Blind injections such as interlaminar epidural steroid injections or trigger point injections are safe options when performed by experienced providers.
  - Ultrasound-guided injections have been shown to be both safe and effective.
  - For radicular pain, ultrasound-guided selective nerve root blocks have been shown to be superior to a caudal approach.
  - Ultrasound-guided sacroiliac joint injections have been shown to be very effective for sacroiliitis which is very common in pregnancy [4].
  - Ultrasound-guided joint injections are considered safe and effective.

Neuropathic Pain

- Carpal tunnel syndrome can be treated with activity modification, day or night splinting, and ultrasound-guided steroid injections [18].
- Meralgia paresthetica usually does not require treatment and improves spontaneously after delivery. If pain becomes too severe during pregnancy or persists after delivery, steroid/local anesthetic infiltration at the site of maximal tenderness and lateral femoral cutaneous nerve block are both safe and effective options. Stretching exercises can be safe and effective as an alternative to interventional techniques [19].
- Nerve entrapment syndromes can be safely injected with local anesthetic +/− steroid under ultrasound guidance [5].
- Intercostal neuralgia can be safely treated with topical lidocaine, intercostal nerve blocks, and/or epidural steroid injections [20]. If long-lasting relief cannot be achieved with these measures, intercostal nerve radiofrequency ablation is likely safe as cardiac RFA has been shown to be safe in multiple small studies and intrauterine RFA is frequently performed for twin reversed arterial perfusion sequence (TRAP) and has been shown to be safe for the surviving twin.

Pelvic and Abdominal Pain

- Patient education is the easiest and arguably most effective treatment for the management of pelvic pain. Information on ergonomics, appropriate physical activity, and avoidance of maladaptive movements/poor posture can also be very helpful and a good introduction to physical therapy if needed in the future [4].
- Massage, water gymnastics, acupuncture, pelvic belts, and exercise are all effective and safe treatments for pelvic pain. They are all preferred over medical management. Of note, pelvic belts should only be used for short periods of time [21].

Mechanisms and Characteristics of Labor Pain

Labor is divided into three stages.

- The first stage of labor consists of the beginning of labor until the cervix is fully dilated. Pain is due to dilation, distension, and stretching of the cervix.
  - This pain is typically visceral and is described as dull, crampy, achy, poorly localized, and often referred to other areas.
  - Pain impulses travel through sensory nerves and adjacent sympathetic fibers of T10–L1. Additional neighboring levels may occasionally be implicated as well, as sympathetics can synapse at multiple levels.
- The second stage of labor begins immediately after full dilation of the cervix and ends with delivery of the fetus.
  - Pain in this stage of labor is due to the passage of the baby through the vaginal canal causing stretching and tearing of multiple tissues including fascia, subcutaneous tissues, and skin.
  - This pain is typically somatic and is described as sharp and localized in the perineum.
  - This somatic pain is transmitted through the pudendal nerve to sacral nerve roots S2–S4.
- The third stage of labor begins after delivery of the baby and ends with the delivery of the placenta.
  - Typically less painful than the first two stages, but is described as dull visceral pain from continued uterine contractions.

Benefits and Potential Adverse Consequences of Labor Pain

The vast majority of study with regard to labor pain deals with different methods of treating it safely and effectively. There has been little research into adverse effects of labor pain on the parturient or baby and even less into the benefits of labor pain.

Pain has several physiologic and psychological effects on the laboring parturient.

- Most negative physiologic effects of labor pain manifest themselves via alterations in the respiratory patterns of the parturient as well as her body's catecholamine-mediated stress response [22].
- The respiratory effects include increased oxygen consumption and hyperventilation with resulting respiratory alkalosis secondary to hypocarbia.
- The stress response effects include increased gastric acidity, decreased gastric emptying, increased cardiac output, increased peripheral vascular resistance leading to elevated blood pressures, decreased placental perfusion, and at times paradoxical or incoordinate uterine activity potentially leading to changes in fetal heart rate.
- It is hypothesized that these responses, at their extremes, can produce maternal acidemia, fetal acidosis, and dysfunctional labor. However, to date there is no data proving that increased labor pain has any measurable negative outcomes on labor or delivery [23].
- It has been found that parturients, especially primiparas, who receive better labor analgesia have higher arterial oxygen saturations [24] and better neonatal acid base status [25] with an inverse correlation to their scores on the visual pain analog scale.
- Psychologically, it has been found that parturients who had good labor analgesia subjectively had an overall more positive childbirth experience and memory of that experience [26].
- Long after delivery, memories of labor pain can invoke negative reactions in some patients, while in others it can lead to feelings of increased self-esteem and self-efficacy [27]. This is largely due to preexisting cultural and psychosocial conditioning and does not appear to correlate to pain scores.

One possible benefit of labor pain which has been studied and measured is the increased concentration of beta-endorphin in the colostrum of lactating mothers who have gone through the labor process and vaginal delivery as opposed to those who have undergone cesarean section [28]. The predominant theory is that there are increased endorphin levels in the parturient during painful labor which leads to concomitant increase in beta-endorphin concentrations in colostrum. The increased beta-endorphin helps decrease newborns' stress response in the perinatal period.

Management of Labor Pain

Management of the laboring patient is typically not performed by a pain management specialist. Usually, in this acute situation, pain is managed by an anesthesiologist,

obstetrician, or midwife via various methods with varying levels of evidence.

- The highest quality evidence for efficacy exists for combined spinal epidural, epidural, and inhaled analgesia.
  - Combined spinal epidural relieves pain faster than epidural, although with higher frequency of pruritus and with less nausea/vomiting/dizziness than inhaled analgesia.
  - Epidural, while very effective for treating labor pain, is associated with more instrumental vaginal births and increased rate of cesarean section for fetal distress, although overall section rate was unchanged from placebo or alternate therapy (e.g., parenteral opioids or inhaled analgesia).
  - Inhaled analgesia (nitrous oxide), though not available at many centers, can be highly effective, but is associated with adverse effects including nausea, vomiting, and dizziness.
- There is moderate evidence that acupuncture, massage, relaxation, local anesthetic nerve blocks, non-opioid drugs, or water immersion therapy may improve labor pain with few adverse effects. Studies on the above are usually limited to single trials and most require further study, but they remain as alternatives.
  - Acupuncture was associated with a lower rate of assisted vaginal birth and c-section.
  - Relaxation was associated with a lower rate of assisted vaginal birth.
- There is currently not enough evidence to support hypnosis, TENS, aromatherapy, parenteral opioids, or biofeedback as being more effective than placebo [29].

References

1. Hapidou EG. Perception of pain during pregnancy and labor. In: Stefan Lautenbacher RBF, editor. Pathophysiology of pain perception. New York: Springer Science & Business Media; 2012.
2. Aloisi A. Gonadal hormones and sex differences in pain reactivity. Clin J Pain. 2003;19(3):168–74.
3. Ebirim LN, Buowari OY, Ghosh S. Physical and psychological aspects of pain in obstetrics. In: Pain in perspective. London: InTech; 2012. p. 219–36.
4. Shah S, Banh ET, Koury K, Bhatia G, Nandi R, Gulur P. Pain Management in Pregnancy: multimodal approaches. Pain Res Treat. 2015;2015:1–15.
5. Peleg R, Gohar J, Koretz M, Peleg A. Abdominal wall pain in pregnant women caused by thoracic lateral cutaneous nerve entrapment. Eur J Obstet Gynecol Reprod Biol. 1997;74(2):169–71.
6. Deal CL, Canoso JJ. Meralgia paresthetica and large abdomens. Ann Intern Med. 1982;96(6):787–8.
7. Padua L, Aprile I, Caliandro P, Carboni T, Meloni A, Massi S, Mazza O, Mondelli M, Morini A, Murasecco D, Romano M, Tonali P. Symptoms and neurophysiological picture of carpal tunnel syndrome in pregnancy. Clin Neurophysiol. 2001;112(10):1946–51.
8. Ertresvåg JM, Zwart JA, Helde G, Johnsen HJ, Bovim G. Headache and transient focal neurological symptoms during pregnancy, a prospective cohort. Acta Neurol Scand. 2005;111(4):233–7.
9. Nappi RE, Albani F, Sances G, Terreno E, Brambilla E, Polatti F. Headaches during pregnancy. Curr Pain Headache Rep. 2011;15(4):289–94.
10. Choi HJ, Lee JC, Lee YJ, Lee EB, Shim SS, Park JS, Jun JK, Song YW. Prevalence and clinical features of arthralgia/arthritis in healthy pregnant women. Rheumatol Int. 2008;28(11):1111–5.
11. Silman A, Kay A, Brennan P. Timing of pregnancy in relation to the onset of rheumatoid arthritis. Arthritis Rheum. 1992;35(2):152–5.
12. Borg-Stein J, Dugan SA. Musculoskeletal disorders of pregnancy, delivery and postpartum. Phys Med Rehabil Clin N Am. 2007;18(3):459–76.
13. Sabino J, Grauer JN. Pregnancy and low back pain. Curr Rev Musculoskelet Med. 2008;1(2):137–41.
14. Pennick VE, Young G. Interventions for preventing and treating pelvic and back pain in pregnancy. Cochrane Database Syst Rev. 2013;(8)
15. Licciardone JC, Buchanan S, Hensel KL, King HH, Fulda KG, Stoll ST. Osteopathic manipulative treatment of back pain and related symptoms during pregnancy: a randomized controlled trial. Am J Obstet Gynecol. 2010;202(1):43–8.
16. Granath AB, Hellgren MS, Gunnarsson RK. Water aerobics reduces sick leave due to low back pain during pregnancy. J Obstet Gynecol Neonatal Nurs. 2006;35(4):465–71.
17. Keskin EA, Onur O, Keskin HL, Gumus II, Kafali H, Turhan N. Transcutaneous electrical nerve stimulation improves low back pain during pregnancy. Gynecol Obstet Invest. 2012;74(1):76–83.
18. Seror P. Pregnancy-related carpal tunnel syndrome. J Hand Surg. 1998;23(1):98–101.
19. Mabie WC. Peripheral neuropathies during pregnancy. Clin Obstet Gynecol. 2005;48(1):57–66.
20. Sax TW, Rosenbaum RB. Neuromuscular disorders in pregnancy. Muscle Nerve. 2006;34(5):559–71.
21. Vleeming A, Albert HB, Ostgaard HC, Sturesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. Eur Spine J. 2008;17(6):794–819.
22. Walls JD, Gaiser R. Chronic pain in the obstetric patient. Anesthesiol Clin. 2013;31(3):505–15.
23. Lowe NK. The nature of labor pain. Am J Obstet Gynecol. 2002;186(5):S16–24.
24. Brownridge P. The nature and consequences of childbirth pain. Eur J Obstet Gynecol Reprod Biol. 1995;59:S9–15.
25. Deckardt R, Fembacher PM, Schneider KT, Graeff H. Maternal arterial oxygen saturation during labor and delivery: pain-dependent alterations and effects on the newborn. Obstet Gynecol. 1987;70(1):21–5.
26. Hur MH. Effects of one-to-one labor support on labor pain, labor stress response, childbirth experience and neonatal status for primipara. Korean J Women Health Nurs. 2001;7(2):188–202.
27. Niven CA, Murphy-Black T. Memory for labor pain: a review of the literature. Birth. 2000;27:244–53.
28. Zanardo V, Nicolussi S, Giacomin C, Faggian D, Favaro F, Plebani M. Labor pain effects on Colostral Milk Beta-endorphin concentrations of lactating mothers. Biol Neonate. 2001;79:87–90.
29. Jones L, Othman M, Dowswell T, Alfirevic Z, Gates S, Newburn M, Jordan S, Lavender T, Neilson J. Pain management for women in labour: an overview of systematic reviews. Cochrane Database Syst Rev. 2012;3:CD009234.